Environment & Heritage Service/National Parks and Wildlife Service

ALL-IRELAND SPECIES ACTION PLAN
KILLARNEY FERN

April 2008

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

Environment & Heritage Service
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All-Ireland Species Action Plan
Killarney Fern *Trichomanes speciosum*
April 2008

1 Current status

1.1 *Trichomanes speciosum* Willd. (Killarney Fern; Raithneach Chill Airne) is a member of the family Hymenophyllaceae (Filmy ferns). It is a distinctive, long-lived fern with dark-green, translucent pinnately divided fronds (leaves) which arise from a creeping rhizome. The leaves can be up to 450mm in length (Stace, 1997). They are particularly sensitive to dessication and are not adapted to reduce or control water loss (Rumsey, 1994). *T. speciosum* has a 2-stage life cycle. The typical fern-like stage is known as the sporophyte, while the other stage is the perennial filamentous gametophyte which is capable of reproducing asexually by means of gemmae (Vogel *et al.*, 1993). In Ireland the sporophyte occurs in dripping caves, cliff faces, crevices by waterfalls and cascades, rock crevices in woodlands and very occasionally on the floor of damp woodlands. The gametophyte grows in similar habitats, albeit drier and darker, as it does not appear to require direct contact with water (Johnson *et al.*, 2000; Kingston & Hayes, 2005). The species is frost-sensitive (JNCC, 2005). Comparatively little has been written on the ecology of the species in Ireland (but see Doyle, 1987, Ratcliffe *et al*, 1993, Rumsey, various works 1994-2002 & Kingston & Hayes, 2005).

1.2 *T. speciosum* is a rare Macronesian/European endemic species and is thought to be indicative of an ancient Tertiary flora (Jermy, 1994). Both generations in the life cycle are found in Ireland, Great Britain, the Atlantic islands of Madeira, the Canaries and the Azores, France, Spain, Portugal and on the west coast of Italy (Ratcliffe *et al.*, 1993; Kingston & Hayes, 2005). The gametophyte generation is more widespread than the sporophyte, and has been reported from Germany (Rumsey *et al.*, 1998a), the Czech Republic-German border (Vogel *et al.*, 1993) and Luxembourg (Krippel, 2001). Temperature and water supply are considered to be the main factors determining the distribution of *T. speciosum* (Vogel *et al.*, 1993).

1.3 The first record of *T. speciosum* in Ireland was made before 1804 by Dr Whitley Stokes at Powerscourt Waterfall (Colgan & Scully, 1898). Recent (1987-2000) records for the sporophyte generation from twenty 10x10 km squares (ten squares in the case of the gametophyte generation) in both the Republic of Ireland and Northern Ireland are mapped in Preston *et al.* (2002), although a number of other more recent records are also known (National Parks and Wildlife Service (NPWS) unpublished data). Additional older records for of the sporophyte generation are mapped in Preston *et al.* (2002) and Curtis & McGough (1988). Within Ireland, sporophyte populations are mainly found in Kerry and West Cork. There are also restricted sites reported in Carlow, Clare Donegal, Limerick, Waterford, Wicklow & Sligo (Curtis & McGough, 1998, NPWS, unpublished data). Records of the sporophyte have been documented from an altitude of 340m (NPWS, unpublished data). The gametophyte generation exhibits a similar distribution in the Republic of Ireland but is more widespread, occurring in Galway and Mayo also (Rumsey *et* al., 1998a; Preston *et al.*, 2002). In Northern Ireland the sporophyte is only known from one site in NE Antrim while the gametophyte is known from a number of sites in Co. Fermanagh.

1.4 The historic decline of *T. speciosum* in Ireland can, in part, be attributed to the collection of the sporophyte during the Victorian fern craze (Allen, 1969). Only three of the original nine records of *T. speciosum* from the 1800s have been seen since (NPWS, unpublished data). Curtis and McGough (1988) document 10 records of the sporophyte in the Irish Red Data Book. Several more sites have been reported since 1988. Ratcliffe *et al.* (1993) mention 30 sites in their research and are certain that existing sporophyte colonies remain to be discovered in Ireland. Records of gametophyte sites have been documented in Rumsey (1994) and Preston *et al.* (2002) with 10 sites having been recorded in the period 1987 to 1999. The distribution of *T. speciosum* is enigmatic in that it is absent from many apparently suitable habitats within its climatic range (Ratcliffe *et al.*, 1993).

1.5 Limited monitoring of colonies by Ratcliffe *et al.* (1993) in England, Wales and Ireland (over 20 years) suggests that there is a reasonable level of stability over at least 10 to 30 years in the number of fronds, size and shape of fronds and their position within the habitat. Some colonies remain almost constant while other develop or decline to a degree according to annual variations in weather (Ratcliffe *et al.*, 1993). One population in Ireland has at least 21 sporophyte colonies made up of at least 2390 fronds (NPWS, unpublished data).

1.6 *T. speciosum* is an autotetraploid (Rumsey, 1994) and is unique among European ferns in that its gametophytic generation produces perennial gemmae (specialised structures for vegetative propagation) which may grow and persist in the absence of the sporophyte generation (Rumsey *et al.*, 1998a). The gemmae can be dispersed by water or air or a combination of both. However, the method by which the gametophyte detaches the gemmae is not clear (Jermy, 1994). The sporophyte forms sporangia on specialised receptacular organs which emerge from tubular pockets at the edges of the leaf (Jermy, 1994). The spores are green when shed and if they germinate, must do so within a few days (Jermy, 1994). The gametophyte rarely produces archegonia (Rumsey *et al.*, 1991) and although it does produce antheridia, they rarely develop motile antherozoids (Rumsey *et al.*, 1998a). Therefore, the generation of sporophytes from the gametophyte generation cannot be automatically assumed. However, a number of sites in Britain and Ireland have been found to contain gametophytes intimately mixed with juvenile and mature sporophytes, suggesting that sexual recruitment may actually be occurring on a limited basis (Rumsey, 1994; NPWS unpublished data). Out of the 30 Irish sites investigated by Ratcliffe *et al.* (1993), only 4 colonies of sporophytes had fertile fronds. These colonies were found in habitats with fairly high light intensity levels (40-85% full daylight). Fronds growing in deep shade and constant wetness do not usually produce sori (Ratcliffe *et al.*, 1993). A study by Rumsey *et al.* (1999) in south west Scotland, the northern limit of the sporophyte generation, concluded that asexual reproduction of the gametophyte was the main means of propagation in recent times, with overall genetic variability possibly being attributed to sexual reproduction and spore dispersal in historic times under more favourable climatic conditions. Genetic research from populations in Britain suggest that, in the vast majority of cases, each site is occupied by a monoclonal colony (Rumsey, pers comm.) but adjacent clones may be highly genetically distinct (Rumsey *et al.*, 2002a). However, further research is needed to establish if this is also the case in Ireland. Rumsey *et al.* (2002a) found that genetic information from British populations suggest long-distance wind-borne dispersal

followed by slow vegetative expansion as a legitimate colonisation theory. They also found that the diverse populations in Britain and Ireland represent colonisation events from a range of more southerly refugia, resulting in a greater haplotypic diversity in the British Isles.

1.7 Given the restricted distribution of *T. speciosum* in Europe, Ireland has an international responsibility to protect this species *T. speciosum* is listed on Annex II and Annex IV of the European Union Habitats Directive, 1992 [92/43/EEC] and Appendix I of the Bern Convention, 1979. It is also listed as Rare on the IUCN global Red Data List (IUCN, 2001). The species is protected in the Republic of Ireland under the Flora (Protection) Order, 1999, made under the Wildlife Act of 1976 (and Ammendments), and is an Irish Red-listed species (Curtis & McGough, 1988). In Northern Ireland the species is protected under Schedule 8 of the Wildlife (Northern Ireland) Order, 1985.

1.8 The overall conservation status of *T. speciosum*, in the Republic of Ireland, is 'Favourable', according to the 2007 Habitats Directive report (NPWS, 2008).

2 Current factors causing loss or decline

2.1 The collection of samples of *T. speciosum* in the past was arguably the single biggest threat to this species survival, and resulted in the loss of a number of populations and a major decline on the size of many others. This type of activity is still a potential problem along with trampling and vegetation removal associated with botanising and photography.

2.2 Human disturbance may pose a significant threat to some populations. Some of the sporophyte colonies are in woodland localities that are used for recreational purposes. Some of the colonies are in fact close to, and visible from well used pathways.

2.3 Grazing is a problem especially in sites accessible to animals. This is less of a problem for the gametophyte colonies that tend to occur in habitats beyond the reach of grazers.

2.4 Woodland clearance or the limited felling of trees in woodland sites can cause a detrimental change in the ambient humidity of the habitat by opening up new avenues for wind movement, removing shading vegetation and increasing incident light falling onto colonies. This is especially a problem where colonies occur under stands of invasive species (e.g. Beech, Rhododendron, Cherry Laurel) and woodland management recommends removal of the invasive species.

2.5 Natural processes such as wind felling of trees, competition from other plants, unusual weather conditions such as a prolonged frost or drought, and rock falls have contribute to the species' decline as in small, single colony sites.

2.6 Modifications to the hydrology of a catchment or a habitat through afforestation or hydro-electric engineering could have a detrimental effect on a population.

2.7 Water pollution by nitrogenous wastes (sewage, fertiliser) and air pollution by hydrocarbons and airborne particulates may threaten the survival of *T. speciosum* by causing membrane damage.

2.8 It is thought that climate change may have halted the colonisation process of the species in central Europe which began several thousand years ago (Rumsey *et al.*, 1998b) and that a slight shift to a warmer and wetter climate may place the gametophytes in an ideal position to extend again. Climate change in Ireland could potentially result in an expansion of the species' range.

3 Current action

3.1 The EU Habitats Directive allows for the selection of a Special Areas of Conservation (SACs) for the protection of sites that contain a generation/s of *T. speciosum*. To date, seventeen candidate SACs have been selected on the basis of the presence of important *T. speciosum* (Kingston & Hayes, 2005). All of the selected sites contain the sporophyte generation while eleven also contain the gametophyte generation.

3.2 Site monitoring, which occurs on a three year cycle in the Republic of Ireland and six-yearly in Northern Ireland, surveys designated sites for any impacts to the habitats and species therein, reports all activities that may have an impact on the habitats and species, and in doing so monitors any effects to the protected species present.

3.3 Management plans for designated sites highlight the presence of *T. speciosum* within a site and include prescriptions for the protection of the species.

3.4 In Ireland there are currently several projects running which involve research on the Killarney fern.

- NPWS is currently funding a research project to study the effects of *Rhododendron ponticum* removal on the species habitat. *R. ponticum* is a major invasive species in a cSAC in the south-west which also includes several *T. speciosum* gametophyte populations. Removal of *R. ponticum* from this site may have a negative effect on the gametophyte. This project aims to establish the optimal form of *R. ponticum* removal from the site which causes minimal disturbance, if any, to the gametophyte populations. Various methods of removal will be investigated by monitoring the gametophyte populations and their microhabitats immediately after clearance and at designated time intervals afterwards.

- Samples of *T. speciosum* from Ireland form part of a broad phylogenetic dataset which is being used to investigate the DNA sequence for a single plastid region (trnL).

- The National Roads Authority is currently funding a baseline study at a site in the south to investigate and describe the environmental conditions pertaining in this site. A detailed description of the vegetation it supports, with particular reference to the *T. speciosum* populations present has been carried out. This

study involves detailed surveys of hydrology, water quality, air quality, climate, microclimate and vegetation in order to increase the understanding of the environmental requirements of *T. speciosum* at the site.

- A new PhD project, funded by NPWS, is due to begin in 2008. This project will investigate best practice for *in situ* and *ex situ* conservation of *T. speciosum*, by testing monitoring protocols, developing in vitro propagation and long term storage methods, and assessing the genetic variability of the species in Ireland.

3.5 *T. speciosum* is protected in the Republic of Ireland by the Wildlife Act, 1976 under the Flora (Protection) Order, 1999, and is an Irish Red-listed species (Curtis & McGough, 1988). The Flora (Protection) Order is regularly updated in light of the most current data available for Irish plant species. In Northern Ireland the species is protected under Schedule 8 of the Wildlife (Northern Ireland) Order, 1985. Although the gametophyte is more widely distributed than the sporophyte, it should still continue to be legally protected as it houses far more of the genetic variation shown by *T. speciosum* than the sporophyte (Rumsey *et al.*, 2002b).

3.6 In the Republic of Ireland, under the Wildlife (Amendment) Act, 2000, sites can be designated as Refuges for Flora, and the designation of such sites is currently under consideration.

3.7 In the Republic of Ireland, under the Wildlife (Amendment) Act, 2000, sites can be designated as Natural Heritage Areas, and the designation of such sites for *Trichomanes speciosum* is currently under consideration.

4 Action plan targets

4.1 Maintain all viable populations of both generations of *T. speciosum* throughout Ireland.

5 Proposed actions with lead agencies

5.1 Policy and legislation

5.1.1 By 2010, ensure the conservation designation of extant sites, as appropriate, in Special Areas of Conservation, Natural Heritage Areas, Areas of Special Scientific Interest or Refuges for Flora.
(ACTION: EHS, NPWS)

5.1.2 Ensure that the species' requirements are considered during reviews of relevant farming policies and agri-environment schemes.
(ACTION: EHS, NPWS,

5.1.3 By 2010, determine the IUCN Red list threat status of *T. speciosum* in Ireland based on the 2001 categories and criteria, and submit this information to the IUCN Species Survival Commission.
(ACTION: EHS, NPWS)

5.2 Site safeguard and management

Extreme discretion with information regarding population localities may be necessary. Therefore such information should be kept confidential and only disseminated when and where necessary, until the level of actual risk to the species of publicising site locations is established.

5.2.1 By 2008, ensure that management plans for Special Areas of Conservation with *T. speciosum* as a selection feature include prescriptions for the species' conservation.
(ACTION: EHS, NPWS)

5.2.2 By 2009, ensure those agri-environment schemes for sites containing *T. speciosum* include prescriptions for the species' conservation.
(ACTION: EHS, NPWS)

5.2.3 By 2010, secure favourable management of all sites containing *T. speciosum*.
(ACTION: EHS, NPWS)

5.2.4 By 2010, develop suitable monitoring programmes that incorporate the findings of the research projects, detailed in section 3.4.
(ACTION: EHS & NPWS)

5.3 Species management and protection

5.3.1 By 2010, publish a management plan for the conservation of *T. speciosum* incorporating the findings of recent research projects.
(ACTION: EHS, NPWS)

5.3.2 By 2010, ensure the maintenance of *ex situ* plants of known provenance in the Trinity College Botanic Gardens and in the National Botanic Gardens, Glasnevin.
(ACTION: EHS, NPWS, NBG, TCD)

5.4 Advisory

5.4.1 By 2009 distribute to relevant state agencies a GIS layer of the records of *T. speciosum*.
(ACTION: NPWS)

5.4.2 By 2009, inform landowners of the presence of *T. speciosum* on their lands, and highlight the importance of this rare fern in the All-Ireland and European contexts.
(ACTION: EHS, NPWS)

5.4.3 By 2009, advise landowners of potential impacts to *T. speciosum* that could be caused by land management practices.
(ACTION: EHS, NPWS)

5.4.5 By 2009, distribute advisory leaflets on legislation relevant to *T. speciosum* to all landowners whose land supports the species, as and whenever the legislation is updated.
(ACTION: EHS, NPWS)

5.5 Future research and monitoring

5.5.1 By 2008, collate all available information and determine future research needs, further to section 3.4.
(ACTION: All Parties)

5.5.2 Monitor all populations in sufficient detail to determine whether viable populations are being maintained, assess the factors causing population fluctuations, and determine the conservation status of the populations.
(ACTION: EHS, NPWS,)

5.5.3 Monitor habitat condition and management on a periodic basis to ensure that optimal site management is being achieved.
(ACTION: EHS, NPWS)

5.5.4 By 2010, visit and make efforts to refind populations that have not been surveyed or recorded in the last 20 years.
(ACTION: EHS, NPWS)

5.5.5 By 2010 survey areas to discover additional gametophyte colonies especially in areas where their development into sporophytes seems more likely.
(ACTION: EHS, NPWS)

5.5.6 By 2010, investigate if Irish colonies of *T. speciosum* are essentially monoclonal, with genetic variation partitioned between and not within sites, as is the case in Britain.
(ACTION: EHS, NPWS)

5.5.7 By 2009, compile a catalogue of all sporophyte colonies in cultivation in Ireland (botanic gardens and private collections where known) and establish their provenances if possible.
(ACTION: EHS, NPWS)

5.6 Communications and publicity

5.6.1 By 2009, inform local authorities of the presence of *T. speciosum* in their areas of responsibility and ensure that they are aware of the potential risks to the species that could be caused through inappropriate land management or development.
(ACTION: All Parties)

5.6.2 Raise awareness of the species, particularly the existence and identification of gametophyte generation, among volunteers, botanists, professional conservation workers and researchers by means of reports, publications, field meetings and presentation of research results at conferences.
(ACTION: All Parties)

6 Links with other Action Plans

6.1 This plan should be considered in conjunction with the following Northern Ireland Habitat Action Plans:

- Upland Oakwood

7 References

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List of useful acronyms

ASSI	Area of Special Scientific Interest
BAP	Biodiversity Action Plan
CEDaR	Centre for Environmental Data and Recording
CMB	Countryside Management Branch
CMS	Countryside Management Scheme
DAF	Department of Agriculture, Fisheries and Food
DARD	Department of Agricultural and Rural Development
DCAL	Department of Culture, Arts and Leisure
DCMNR	Department of Communications, Marine and Natural Resources
DETI	Department of Enterprise, Trade and Investment
DOE	Department of the Environment
DRD	Department for Regional Development
EHS	Environment and Heritage Service
ESA	Environmentally Sensitive Area
ESCRs	Earth Science Conservation Review Site
HAP	Habitat Action Plan
IUCN	International Union for Conservation of Nature and Natural Resources
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan
NMNI	National Museums of Northern Ireland
NHA	Natural Heritage Area
NI	Northern Ireland
NIBG	Northern Ireland Biodiversity Group
NICS	Northern Ireland Countryside Survey
NNR	National Nature Reserve
NPWS	National Parks and Wildlife Service
PPG	Planning Policy Guideline
PPS	Planning Policy Statement
RA	Rivers Agency
RoI	Republic of Ireland
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SAP	Species Action Plan
SLNCI	Sites of Local Nature Conservation Importance
SoCC	Species of Conservation Concern
SPA	Special Protection Area
UWT	Ulster Wildlife Trust
WFD	Water Framework Directive
WT	Woodland Trust
WWT	Wildfowl and Wetlands Trust

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