

## THE CURRENT STATUS OF AND THREATS TO, THE VASCULAR FLORA OF THE FALKLAND ISLANDS, SOUTH ATLANTIC

### ESTADO ACTUAL Y AMENAZAS PARA LA FLORA VASCULAR DE LAS ISLAS FALKLAND, ATLÁNTICO SUR

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The Falkland Islands are an archipelago of 782 islands (Woods 2001) situated in the South Atlantic between latitudes 51°S and 53°S and longitudes 57°W and 62°W. They cover an area of c. 12,200 km<sup>2</sup> and are approximately 500 kilometres from the nearest point on mainland South America. The climate is cool temperate oceanic and is characterised by its lack of extremes. Temperatures are never high but are maintained at a moderate level with a mean for January of 9.4°C and a mean for July of 2.2°C, and ground frosts can occur throughout the year. Rainfall is low with a mean annual precipitation, during the period 1944-1978, at Stanley of 640 mm, though the rainfall received tends to decline towards the south and west. Rainfall is lowest in spring and this, combined with the strong winds, reduces plant growth (McAdam 1985; Summers & McAdam 1993). Climatic variation across the Falkland Islands archipelago is poorly understood but West Falkland tends to have a milder, drier and sunnier climatic regime, particularly in the northwest.

### SOILS AND VEGETATION

The topography of the Islands is not extreme with the landscape being generally hilly and the tallest mountain, Mt. Usborne on East Falkland, is only 705 m high. A typical Falkland soil comprises a shallow (usually no deeper than 38 cm) peaty horizon overlying a compact, poorly drained, silty-clay subsoil. Mineral soils occur in areas wherever the underlying geology is exposed, particularly on mountain tops and in coastal areas. Falkland soils generally have a pH in the range 4.1 to 5.0 and are deficient in calcium and phosphate (Cruickshank 2001). The main vegetation types are acid grasslands dominated by *Cortaderia pilosa* (Poaceae) and dwarf shrub heathland dominated by *Empetrum rubrum* (Ericaceae), but other vegetation types of more limited extent may be locally important particularly around the coasts. Scrub communities dominated by *Chiliodendron diffusum* (Asteraceae) or *Hebe elliptica* (Plantaginaceae) would have been much

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more widespread before the introduction of livestock as was a coastal community dominated by the three metre tall grass, *Poa flabellata* (Poaceae), which today survives mainly on small offshore islands. There is no native tree cover.

## LAND USE

The history of land use in the Islands is one of little change since post glacial times until man's limited presence from about 240 years ago, when cattle pigs, sheep and goats were first introduced by French settlers (Summers & McAdam 1993). Sheep were farmed commercially from the 1860s, numbers increasing up to a maximum of 800,000 in the early 1900s. Stock density declined to about 600,000 by 1930 and remained relatively constant (at a mean stocking density of approximately 1 sheep per 2 ha) until early in the 1980s when a programme of farm-subdivision was introduced (McAdam 1984a; Summers & McAdam 1993) and since then sheep numbers have increased by approximately 20% (Summers, Haydock & Kerr 1993). Some reseeding has been carried out using introduced European forage species but most of the grassland is extensively grazed. Since the late 1990s there have been moves to increase the numbers of cattle on the Islands. The rural population is small (3-400 people) and though most are still engaged in agriculture, farm-based tourism has steadily increased in popularity in recent years and become economically more significant than sheep farming on several inhabited islands.

## THE FLORA

The first botanist known to have visited the Falkland Islands was Antoine-Joseph Pernetty in 1764 (Moore 1968) and botanists have visited the Islands intermittently throughout their history. Over 60 botanists made collections of Falkland Islands plants before 1968, summarised in Moore (1968). Accounts of the flora were produced at disjunct intervals interspersed with long periods of inactivity (eg. Skottsberg 1913; Moore 1968) and it was not until the latter publication that a significant step forward was taken in the understanding of the Falkland Islands flora. Moore's work can be regarded as the first true flora, as with the keys and full species descriptions it

contained, it allowed identification of taxa, and as a result was more than just a list of species recorded. In consequence this text is still the definitive guide to the flora of the Falkland Islands and has provided a firm foundation for all subsequent floristic investigation in the archipelago. Recent work (Broughton & McAdam 2002a,b,c; 2003; Broughton, McAdam & Brännström 2000) which included substantial field recording, has resulted in significant increase in the number of species recognised, particularly through a substantial increase in the known alien flora (Broughton & McAdam 2002c) and in our knowledge of the status and distribution of the flora (Broughton & McAdam 2002a, 2003). Similarly there have been changes to accepted nomenclature, to those species considered endemic, and a gradual increase in knowledge of the flora as a whole.

Seventy-five families, 215 genera, and 363 species have so far been recorded growing wild in the Falkland Islands and are listed in the checklist (Broughton & McAdam 2005). Of these, fifty-four families, 120 genera and 171 species are native. The substantial non-native flora of 192 species has been (partially) reviewed (Broughton & McAdam 2002c). There are 18 native and 3 non-native pteridophytes (Broughton & McAdam 2003).

The Falkland Islands are currently considered to have 13 endemic species. These are: *Chevreulia lycopodiodes*, *Erigeron incertus*, *Gamochaeta antarctica*, *Hamadryas argentea*, *Leucheria suaveolens*, *Nassauvia gaudichaudii*, *Nassauvia serpens*, *Nastanthus falklandicus*, *Phlebolobium maclovianum*, *Plantago moorei*, *Senecio littoralis* and *Senecio vaginatus* and *Calceolaria fothergillii*. Two taxa - *Nastanthus falklandicus* and *Plantago moorei* - are of particular note as they appear to be narrow-endemics, restricted to the southern coast of West Falkland. *Calandrinia feltonii* was previously regarded as an endemic but recent DNA studies (Hershkovitz 2006) have shown that it is a weedy introduction from western North America, properly classified as *C. menziesii*.

As would be expected the native flora shows strong affinities with that of southern South America. Thirty-three species (19%) have a 'circum-Antarctic' distribution occurring in some part of the sub-Antarctic zone, New Zealand or southeastern Australia, and sixteen species (9%) have a bipolar distribution, being found also in the higher latitudes

of North America and to a slightly lesser extent, Europe (Moore 1968). The juxtaposition of the Islands between Antarctica, South America and other remote South Atlantic Islands gives them high biogeographic importance.

### *Threats to the flora*

a. *Reform of rural infrastructure.* Land reform in the 1980s has resulted in farm subdivision and increased stock numbers. In many cases this has been accompanied by fencing, pasture improvement and greater stock control but overgrazing and erosion of some of the shallow, fertile soils has occurred. Research activities have greatly contributed to an understanding of the sustainable management of the rangeland vegetation (eg Kerr 2003). Other rural development activities related to oil, fishing, aquaculture and tourism have had limited impact.

b. *Plant introductions.* The total number of non-native species is now known to be 192, nearly double that previously recognised by Moore (1968), and exceeding the total for native taxa (171 species) (Broughton & McAdam 2002c). Taxa come from 46 families of which the Asteraceae (28 species and 16% of the non-native flora) and the Poaceae (36 species and 21% of the non-native flora) are undoubtedly the most important. Most non-native species, (131 taxa and 75% of the non-native flora), show an association with human habitation and other built environments. Of these, approximately 50% are dependent upon such habitats, reflecting the requirement of many non-natives for open, disturbed or nutrient enriched ground. Other species associated with habitation are more widespread and can also be found in naturally open and disturbed habitats such as beaches and seabird colonies, or in vegetation that has been modified by domestic animals. However, the association of some species with habitation is equally a reflection of their horticultural and agricultural origins and some species, particularly the trees and shrubs, are merely relicts surviving where settlements and gardens have been abandoned. Most non-native taxa were rare or local in occurrence and so probably do not have the competitive ability to spread far in the harsh environment of the Falklands (Broughton & McAdam 2002c). As man's activities continue

to expand and diversify in the Falkland Islands the non-native flora can also be expected to expand and to become more prominent. A similar trend has already been noted in Tierra del Fuego, where the increasing activity of man has undoubtedly extended the area of many non-native taxa (Moore 1983). *Cirsium vulgare*, for example, arrived in Tierra del Fuego prior to 1917 but was not common. During the 1960s, however, it became more widespread, particularly along roads.

c. *Countryside access.* Before 1985 there were virtually no roads in the Falkland Islands and building a rural road network commenced. Now a sparse network of roads exists, giving more people from Stanley (the only town) access to the countryside. This, coupled with more leisure time, a greater interest in wildlife, and the growth of the tourism industry has put more pressure on coastal and other sensitive habitats. A road network allows weed species to expand their range. This has already happened with *Senecio sylvaticus* and *Cirsium vulgare* may follow the same expansion pattern as on Tierra del Fuego.

d. *Fire.* As the vegetation emerges from the winter it has accumulated a high proportion of dead matter which creates a fire hazard, particularly in the dry windy spring and summer (McAdam 1984b). The peat soils that dominate much of the landscape are also vulnerable to fire particularly following prolonged periods of dry weather or drought. It is a common land management practice to burn pasture in spring to remove this dead material and to make the greener leaves below more available to sheep, but is used less often nowadays. This practice may have some detrimental effect on the flora but this is not clearly known. Fires can also occur through carelessness and from lightning strikes.

e. *Climate change.* On a more global scale, climatic change may have a significant effect on the flora of the Falkland Islands (Bokhorst *et al.* 2007a & b; Sear *et al.* 2001; Wadhams 1993). There is evidence that rainfall is slowly declining on the Islands (Hoppé and McAdam 1998) and there are occasional periods when ozone depletion is particularly strong over the Islands. A combination of these processes may well have a significant impact on the flora.

### *Current status and distribution*

The extent and distribution of the flora was little known until work by Moore (1968, 1973) and, a more thorough and extensive study, a Darwin Initiative (DEFRA) funded project. The latter resulted in the production of a checklist and preliminary atlas of the distribution of the flora (Broughton & McAdam 2002a); the first comprehensive assessment of the conservation status of the flora and a review of conservation measures in place (Broughton & McAdam 2002b); detailed studies of floras of specific islands in the Falklands archipelago (McAdam & Woods 1995; Broughton *et al.* 2000) and plant groups (Broughton & McAdam 2003, 2005). These studies have highlighted the general uniformity of the distribution of the flora, though some species, such as *Plantago moorei*, are extremely rare, localised in distribution and merit further study.

The greatest increases in sheep numbers have been on vegetation types overlying drier, more fertile, soils (such as around ponds), in valleys and on coastal pastures. There is some evidence that soil erosion on shallow soils may have increased in extent because of overgrazing but little is understood of the response of individual communities to increased grazing pressure (Kerr 2003). While sheep grazing has affected the flora considerably there is no evidence to support actual loss of species through the practice. However, two native plant species, *Scutellaria nummulariifolia*, *Saxifraga magellanica* and have not been recorded recently and require urgent survey work to assess their current status (Broughton & McAdam 2002b).

### *Protection*

Under the Conservation of Wildlife and Nature Ordinance 1999 (FIG 1999) nineteen species of plant are protected. Broughton & McAdam (2002 b). This, the first Red Data List for the Falklands, contained 23 species and included a further 16 species of relevance to the national conservation strategy. Internationally the conservation of endemic Falkland Islands taxa is perhaps of greatest importance, and should be the focus of priority action. Thirteen species (8% of the native flora) are endemic to the Falkland Islands archipelago. Five of these (43% of endemics) are threatened (26% of threatened plants)

and one is "Near Threatened". Of the threatened endemic plants, the Antarctic cudweed *Gamochaeta antarctica* is Endangered, and the other four species are Vulnerable.

The only international Convention currently relevant to the Falkland Islands flora is CITES and the Convention is only applicable to the four Falkland Islands members of the Orchidaceae, only one of which is threatened. All orchids are covered by Appendix II of the Convention. The conservation of wild flora in the Falkland Islands is still in its early stages and has advanced little beyond initiatives to purchase nature reserves. However, with an increase in public awareness and interest in conservation issues, fuelled to some degree by land reform and the increased role of tourism in the economy, there are signs of a shift in focus from protecting sites of high wildlife value to direct action to address conservation problems, such as the development of an *ex situ* conservation strategy with Royal Botanic Gardens, Kew. In particular, there is a slowly growing awareness of the need to protect and manage threatened plants outside nature reserves and protected sites. This will be vital because most of the species on the Red List are not well represented in the current framework of protected areas. Thus, land-managers whose prime concern is other than with nature conservation may have a significant responsibility in ensuring the continued survival of threatened plant species.

The establishment of a national herbarium, the production of new field guides to the flora (Woods 2000; Liddle 2008) and the production of a conservation orientated visitors guide to the Islands (Summers 2001 and 2005) has encouraged further interest in the flora and its conservation.

### *Conclusions*

Whilst agriculture and development have been identified as major factors in the decline of some elements of the native flora, it is also possible to implicate a general lack of knowledge of the native Falkland Islands flora and its importance. Given the small size of the Falkland Island's human population, there is scope for halting and reversing the decline of threatened flora. However, this will be dependent on the provision of sufficient resources and increased public awareness. Regular monitoring of threatened plant populations is required along with

investigations of their biology and the reasons for their decline, and all threatened taxa not currently protected need to be afforded full legal protection. Also, given the importance of conserving genetic diversity (Wigginton 1999; Lesica & Allendorf 1995), the genetic aspects of rare plant conservation require greater attention.

Most visitors to the Islands (about 60,000 in 2006/07) are cruise-ship based tourists and make little or no impact on the flora. There are a small number of special-interest tourists who visit the Islands, mainly for the wildlife. Such tourists represent a considerable income potential for the Islands and provided their activities are managed in a sustainable manner, as has been recommended for *Poa flabellata* (Hoppé & McAdam 1992), such eco-tourism should be viewed as a positive step for sustainable conservation and management of the flora.

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