Chapter 14
The Flora and Vegetation of Easter Island: Past and Present

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1 Introduction

The floristic inventory of a region can be divided into two groups based on immigration history: native species that evolved in situ or arrived via dispersal without human action and introduced species that occur in an area due to human impact (Richardson et al. 2000). Introduced species may have arrived by direct human transport of diaspores or depend on the creation of suitable habitats by humans. For the analysis of biogeographic relationships and the reconstruction of past vegetation, only the native species are of interest. On Easter Island, the identification of native species is challenging, because of the high human impact for a long time, and the resulting high number of introduced species and putatively extinct native species in the present-day flora. Palynological and archeological studies can provide direct evidence of the presence of species before human arrival, yet are often incomplete. In the absence of sufficient direct evidence, analyses of the distribution and ecology of recent species can provide circumstantial evidence for the reconstruction of the native flora and its ecological preferences.

Numerous attempts to reconstruct the native flora of flowering plants of Easter Island exist (Skottsberg 1922, 1928, 1953, 1956; Guillaumin et al. 1936; Etienne et al. 1982; Etienne and Faundez 1983; Flenley and King 1984; King and Flenley 1989;

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V. Rull, C. Stevenson (eds.), *The Prehistory of Rapa Nui (Easter Island)*,
Developments in Paleoenvironmental Research 22,
https://doi.org/10.1007/978-3-030-91127-0_14

Zizka 1990, 1991; Flenley et al. 1991; Orliac 1998; Butaud 2006; Azizi and Flenley 2008; Butler and Flenley 2010; Dubois et al. 2013; Rull 2020). Most of these authors agree that the current flora and vegetation of the island are the product of intensive human impact over centuries, driving native species to extinction and introducing species from other parts of the world, many of which have become naturalized or invasive. In addition, recent studies point toward the role of Quaternary climatic changes in the depletion of the flora and vegetation of Easter Island (Cañellas-Boltà et al. 2013; Rull et al. 2010, 2015).

Here we provide an updated, commented list of angiosperms, ferns and fern allies, mosses, and liverworts putatively native to Easter Island (see Appendix) based on a review of the existing literature, and assess the biogeographic relationships of these species. We emphasize the differences in biogeography between angiosperms and the other groups of terrestrial plants, because, in contrast to angiosperms, ferns and fern allies, mosses, and liverworts are rarely found to be introduced and thus may be more informative on the biogeographic affinities of the native island flora. We make use of publicly available distribution data and of the concept of ecoregions (Olson et al. 2001) to extract information about the biogeographic relationships of the native flora of Easter Island.

2 The Present Flora of Easter Island

Comprehensive inventories of the flora of Easter Island exist for the major groups of terrestrial plants (seed plants, ferns and fern allies, mosses, and liverworts), which form the basis of this contribution (mosses sensu lato: Brotherus 1924, Theriot 1937, Ireland and Bellolio 2002, Grolle 2002, Müller 2009; ferns and fern allies: Christensen and Skottsberg 1920, Guillaumin et al. 1936, Godoy and Figueroa 1989, Looser 1958, Baeza et al. 1998, Butaud 2006, Meyer 2013; angiosperms: Skottsberg 1922, Etienne et al. 1982, Etienne and Faundez 1983, Zizka 1991, Butaud 2006, Finot et al. 2015, Dubois et al. 2013).

Our list of putative native species comprises 33 moss taxa (Bryophytina; Ireland and Bellolio 2002; Müller 2009) and 11 species of liverworts (Marchantiophytina, Grolle 2002). Three species of mosses are endemic to the island (none of the liverworts). There is no information about introduced species available for mosses so we assume all species to be native to Easter Island. One sterile species of hornwort (Anthocerotophytina) is documented but remains unidentified (Grolle 2002), and we therefore do not consider it here.

Our list comprises 21 native fern and fern allies taxa. Of these, 16 species were reported by Meyer (2013), including 13 species in the subclass Polypodiidae (true ferns, both Polypodiopsida) and 3 in the subclass Ophioglossidae (genera *Ophioglossum, Psilotum*). Additionally, the genera *Lycopodium, Huperzia* (both Lycopodiopsida), *Cyathea, Hymenophyllum*, and *Pteris* (Polypodiopsida) were recorded on the island based on spore records without identification to species level

(Azizi and Flenley 2008; Butler and Flenley 2010; Horrocks et al. 2015; Rull et al. 2015). All of these fern and fern allies species are putatively native. In addition, Meyer (2013) observed four introduced fern species, cultivated in gardens in the village Hanga Roa. One of these species, *Cyclosorus* cf. *parasiticus*, was observed also outside cultivation. However, its status of naturalization is unclear and we therefore do not consider it here.

Our list comprises 33 native seed plant taxa in the present-day flora, excluding the extinct *Paschalococos disperta* and corresponding to 18.4% of the 179 species growing outside cultivation reported by Zizka (1991) (Figs. 14.1 and 14.2). One native species, *Sophora toromiro*, is surviving only in cultivation. No native gymnosperm species are known from the island (although Butaud 2006 mentions seven introduced and cultivated species); hence, seed plants are only represented by angiosperms. The high number of introductions, together with increasing tourism and traffic/trade—as in all parts of the world—results in the increase of alien species, which occur outside cultivation and may become naturalized or even invasive (Fig. 14.3). Due to the continuously ongoing introduction of new species (e.g., Fig. 14.3), the total number of naturalized species on Easter Island has increased since 1991 (Butaud 2006; Dubois et al. 2013; Meyer 2008; Finot et al. 2015). New additions to the flora since 1991 mostly include cultivated species and cosmopolitan weeds associated with human settlements and disturbed habitats worldwide, such as *Asclepias curassavica*, *Cortaderia selloana, Cenchrus clandestinus, Triticum aestivum,* and *Zea mays*. The species list of Butaud (2006) comprises 437 species (18 ferns and fern allies, 7 gymnosperms, 412 angiosperms), including 351 species that were introduced after 1722, of which many are found exclusively in cultivation.

Further updates of the species list presented here compared to Zizka (1991) result from taxonomic revisions and nomenclatural changes. Specifically, Finot et al. (2015) in their treatment of the flora of Easter Island rely on the revision of *Eragrostis* in Chile by Escobar et al. (2011), which regard the records of *E. leptostachya* and *E. spartinolides* in Zizka (1991) as misidentifications and place the investigated specimen Zizka 1541 in *E. atrovirens* (Escobar et al. 2011). Furthermore, *Boerhavia acutifolia* is recognized as a native species instead of subspecies *Boerhavia diffusa* var. *acutifolia* of the widespread *B. diffusa* (Dubois et al. 2013). Finally, progress in taxonomic research has led to changes in genus delimitation resulting in nomenclatural changes, e.g., the transfer of the endemic species *Danthonia paschalis* to the new genus *Rytidosperma (R. paschale*; Baeza 1991) and the placement of the prominent Totora in *Schoenoplectus* (*Schoenoplectus californicus* instead of *Scirpus c.*; Figs. 14.1 and 14.2).

In the Appendix, we provide a list of the accepted scientific names of all taxa of angiosperms, fern and fern allies, mosses, and liverworts which are discussed to be native on Easter Island based on the GBIF Taxonomy backbone (see URL: https://www.gbif.org/dataset/d7dddbf4-2cf0-4f39-9b2a-bb099caae36c). Furthermore, we provide synonyms, native distribution according to Kew Plants of the Worlds Online (POWO; http://www.plantsoftheworldonline.org/), and literature references.

Fig. 14.1 Crater Lake of Rano Raraku with a large stand of Totora (*Schoenoplectus californicus*) and obvious erosion marks on the slopes

Fig. 14.2 Two prominent native species of Easter Island: Totora (*Schoenoplectus californicus*) and Tavari (*Persicaria acuminata*)

Fig. 14.3 In vast areas, the vegetation is dominated by introduced species. Here, at the foot of Rano Raraku, *Cirsium vulgare*, *Psidium guajava*, *Crotalaria pallida, Asclepias curassavica*, and *Macroptilium lathyroides* are abundant species

The described spread of human introduced invasive species poses pressure on the remaining native flora. Multiple conservation projects aiming at propagating native species, protecting their habitats, and removing invasive species exist (e.g., Zizka 1993; Meyer 2008; Dubois et al. 2013). Yet, as tragically illustrated by the so far unsuccessful attempt to reintroduce the iconic Toromiro (*Sophora toromiro*), the changes in vegetation, fauna, soil conditions, and probably in genetic diversity are a substantial hurdle to these conservation efforts, even if sufficient plants for reintroduction are available (Maunder et al. 2000).

3 The Flora of Easter Island Before the Arrival of Humans

The natural history of Easter Island, in particular its native flora and vegetation, has received great scientific attention, since it provides the basis for the development of the islands' human population and the iconic Moai and Birdman cultures. It had long been postulated that Easter Island is currently exceptionally poor in native plant species (van Balgooy 1971). Only later studies provided scientific documentation that this flora, as already encountered by the first Europeans in the eighteenth century, was only the depauperate remainder of a once more diverse set of species (Flenley and King 1984; Flenley et al. 1991; Flenley 1993a, b, 1996). Since then,

the reconstruction of the original biodiversity of the island has profited in particular from palynological and archeological studies.

First, paleoecological studies based on pollen cores from lakes in the three island volcanos Rano Kao, Rano Raraku, and Rano Aroi provided the first evidence for once existing large forests, and added taxa to the native plant diversity before the arrival of humans (e.g., members of the genera *Acalypha, Metrosideros, Potamogeton, Typha*; Flenley et al. 1991). However, the reconstruction of flora and vegetation based on palynological evidence has limitations. Most importantly, taxon identification is relying on diacritic characters in pollen or spore morphology often limiting identification to higher taxonomic levels, yielding identifications such as "palm", "Urticaceae/Moraceae", "Asteraceae-Tubiflorae", "*Coprosma*", and others. Furthermore, the amount of pollen produced differs largely among wind- and animal pollinated species. Hence, a lack of pollen, especially from animal pollinated species, does not rule out a former occurrence on Easter Island. In the "transitional" and "revival phase" of Easter Island research (Rull 2020), new paleoecological and archeological evidence added taxa to the list of native Easter Island species. For instance, the analysis of fossil palm phytoliths has provided evidence for other palm (Arecaceae) species besides *Paschalococos disperta* on Easter Island (Orliac and Orliac 2008; Delhon and Orliac 2010; Gossen 2011; Bowdery 2015).

Second, archeological studies of charcoals and the wood anatomy from dwelling sites and of artifacts (e.g., carvings; Orliac 1998, 2000, 2007) provided insights into the flora of Easter Island before the arrival of the Europeans. However, these records are dated to the time after the arrival of humans, and it cannot be excluded that charcoal or artifacts originated from driftwood. Thus, the wood anatomical data in our opinion do not necessarily provide information about flora and vegetation before the arrival of humans. Butaud (2006) provides a comprehensive review on the flora of tracheophytes (ferns and fern allies and seed plants) of Easter Island, estimating the number of native species between 63 and 68 and providing a list of 68 native species.

In addition to the direct evidence from paleoecological and archeological studies, the botanical investigation of the current flora from collections, historical documents, and scientific literature can provide circumstantial evidence for the identification of native species, although limited in time to the oldest collections and scientific reports. Taking distribution, dispersal abilities, and ecology into consideration allows for an assessment of the present flora and its immigration history.

Our list of putatively native angiosperm species (Appendix) includes 20 taxa that have been recorded in paleoecological studies and mostly dated to before human arrival. We also included records only identified to genus and family level (the latter not included in the biogeographic analysis). For the recorded representative of the genus *Capparis*, we regard the native status doubtful and excluded it from the biogeographic analysis. The following taxa have also been added to the list, but for various reasons we did not include them in the biogeographic analysis (for more details, see Appendix): (1) Two taxa (*Santalum* spec., *Sesuvium portulacastrum*)

reported in the literature without underlying herbarium specimens or pollen records. (2) Six palm species. The occurrence of more than one palm species appears reliable from the phytolith studies, and, when following Gossen (2011), three additional palm species, and according to Bowdery (2015), even six palm species may have been native to the island. However, the number of palm species and their taxonomic relationships remain doubtful. (3) Orliac (1998, 2000, 2007) and Orliac and Orliac (2008) identified ten additional species from studies of charcoal and wood carvings. We regard the origin of these species as doubtful; for a human introduction or origin from driftwood cannot be excluded. In total, our list of angiosperm species for Easter Island comprises 70 taxa, of which 48 were included in the biogeographic analysis.

Van Balgooy (1969, 1971) included Easter Island in his geographically comprehensive studies on island plant diversity. Based only on the number of genera and families he suggested the plant diversity of the island to be exceptionally poor in relation to island area. Yet, van Balgooy underestimated the number of native families and genera of the island (15 and 22, respectively, van Balgooy 1969). Based on our list taking the pollen records and more recent publications into consideration, the native flora comprised at least 28 families and 48 genera. A different attempt to calculate the native angiosperm flora of Easter Island was published by Weigelt et al. (2013). In a modeling approach based on data from 17,883 marine islands worldwide and considering area, climate data, elevation, isolation, and past connectivity, they proposed a hypothetical vascular plant species number of 67.42 (standard error ±20.16) for Easter Island (Weigelt et al. 2013; Kreft et al. 2008), which fits well with the here listed 69 species (48 angiosperms, 21 ferns and fern allies).

4 From Distribution to Biogeography and Ecoregions

Various authors dealing with Easter Island´s plant diversity have analyzed the global distribution of putatively native species in order to characterize the biogeographic relationships of the island. However, such analyses have been almost exclusively restricted to angiosperms. Here, we integrate all groups of land plants (mosses, liverworts, fern and fern allies, and seed plants) with the aim to identify potential source areas and global ecoregions similar to the initial vegetation of the island. We use distribution information from the Global Biodiversity Information Facility (GBIF 2021) accounting for quality issues, by only retaining records with occurrence status "present," removing fossils, material based samples, non-native entries, as well as issues flagged with common geo-referencing errors when possible (Zizka et al. 2019, 2020), and Plants of the World Online (POWO; URL: http://www.plantsoftheworldonline.org/), the latter providing only information for angiosperms and ferns and fern allies. GBIF and POWO provide different types of data. While GBIF contains geo-referenced localities of species occurrences, POWO provides a list of geographical regions ("Botanical countries", usually at the scale of countries

or provinces in the case of large countries, e.g., New Guinea, Queensland, or Bolivia), for which the species is considered native. While GBIF locality data are more precise, their completeness depends on the sampling effort across regions, which is often low, particularly on small archipelagos and islands. In contrast, POWO provides a relatively complete geographical coverage, but on a rough scale (regions).

Looking at the POWO data first, for the angiosperms (Fig. 14.4a), based on 48 species, the strongest links of the flora of Easter Island are with Australia, SE Asia, and Oceania. Most native Easter Island species (and genera) occur also in New South Wales, Queensland, Western Australia, and New Guinea, followed by regions/islands/archipelagos from SE Asia, Oceania, and the Neotropics. Among the Pacific Islands, Society Islands, Solomon Islands, Cook Island, Samoa, and Fiji have most native species in common with Easter Island. However, 17 taxa are also distributed in Kenya, 16 in Madagascar, which makes clear that some of the species have a wide distribution. This holds especially true for the few genera included in the analysis based on pollen records (e.g., *Acalypha*), where no species could be identified. It is noteworthy that the biogeographic links to the Neotropics, especially northern South America, are stronger than those to parts of Africa and South Asia.

Looking at the fern and fern allies distribution (Fig. 14.4b; based on 21 species), the link to predominantly humid-tropical SE Asia, especially the Philippines and Lesser Sunda Islands, and to the Pacific Islands, especially Fiji, Samoa, Solomon, and Tubuai, is stronger than observed in the angiosperms, whereas the links to Australia and Oceania are less pronounced. Following the idea that fern and fern allies species have been less affected by direct human impact, this stronger SE Asian link may better reflect the relationships of the original flora and vegetation in the more humid periods in Easter Island history. Inaccessible localities like cliffs or parts of caves with sufficient light might have been micro-habitats for the fern and fern allies to survive putatively drier periods in the island's history.

For mosses and liverworts, no POWO data are available. Therefore, the following analyses are based on GBIF distribution data. In the mosses (Bryophytina; Fig. 14.5a), most Easter Island species are shared with (South) Eastern Australia and northern New Zealand. Less speciose links are with SE Asia and S and C America. In the liverworts (Marchantiophytina; Fig. 14.5b), (S)E Australia, mountainous parts of New Guinea, and parts of S America have the most species in common with Easter Island. Links to the remainder of tropical SE Asia are less prominent than in the mosses.

Ecoregions and biomes (Olson et al. 2001) provide an approach to use the recent floristic elements of Easter Island to approximate the past vegetation of the island. These ecoregions have been defined as biogeographic units primarily as a tool for conservation planning. However, they are built on the elements of classical biogeography like species diversity and endemism as well as environmental conditions and vegetation structure, and thus, we use them here to hypothesize about the original vegetation of the island. It should be noted that a species can be assigned

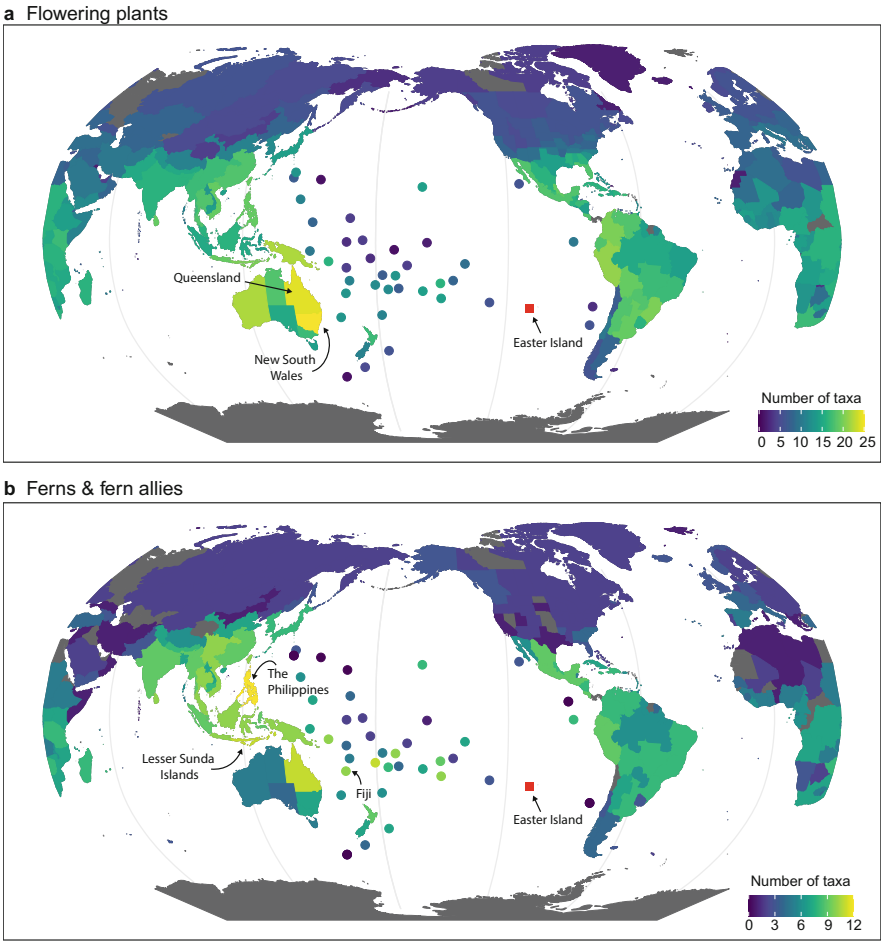

Fig. 14.4 Occurrence of putatively native Easter Island angiosperm and fern and fern allies taxa based on the distribution data given in Plants of the World Online (POWO). The color-coding indicates the number of taxa occurring in the areas defined by POWO. (**a**) Angiosperms ($n = 48$). (**b**) Ferns and fern allies ($n = 21$). The labels identify regions mentioned in the main text

to one, several, or many ecoregions depending on their range size (e.g., *Dicranella hawaiica* occurs in one ecoregion outside Easter Island, whereas *Bryum argenteum* occurs in 221). Figure 14.6 shows the number of species from the putatively native Easter Island flora that could be assigned to one or several of the altogether 867 terrestrial ecoregions worldwide, grouped into 14 biomes and 8 biogeographic realms (Olson et al. 2001). For angiosperms, ferns and fern allies, and mosses, a fairly similar picture arises: the ecoregions, where these Easter Island plants occur, are predominantly from the Australasia, Neotropic, and Indo-Malay realm, and are principally characterized by forest vegetation, and only rarely by savanna

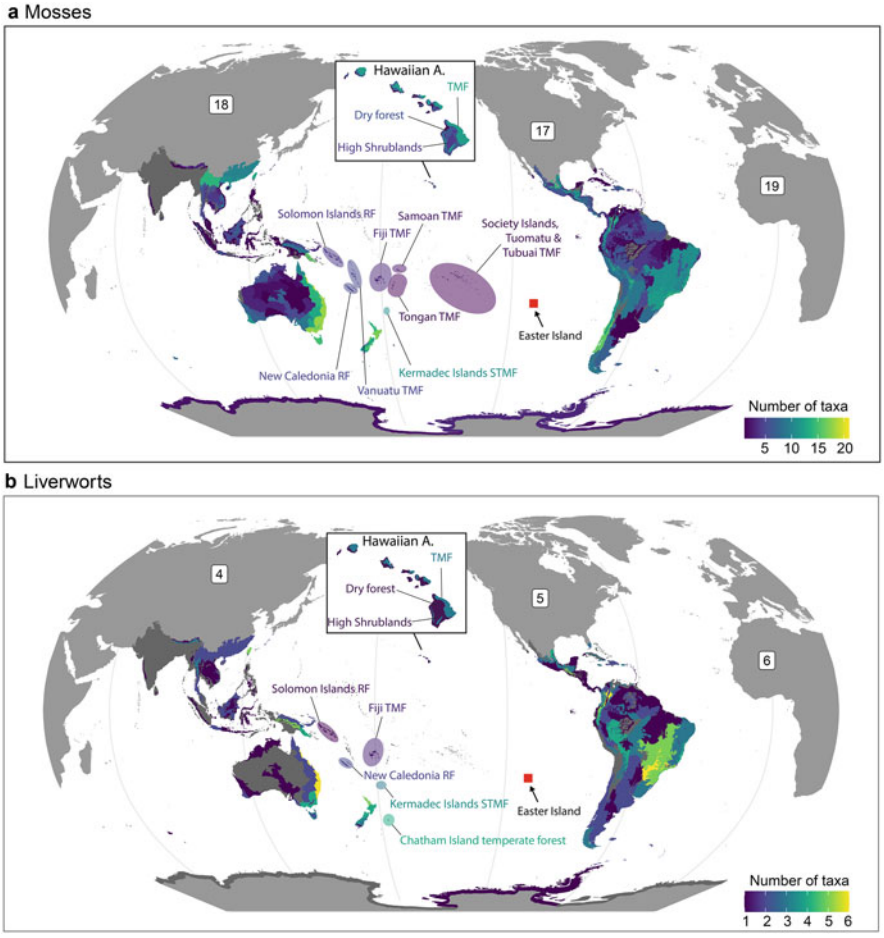

Fig. 14.5 Occurrence of putatively native Easter Island moss and liverwort taxa in the tropical and subtropical circum-Pacific area based on occurrence data from www.gbif.org. The color-coding indicates the number of taxa occurring in an area. Pacific archipelagos summarized by the shaded ellipses for readability. The Hawaiian archipelago is enlarged for readability. The numbers in squares refer to the number of Easter Island taxa occurring outside the relevant area. (**a**) Mosses. Number of taxa included: 29 (5 genera, 24 species). (**b**) Liverworts. Number of taxa included: 11 (1 genus, 10 species). *(S)TMF* (Sub-)Tropical Moist Forest, *RF* Rainforest

or grassland. In liverworts, the link to the Indo-Malay realm is less prominent, and stronger to S America. The strong dominance of species from ecoregions characterized by forest supports the idea of a forest-like original vegetation on Easter Island. Note that the weak biogeographic link to Oceania in the analysis of the GBIF data may be an artifact of low sampling density of records from Oceanian archipelagos.

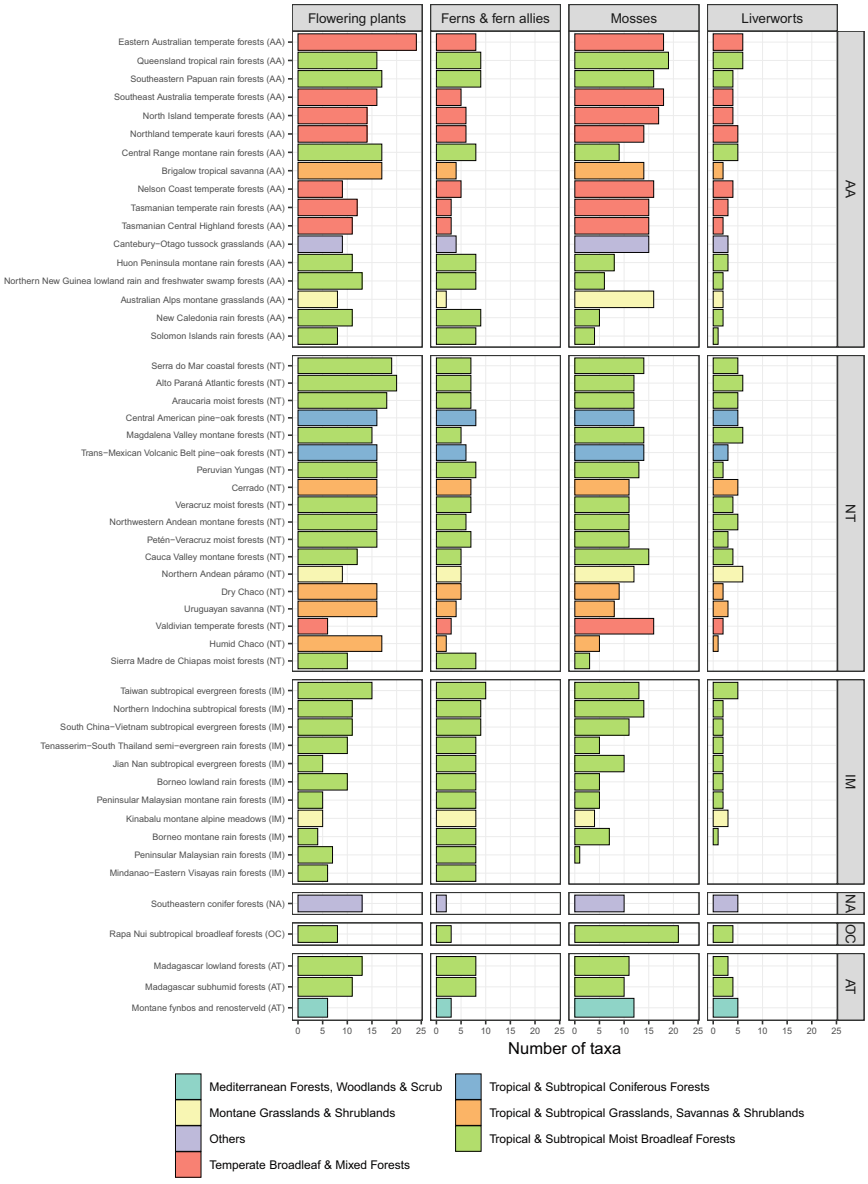

Fig. 14.6 The number of taxa putatively native to Easter Island assigned to ecoregions (Olson et al. 2001) worldwide. The assignment is based on the available distribution data of the species from GBIF; one species can be assigned to one up to numerous ecoregions. Assignment is given for the studied group of land plants: angiosperms, fern and fern allies, mosses, and hornworts. The color of the bars refers to the biome regarded characteristic for each ecoregion. The abbreviations refer to the biogeographic realms recognized in Olson et al. 2001. *AA* Australasia, *AT* Afrotropic, *IM* Indo-Malay, *NA* Nearctic, *NT* Neotropic, *OC* Oceania, *PA* Palearctic. Ecoregions are ordered by total number of species; only the most important ecoregions are shown

5 Conclusion

The native flora of Easter Island remains incompletely known. Some species probably so far have not been detected at all, some still lack reliable evidence (e.g., *Santalum*), and others are only identified to genus or family level. Additionally, the reconstruction of immigration history (native vs. alien) in some cases is doubtful (e.g., *Capparis*). However, the number of vascular plants regarded native today (69 spp.) fits well with the number of expected native species based on environmental conditions, island size, orography, isolation, and distance to the next continent. Biogeographic analyses for angiosperms, ferns and fern allies, mosses, and liverworts confirm strong links to Eastern Australia, New Guinea, and Oceania with additional links to SE Asia and the Neotropics in mosses and liverworts. The distribution of native Easter Island species in ecoregions worldwide reveals a predominance of forest ecoregions, suggesting an important role of forests in past Easter Island vegetation. This does not contradict drier periods in the Easter Island history, which especially ferns and fern allies, mosses, and liverworts might have survived in suitable micro-habitats.

Acknowledgments We thank Holger Kreft for providing data about Global Island Biodiversity as well as all data providers to GBIF and the curators of POWO for their effort. Jean-Francois Butaud provided important comments and information. AZ is funded by iDiv via the German Research Foundation (DFG FZT 118), specifically through sDiv, the Synthesis Centre of iDiv. We are thankful to Christopher D. Barratt for linguistic proofreading.

Appendix

Commented list of putatively native angiosperm, fern and fern allies, mosses, and liverworts species recorded for Easter Island.

Taxon	Family	Status	Source	Synonym(s)	Remarks	Included in analyses
Flowering Plants (Magnoliopsida)						
Acalypha spec.	Euphorbiaceae	Native	Flenley et al. (1991)		Only genus documented by pollen records, no species identified. Native species are reported for French Polynesia (Chevilotte et al. 2019).	x
Adenanthera spec.	Fabaceae	Native	Azizi and Flenley (2008)		Only documented by pollen records.	x
Alphitonia zizyphoides A. Gray	Rhamnaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Apium prostratum Labill. ex Vent.	Apiaceae	Native	Zizka (1991)			x
Axonopus paschalis (Stapf) Pilg.	Poaceae	Endemic?	Zizka (1991), Finot et al. (2015)	*Axonopus compressus* (Sw.) P. Beauv.	Originally described as endemic *A. paschalis*. In recent revision (Finot et al. 2015) sunk in widespread *A. compressus*, but this view not generally accepted	x

Bidens spec.	Asteraceae	Native	Butler and Flenley (2010)		Only documented by pollen records, originally identified as Asteraceae-Tubiflorae. Identified to genus by Butler and Flenley (2010)	x
Boerhavia diffusa L. var. *acutifolia* Choisy	Nyctaginaceae	Native	Zizka (1991), Dubois et al. (2013)	*Boerhavia acutifolia* (Choisy) J.W. Moore; *Boerhavia diffusa* L.	Taxonomic rank is doubtful, concepts range from synonym of *Boerhavia diffusa* to separate species *B. acutifolia*. GBIF gives distribution data for *B. acutifolia*, these distribution data are used here.	x
Bromus catharticus Vahl	Poaceae	Native	Zizka (1991)			x
Broussonetia papyrifera Vent.	Moraceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Butia odorata (Barb. Rodr.) Noblick	Arecaceae	Doubtful	Bowdery (2015)	*Butia capitata* Becc. var. *pulposa* (Barb. Rodr.) Becc.	Only documented by phytoliths. Hypothetical species (“best match” of phytoliths with recent species).	
Caesalpinia globulorum Bakh. f. & P. Royen	Fabaceae	Native	Zizka (1991), Butler and Flenley (2010)	*Guilandina major* (Medik.) Small *Caesalpinia major* (Medik.) Dandy and Exell	Pollen records of Butler and Flenley (2010) identified only to genus.	x
Calystegia sepium R. Br.	Convolvulaceae	Native	Zizka (1991)			x
Canavalia spec.	Fabaceae	Native	Butler and Flenley (2010), Cañellas-Bolta et al. (2013), Rull et al. (2015)		Only documented by pollen records.	x

Capparis spec.	Capparidaceae	Doubtful	Flenley et al. (1991)		Only documented by a pollen record from between app. 550 and 1000 B.P. Possibly introduced.	
Chrysogonum spec.	Asteraceae	Native	Flenley et al. (1991), Rull (2020), Butler and Flenley (2010)		Only documented by pollen records, identified as Asteraceae-Tubiflorae. The genus given is hypothetical, known from SE Polynesia.	x
Coprosma spec.	Rubiaceae	Native	Flenley et al. (1991), Orliac (1998), Butler and Flenley (2010)		Only documented by pollen records and charcoal, no species identified.	x
Cynodon dactylon (L.) Pers.	Poaceae	Native	Zizka (1991)			x
Cyperus brevifolius (Rottb.) Hassk.	Cyperaceae	Native	Zizka (1991)	*Kyllinga brevifolia* Rottb.		x
Cyperus cyperoides Kuntze	Cyperaceae	Native	Zizka (1991)			x
Cyperus eragrostis Lam.	Cyperaceae	Native	Zizka (1991)			x
Dianella spec.	Xanthorrhoeaceae	Native	Cañellas-Bolta et al. (2014)		Only documented by pollen from Rano Kao for 9.5–5.4 kyr B.P. Cañellas-Bolta et al. (2014) name *D. intermedia/adenanthera* as possible species and report the genus as widespread in the Pacific islands. Butaud (pers. comm.) regards *D. adenanthera* as the most probable species due to its wide occurrence in Polynesia.	x

Dichelachne crinita Hook. f.	Poaceae	Native	Zizka (1991)			x
Dichelachne micrantha (Cav.) Domin	Poaceae	Native	Zizka (1991)			x
Elaeocarpus rarotongensis Hemsl.	Elaeocarpaceae	Doubtful	Orliac (1998)	*Elaeocarpus floridanus* Hemsl.	Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Erythrina spec.	Fabaceae	Native	Butler and Flenley (2010)		Only documented by rare pollen records.	x
Euphorbia serpens Kunth	Euphorbiaceae	Native	Zizka (1991)			x
Gen. spec.	Ericaceae	Native	Rull et al. (2015)		One pollen record from app. 800 BP (Rull et al. 2015), introduced?	
Gen. spec.	Moraceae	Native	Azizi and Flenley (2008), Butler and Flenley (2010), Rull et al. (2015)		Only documented by pollen records, in Butler and Flenley (2010: fig. 1) as "Urticaceae/Moraceae"	
Gen. spec.	Urticaceae	Native	Butler and Flenley (2010), Horrocks et al. (2013)		Only documented by pollen records	
Heterospathe longipes (H.E. Moore) Norup	Arecaceae	Doubtful	Bowdery (2015)		Only documented by phytoliths. Hypothetical species ("best match" of phytoliths with recent species).	
Howea belmoreana (C. Moore & F. Muell.) Becc.	Arecaceae	Doubtful	Bowdery (2015)		Only documented by phytoliths. Hypothetical species ("best match" of phytoliths with recent species).	

Ipomoea pes-caprae (L.) R. Br.	Convolvulaceae	Native	Zizka (1991)			x
Lachnagrostis filiformis Trin.	Poaceae	Native	Zizka (1991)	*Agrostis avenacea* J.F. Gmel.		x
Lycium carolinianum Walter var. *sandwicense* (A. Gray) C.L. Hitchc.	Solanaceae	Native	Zizka (1991)	*Lycium sandwicense* A. Gray		x
Macaranga spec.	Euphorbiaceae	Native	Flenley et al. (1991), Horrocks et al. (2013)		Only documented by pollen records, no species identified. Several endemic species in French Polynesia (pers. comm. Jean-Francois Butaud)	x
Metrosideros spec.	Myrtaceae	Native	Flenley et al. (1991), Butler and Flenly (2010)		Only documented by pollen records, no species identified. Butler and Flenley (2010) refer only to family Myrtaceae.	x
Metroxylon sagu Rottb.	Arecaceae	Doubtful	Bowdery (2015)		Only documented by phytoliths. Hypothetical species ("best match" of phytoliths with recent species).	
Metroxylon vitiense (H. Wendl.) Hook. f.	Arecaceae	Doubtful	Bowdery (2015)		Only documented by phytoliths. Hypothetical species ("best match" of phytoliths with recent species).	
Myrsine spec.	Primulaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Oxybasis glauca (L.) S. Fuentes, Uotila & Borsch	Amaranthaceae	Native	Zizka (1991)	*Chenopodium glaucum* L.		x

Paschalococos disperta J. Dransf.	Arecaceae	Endemic	Zizka (1991)		Extinct.	x
Paspalum forsterianum Flügge	Poaceae	Endemic	Zizka (1991)			x
Peperomia tetraphylla (G. Forst.) Hook. & Arn.	Piperaceae	Native	Skottsberg (1956)			x
Persicaria acuminata (Kunth) M. Gomez	Polygonaceae	Native	Zizka (1991)	*Polygonum acuminatum* Kunth		x
Pittosporum spec.	Pittosporaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Plantago spec.	Plantaginaceae	Native	Azizi and Flenley (2008), Cañellas-Bolta et al. (2013), Horrocks et al. (2013)		Family Plantaginaceae documented by pollen records before arrival of humans.	x
Portulaca oleracea L.	Portulacaceae	Native	Zizka (1991)			x
Potamogeton spec.	Potamogetonaceae	Native	Flenley et al. (1991), Horrocks et al. (2015)		Only genus documented by pollen records, no species identified.	x
Premna cf. *serratifolia* L.	Lamiaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Pritchardia vuylstekeana H. Wendl.	Arecaceae	Doubtful	Bowdery (2015)		Only documented by phytoliths. Hypothetical species (“best match” of phytoliths with recent species).	

Psychotria spec.	Rubiaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Psydrax cf. *odorata* (G. Forst.) A.C. Sm. & S.P. Darwin	Rubiaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Pycreus polystachyos (Rottb.) P. Beauv.	Cyperaceae	Native	Zizka (1991)	*Cyperus polystachyos* Rottb.		x
Rytidosperma paschale (Pilg.) C.M. Baeza	Poaceae	Endemic	Zizka (1991), Baeza (1991)	*Danthonia paschalis* Pilg.		x
Samolus repens Pers.	Primulaceae	Native	Zizka (1991)			x
Santalumc spec.	Santalaceae	Doubtful	Forster (1778–1780), Skottsberg (1956)		Based on G. Forsters report of a carved wooden hand. See discussion in Skottsberg (1956). Regarded doubtful.	
Sapindus saponaria L.	Sapindaceae	Native	Butler and Flenley (2010)		*Sapindus saponaria* is occurring on the island, possibly a Polynesian introduction (Zizka 1991).	x
Schenkia spicata (L.) G. Mans.	Gentianaceae	Native	Zizka (1991)	*Centaurium spicatum* (L.) Fritsch		x
Schoenoplectus californicus (C.A. Mey.) J. Soják	Cyperaceae	Native	Zizka (1991)	*Scirpus californicus* (C.A. Mey.) Steudel		x
Sesuvium portulacastrum (L.) L.	Aizoaceae	Doubtful	Hemsley (1885)		One single record in literature, no herbarium specimens available, doubtful (Zizka 1991).	

Solanum opacum A. Braun & C.D. Bouché	Solanaceae	Native	Zizka (1991)	*Solanum forsteri* Seem.		x
Sophora toromiro Skottsb.	Fabaceae	Endemic	Zizka (1991)		Extinct in the wild.	x
Sporobolus africanus (Poir.) Robyns & Tournay	Poaceae	Native	Zizka (1991)			x
Tetragonia tetragonoides (Pall.) Kuntze	Aizoaceae	Native	Zizka (1991)			x
Thespesia populnea (L.) Sol. ex Correa	Malvaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	
Trema spec.	Ulmaceae	Native	Flenley et al. (1991), Butler and Flenley (2010)		Only genus documented by pollen records, no species identified.	x
Triumfetta semitriloba Jacq.	Malvaceae	Native	Zizka (1991)			x
Typha spec.	Typhaceae	Native	Flenley et al. (1991)		Only genus documented by pollen records, no species identified.	x
Verbena litoralis Kunth	Verbenaceae	Native	Cañellas-Bolta et al. (2013)		Regarded introduced by Zizka (1991). Cañellas-Bolta et al. (2013) document pollen as early as app. 3000 BP.	x
Xylosma cf. *suaveolens* (J.R. Forst. & G. Forst.) G. Forst.	Salicaceae	Doubtful	Orliac (1998)		Based on identification of charcoal, ca. 300–600 years old. Possibly Polynesian introduction or driftwood.	

Clubmosses (Lycopodiopsida, Lycopodiales)						
Huperzia spec.	Lycopodiaceae	Native	Rull et al. (2015)		Only documented by spores.	x
Lycopodium spec.	Lycopodiaceae	Native	Butler and Flenley (2010), Horrocks et al. (2015)		Only documented by spores.	x
Fern allies (Polypodiopsida, Ophioglossidae)						
Ophioglossum lusitanicum L. subsp. *coriaceum* (A. Cunn.) R.T. Clausen	Ophioglossaceae	Native	Meyer (2013)	*Ophioglossum coriaceum* A. Cunn.	Possibly *O. nudicaule* L. f. (pers. comm. Jean-Francois Butaud).	x
Ophioglossum reticulatum L.	Ophioglossaceae	Native	Meyer (2013)			x
Psilotum nudum (L.) P. Beauv.	Psilotaceae	Native	Meyer (2013)			x
Ferns (Polypodiopsida, Polypodiidae)						
Asplenium polyodon G. Forst. var. *squamulosum* (C. Chr.) R.A. Rodr.	Aspleniaceae	Endemic	Meyer (2013)	*Asplenium praemorsum* Sw., *Asplenium adiantoides* Lam. var. *squamulosum* Chr. & Skottsb., *Asplenium indusiatum* Copeland	Endemic variety. According to Base de données Nadeaud de l'Herbier de la Polynésie française, the correct name is *Asplenium indusiatum* Copel. (see URL: http://nadeaud.ilm.pf/details-referentiel/20815).	x
Asplenium obtusatum G. Forst. var. *obtusatum*	Aspleniaceae	Native	Meyer (2013)		According to Brownsey and Perrie (2016) the correct name is *Asplenium decurrens* Willd.	x
Cyathea spec.	Cyatheaceae	Native	Azizi and Flenley (2008)		Only documented by spores.	x

Cyclosorus interruptus (Willd.) H. Ito	Thelypteridaceae	Native	Meyer (2013)	*Thelypteris interrupta* (Willd.) K. Iwats.		x
Davallia solida (Forst.) Sw.	Davalliaceae	Native	Meyer (2013)			x
Diplazium fuenzalidae Espin.	Athyriaceae	Endemic	Meyer (2013)			x
Doodia paschalis C. Chr.	Blechnaceae	Endemic	Meyer (2013)	*Blechnum paschale* (C. Chr.) Christenh.		x
Dryopteris karwinskyana (Mett.) Kuntze	Dryopteridaceae	Native	Meyer (2013)	*Thelypteris espinosae* (Hicken) Rodr.		x
Elaphoglossum skottsbergii Krajina	Dryopteridaceae	Endemic	Meyer (2013)			x
Haplopteris ensiformis (Sw.) E.H. Crane	Pteridaceae	Native	Meyer (2013)	*Vittaria elongata* Sw.		x
Hymenophyllum spec. Sm.	Hymenophyllaceae	Native	Butler and Flenley (2010)		Only documented by spores.	x
Microlepia strigosa (Thunb.) C. Presl	Dennstaedtiaceae	Native	Meyer (2013)			x
Phymatosorus parksii (Copel.) Brownlie	Polypodiaceae	Native	Meyer (2013)	*Microsorum parksii* (Copel.) Copel.		x

Pneumatopteris costata (Brackenr.) Holttum var. *hispida* Holttum	Thelypteridaceae	Native	Meyer (2013)	*Thelypteris luzonica* (Christ) C.F. Reed		x
Polystichum fuentesii Espin.	Dryopteridaceae	Endemic	Meyer (2013)			x
Pteris spec.	Pteridaceae	Native	Butler and Flenley (2010)		Only documented by spores.	x
Mosses (Bryophyta)						
Aongstroemia hookeri Müll. Hal.	Dicranaceae	Native	Ireland and Bellolio (2002)	*Dicranella hookeri* (Müll. Hal.) Cardot		x
Blindia magellanica W.P. Schimper	Seligeriaceae	Native	Ireland and Bellolio (2002)			x
Brachymenium indicum Bosch & Sande Lacoste	Bryaceae	Native	Ireland and Bellolio (2002)			x
Bryum argenteum Hedw.	Bryaceae	Native	Ireland and Bellolio (2002)			x
Bryum argenteum Hedw. var. *lanatum* (P. Beauv.) Hampe	Bryaceae	Native	Ireland and Bellolio (2002)			x
Campylopus clavatus Wilson	Dicranaceae	Native	Ireland and Bellolio (2002)			x

Campylopus introflexus (Hedw.) Brid.	Dicranaceae	Native	Ireland and Bellolio (2002)			x
Campylopus vesticaulis Mitten	Dicranaceae	Native	Ireland and Bellolio (2002)			x
Campylopus spec.	Dicranaceae	Native	Ireland and Bellolio (2002)			x
Ceratodon purpureus (Hedw.) Brid.	Ditrichiaceae	Native	Ireland and Bellolio (2002)			x
Chenia leptophylla Zander	Pottiaceae	Native	Ireland and Bellolio (2002)			x
Dicranella hawaiica Brotherus	Dicranaceae	Native	Ireland and Bellolio (2002)			x
Dicranum campylophyllum Taylor	Dicranaceae	Native	Ireland and Bellolio (2002)	*Dicranella campylophylla* (Taylor) A. Jaeger		x
Ditrichium difficile Fleischer	Ditrichiaceae	Native	Ireland and Bellolio (2002)			x
Fabronia jamesonii Taylor	Fabroniaceae	Native	Ireland and Bellolio (2002)			x
Fissidens pascuanus Brotherus	Fissidentaceae	Endemic	Ireland and Bellolio (2002)			x
Fissidens pellucidus Hornschuch	Fissidentaceae	Native	Ireland and Bellolio (2002)			x
Isopterygium albescens Jaeger	Hypnaceae	Native	Ireland and Bellolio (2002)			x

Leptobryum pyriforme Wilson	Bryaceae	Native	Ireland and Bellolio (2002)			x
Macromitrium spec.	Orthotrichaceae	Native	Ireland and Bellolio (2002)			x
Papillaria crocea Jaeger	Meteoriaceae	native	Ireland and Bellolio (2002)			x
Philonotis hastata Wijk & Margadant	Bartramiaceae	Native	Ireland and Bellolio (2002)			x
Pohlia spec.	Bryaceae	Native	Ireland and Bellolio (2002)			x
Ptychomitrium subcylindricum Theriot	Ptychomitriaceae	Endemic	Ireland and Bellolio (2002)			x
Pyrrhobryum spiniforme Mitten	Rhizogoniaceae	Native	Ireland and Bellolio (2002)			x
Racopilum cuspidigerum Angström	Racopilaceae	Native	Ireland and Bellolio (2002)			x
Sematophyllum aberrans E.B. Bartram	Sematophyllaceae	Native	Ireland and Bellolio (2002)			x
Sematophyllum brachycladulum Brotherus	Sematophyllaceae	Native	Ireland and Bellolio (2002)			x

Tortella humilis Jennings	Pottiaceae	Native	Ireland and Bellolio (2002)			x
Trematodon pascuanus Theriot	Bruchiaceae	Endemic	Ireland and Bellolio (2002)			x
Trichostomum brachydontium Bruch	Pottiaceae	Native	Ireland and Bellolio (2002)			x
Weissia controversa Hedw.	Pottiaceae	Native	Ireland and Bellolio (2002)			x
Weissia spec.	Pottiaceae	Native	Ireland and Bellolio (2002)			x
Liverworts (Marchantiophyta)						
Acrobolbus knightii (Mitt.) Briscoe	Acrobolbaceae	Native	Grolle (2002), Ireland and Bellolio (2002)	*Marsupidium knightii* Mitt.		x
Cephaloziella spec.	Cephaloziellaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Dumortiera hirsuta (Sw.) Nees	Dumortieraceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Frullania ericoides Raddi	Frullaniaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Jackiella javanica Schiffn.	Jackiellaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x

Lejeunea flava (Sw.) Nees	Lejeuneaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Lejeunea minutiloba A. Evans	Lejeuneaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Lophocolea aberrans Lindenb. & Gottsche	Lophocoleaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Marchantia berteroana Lehm. & Lindenb.	Marchantiaceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Myriocoleopsis minutissima (Sm.) R.L. Zhu, Y. Yu & Pocs subsp. *myriocarpa* (Nees & Mont.) R.L. Zhu, Y. Yu & Pocs	Lejeuneaceae	Native	Grolle (2002), Ireland and Bellolio (2002)	*Cololejeunea minutissima* (Sm.) Schiffn.		x
Riccardia tenerrima (Steph.) A. Evans	Aneuraceae	Native	Grolle (2002), Ireland and Bellolio (2002)			x
Hornworts (Anthocerotophyta)						
Gen. spec.	Family	Native	Grolle (2002)			

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