

英國植物保育策略

大不列顛及北愛爾蘭原生植物保育策略綱領

Margaret Palmer 原著

陳志輝 譯

彭國棟 審訂

行政院農業委員會

補助

台灣省特有生物研究保育中心

印行

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序

三百年前，葡萄牙人路過台灣，看到本島山巒疊翠，溪谷縱橫，一片青山綠水，鳥語花香，景色怡人，由衷頌讚台灣為「ilha Formosa！」，意即「美麗之島」。以台灣的地理及氣候條件，歷經億萬年的演化所孕育之豐富動植物資源，「美麗之島」實當之無愧。這些豐富的動植物資源是我們珍貴的自然遺產，也長期維護著本島生態體系之穩定平衡。惟近百年來，國人缺乏永續利用自然資源的觀念，動輒濫墾、濫伐、濫捕，加以近年工商業發達，人口增加，各種開發建設行為對自然資源的掠奪與自然生態環境的破壞更甚於以往，導致許多動、植物族群銳減，部分物種甚至已滅絕，令人扼腕。因此，積極推動自然生態與物種的保育工作實已刻不容緩。

保育工作絕非狂熱、無組織、無規畫的行動，而是必須建立在充分而完善的專業基礎之上，擬訂明確的目標、清晰的策略、實際而可行的步驟，以有組織的團隊合作來進行，方能整合各方面的人力、財力及物力資源，以收事半功倍之效。國內近年來的保育風潮正方興未艾，各界已有積極推動保育之共識；惟以目前情況來看，保育法令未能趕上時代潮流、缺乏整體性的理論架構及整合、基礎調查資料不完整、基層保育專責機構及人力嚴重缺乏，均使得保育工作的推動顯得遲緩而效果不彰，殊為可惜。

有鑒於此，本中心於八十五年度起，承行政院農業委員會經費補助，由彭研究員兼秘書國棟規劃主持，進行「野生植物保育策略之研究」計畫，並指派相關研究人員共十三人成立工作小組，廣泛蒐集世界各保育先進國家之植物保育立法、策略及行動計畫等文獻資料，詳加研讀並翻譯，目標是吸收先進國家之經驗，經過整理後擬訂出切合台灣自然、社會、經濟及人文背景之植物保育策略，以供政府決策單位及國內保育界參考，俾利形成共識，更有效地推動植物保育工作。其中由Margaret Palmer原著之「A UK Plant Conservation Strategy」（英國植物保育策略），乃介紹英國目前推動植物保育的策略綱領，內容詳實，架構完整而嚴謹，為一不可多得之參考文獻。為能突破語言的隔閡，引介該書於國內保育界，特函商該書之著作權所有者英國聯合自然保育委員會（Joint Nature Conservation Committee），獲其同意授權本中心出版該書之中文版。經本中心陳助理志輝完成原文之翻譯，並由彭研究員兼秘書國棟完成審閱校訂，以及彭副研究員仁傑協助相關之編輯作業，終能完成本書之出版，在此特別感謝英國聯合自然保育委員會及該會I F G McLean博士之慷慨協助及本中心工作人員的辛勞。冀望本書之付梓，能獲得國內保育界之回響，形成共識，共同推動國內之植物保育工作。

主任

顏仁德

謹誌

英國植物保育策略

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摘要

爲了保育英國的野生植物，本書陳述英國法定保育主管單位的保育行動綱領，其範圍涵蓋了非維管束植物及維管束植物，從單一物種到群聚，包括稀有物種也包括一般物種。本書主要探討英國的野生植物資源並將英國的植物資源融入國際性視野中。在此要感謝許多民間自發性的團體、保育專家及植物學者們的重大貢獻。

本策略的目標將藉由法定的保育主管單位共同採取下列行動以達成：

- * 調查並監測植物相的狀況
- * 維持資料庫的運作
- * 進行相關研究
- * 經由宣導以提昇植物及棲地的保育
- * 指定、保護及經營管理植物保育地區
- * 爲瀕絕物種研擬行動計畫及執行復育行動
- * 在大環境中提升植物及棲地之保育
- * 用立法的手段來保護物種
- * 鼓勵地方參與，協助資料蒐集及保育工作
- * 遵守植物保育的國際性義務

此外，本策略對於英國執行聯合國生物多樣性公約（Convention on Biological Diversity）之各項保育行動有很大貢獻。

一、背景

（一）前言

本策略係與聯合自然保育委員會秘書處（Support Unit of the Joint Nature Conservation Committee, JNCC）及英國4個地區性保育機構（威爾斯鄉野委員會 Countryside Council for Wales, CCW；英格蘭自然委員會 English Nature, EN；蘇格蘭自然襲產委員會 Scottish Natural Heritage, SNH；北愛爾蘭環境部 Department of the

Environment for Northern Ireland, DoE NI) 之專家們諮詢研商後所研訂，主要在陳述英國原生植物(包括稀有及一般物種)的國家保育策略；它也是法定自然保育主管單位的保育行動綱領。本書之編撰係以自然保育委員會(Nature Conservancy Council, NCC)以前出版的“稀有維管束植物保育策略”(Farrell 1991)為基礎，增列了非維管束植物並整合JNCC出版的“低等植物保育策略”(Hodgetts 1991)，英國植物保育策略的存在並不影響CCW, EN, SNH或DoE NI各別保育策略的研訂，而且它們之間的關係非常密切。

本書所提建議案深獲不列顛群島植物學會(Botanical Society of the British Isles, BSBI)及植物連線(Plantlife Link, 英國關心植物保育的民間組織聯盟)的認同。這些組織也正在草擬自己的屬於民間自發性團體的保育策略，以互相擷長補短。

(二) 目標

本策略的整體目標是有效地保育英國原生植物。

主要目標如下：

- * 維持自然植物的特徵和多樣性，包括：
 - 典型的群聚(assembly)
 - 物種及群聚的自然分布
- * 確保物種和群聚的生存，並體認
 - 一般物種及群聚日漸稀少的危險性
 - 加強瀕危物種和群聚的保育需求
 - 某些分類群的遺傳現況的重要性
 - 防止物種在其自然分佈範圍的全部或部分地區絕滅，或自然群聚組成的全部或部分絕滅的急切需要
 - 英國植物相在國際視野中的重要性
 - 在大自然中賞析野生植物的人類共同渴望

(三) 本策略與“生物多樣性公約”之關係

英國於1994年簽署的聯合國“生物多樣性公約”規定各簽約國應採取下列行動：

- * 鑑別並監測生物多樣性的重要組成
- * 維持資料庫運作
- * 提昇相關研究
- * 提昇對相關議題之了解

- * 建立保護區並發展保護區的遴選及經營管理準則
- * 提昇生態系及自然棲地的保護，以及物種最小存活族群的維持
- * 支持域內 (*in situ*) 保育，執行域外 (*ex situ*) 保育及將物種再引回其自然棲地
- * 研擬或維持立法來保護瀕危物種
- * 支持地方居民實施被破壞地區的復原工作
- * 與其他締約團體合作執行保育工作

公約第6A條要求締約國應發展其全國性的生物多樣性保育及永續利用策略，或配合修正現行之相關計畫和方案。英國政府為回應此挑戰已出版了“生物多樣性：英國保育行動計畫” (Biodiversity: the UK Action Plan) (HMSO 1994)。在這份文件中，鼓勵社區及個人均應與政府各部門配合，積極參與保育行動，並確認“保育應建立在完整的科學知識上”之基本原則。英國保育生物多樣性的目的如下：

1. 保育並儘可能提昇：
 - a. 原生物種的全部族群及自然分布範圍，以及野生物棲地和生態系的品質及範圍；
 - b. 具國際重要性及瀕危的物種、棲地和生態系；
 - c. 有地方特色之物種、棲地、天然的及人為經營的生態系；
 - d. 最近數十年已漸減少的自然或半自然棲地之生物多樣性。
2. 增進公眾對保育生物多樣性的認知及參與。
3. 以全歐洲甚至全球的觀點來保育生物多樣性。

為有助於達成上述目的，英國政府在未來20年內將達成之目標是：

- * 指定並經營管理保護區
- * 在大環境中推動保育措施
- * 完成重要生物多樣性地區之鑑別
- * 研擬受威脅物種的行動計畫(10年至少完成90%的全球性受威脅物種及受威脅的特有物種的行動計畫)
- * 物種復育方案的持續及擴大推動
- * 完成主要分類群紅皮書的優先順序之研訂
- * 更新並發表移置 (translocation)、重建 (re-establishment)、引種 (introduction) 及再栽植 (re-stocking) 的指導準則
- * 持續進行瀕危物種的立法保護
- * 增進資料系統的使用方便性及合作協調；研擬記錄方式的共同標準

- * 推動現行的國際公約
- * 建立歐洲保育工作的完善科學基礎

本植物保育策略提供了一個行動綱領，與生物多樣性公約及英國政府的行動計畫有一致的目標，植物策略的許多目標也與民間保育組織所出版的諮詢文件“生物多樣性的挑戰”（Biodiversity challenge）（Butterfly Conservation *et al.* 1994）一書中所提出的建議一致。

二、涵蓋範圍

本策略涵蓋了生長在陸地、淡水、海水、以及這些生境過渡帶的所有植物。

（一）低等（非維管束）植物

1. 定義

本文所定義的非維管束（或謂低等）植物，其範圍並不侷限在分類學系統的植物界，而是同時包括了更多在習慣上被歸類為植物的生物。所以不只包括了苔蘚植物門，也包括了地衣、真菌類及所有藻類。

儘管像絲狀菌類的微小真菌（肉眼不可見）在生態系的地位非常重要，但以種為基礎的保育措施似乎未將這些缺乏較大而明顯的子實體的菌類生物考慮在內。因此只有肉眼可見的大型真菌包含在本策略。肉眼不可見的藻類，特別是浮游藻類生物，也有很大的生態重要性，我們希望至少能在群落的層次上，能處理並掌握其保育工作，所以我們把它們包含在內。

2. 資源

英國的非維管束植物包括約1,000種苔蘚、約1,700種地衣，至少20,000種真菌及15,000至20,000種的藻類。英國只有少數非維管束特有植物，但在國際上卻有獨特的重要性。約65%的歐洲苔蘚種類存在不列顛（Corley *et al.* 1981；Corley & Hill 1981；Grolle 1983），這些苔蘚擁有獨特的北大西洋、地中海及露西塔尼亞等地過渡帶之混合成份。英國位居寒帶及暖溫帶的緯度，意味著我們沿海水域有豐富的藻類種類，包括約840種大型藻類。三分之二的英國海藻是大西洋沿岸特有的。

3. 非維管束植物的特殊重要性

（1）營養循環

真菌是生態系中重要的分解者，在營養循環中扮演重要角色。藍綠藻及

藍綠藻共生地衣均能行固氮作用，進而影響生物系統的養份含量。

(2) 保持水份

在大西洋沿岸林地，苔蘚植物在水份的保持及釋放上扮演重要角色，因此會影響空氣溼度。泥炭蘚屬之植物 (*Sphagnum* spp.) 形成沼澤植被的重要組成，能像海綿一樣，保持或釋放水份以供給在泛濫平原及河岸的伴生植被。

(3) 形成聚落及固著土壤

低等植物通常是最早遷入自然形成或人為造成的新裸露地並開始繁殖、形成群落的植物。這些植物對土壤的形成和固著，以及沖刷的防止均扮演重要角色。

(4) 某些生育地的優勢種

泥炭蘚屬植物 (*Sphagnum* spp.) 常是沼澤的優勢植物，故在泥炭的形成上扮演重要角色。在某些類型的林地，就生物量而言，苔蘚及地衣比開花草本植物還重要。苔蘚及地衣常是嚴苛環境壓力地區的優勢植被，像是裸露的高山峰頂或是重金屬污染的土壤。藻類在海中為優勢，海草床的生產力是溫帶草原的2倍，與溫帶森林相當。在清澈含石灰質的湖中，輪藻常是主要水底生產者。在高地的溪流，苔蘚、地衣和藻類形成主要的水生植物相。

(5) 菌根系統

菌根菌是生態系中到處存在的重要組成，特別是在林地。有證據顯示，許多陸生綠色植物須依賴伴生的菌根菌方能生長，而且歐洲森林的衰退與菌根菌的減少有關。菌根的真菌可以製造像磷酸鹽及硝酸鹽類的養份，供給其共生的維管束植物，而從其獲得醣類。這在蘭科植物特別重要，若沒有真菌的話，它的微小種子無法提供足夠養份給萌發後的小苗。對 *Neottia nidis-avis* 及 *Monotropa hypopitys* 這種缺乏葉綠素的維管束植物而言，真菌的存在是很重要的。

(6) 污染指標

附生地衣對空氣污染很敏感，這已是眾所皆知。許多其他地衣以及山區的、附生的、沼澤的苔蘚均對空氣污染敏感。焦斑楓菌 *Rhytisma acerinum* 是一種優良的二氧化硫污染的指標生物。歐洲菌根性菇蕈產量的衰退與大氣中氮的沈澱有關。許多藻類，包括輪藻和琴矽藻是水質的敏感指標。低等生物像海草、淡水大型藻類及苔蘚會堆積重金屬在其體內，故可用以監測這些重

金屬污染源。

(7) 生態指標

低等生物可用來做爲土壤因子、營養狀態、及其他環境因子的指標。例如，岩石面的石灰質帶可由偏愛含鈣環境的苔蘚 *Tortella tortuosa* 的生長來追蹤。淡水中氮鹽及磷酸鹽的含量高低通常伴隨著絲狀或浮游藻類的生長。低等植物也可能成爲棲地連貫性的指標，有一些古老的林地指標物種對樹冠層覆蓋的消失以及大氣溼度的降低很敏感，而且其散播能力不強，其中包括了像英格蘭低地的 *Thelotrema lepadinum* 等地衣，以及一些苔蘚和菌類，因其無法在受干擾的原生育地更新，也不能播遷至新生育地，所以皆伐林木常導致這些物種的衰減。

(8) 經濟價值

野生可食用菌之商業性採集逐漸增加，但其他的低等植物則很少被利用做爲食物。現在許多藥物是提煉自菌類，大家最熟悉的例如抗生素盤尼西林，以及提煉自麥角菌 *Claviceps purpurea* 用來治療偏頭痛的生物鹼麥角胺。許多生物性活性化合物有藥用潛力，例如癌症抑制劑已自蘚類中鑑定出來。真菌有時被用來做爲生物防治劑，例如 *Peniophora gigantea* 被用來控制針葉樹造林地的弧菌 *Heterobasidion annosum*。

苔類被大量採集用來作吊籃；苔類及地衣也被用來做裝飾；海草的商業性利用在不列顛群島已有很長的歷史，目前被廣泛利用爲食物、肥料，及藥物的來源，像藻膠及明膠；石灰質海藻的沈積物是商業上重要的土壤調節劑。

4. 目前的資訊

(1) 苔蘚類植物

苔蘚類在過去200年已有相當的記錄活動。這些長久的調查紀錄，促成了英國苔蘚植物學會能應用陸域生態研究所 (Institute of Terrestrial Ecology, ITE) 的生物資料中心 (Biological Records Centre, BRC) 的電腦化資料庫完成分布圖集，它總共掌握了超過75萬筆的資料 (Hill, Preston & Smith 1991, 1992, 1994)。這個資料庫在英格蘭的某些郡也被用來登錄重要的苔蘚植物分布地點 (Newton 1985; Hodgetts 1985, 1986; Hodgetts & Newton 1987)。英國苔蘚植物學會編印有包括各郡苔蘚分布情形的“調查目錄”，且每年更新一次。其他的資料來源包括自然保育委員會 (NCC) 的蘇格蘭林地調查 (Averis

1991)、雪地調查 (Rothero 1991), 以及其他某些郡的植物志及許多學術論文。歐洲受威脅種類及重要分布地點的名錄已經由歐洲苔蘚植物保育委員會 (European Committee for the Conservation of Bryophytes) 完成 (Schumacker *et al.* 1993)。須特別關注的英國特有種則列於該名錄之附錄 I。

(2) 地衣

英國地衣學會有一個大的電腦化資料庫可供製作種類分布圖。此外英國地衣學會對於附生植物、石南林及沿海地衣植物的重要地點也已有報告 (Fletcher 1982, 1984, 1993)。綜合來看, 要對大型地衣進行現況的評估是可能的。至於一些“微地衣”的資訊則較不完全。某些郡植物志已出版 (如 Woods 1993), 而所有種類的完整描述、分布及生態資料可在地衣植物志找到 (Purvis *et al.* 1992)。在威爾斯, 各鄉的地衣普查目錄已接近完成, 愛爾蘭的地衣普查目錄則已出版 (Seaward 1984)。

(3) 真菌類

國際菌類研究所 (International Mycological Institute) 有一個英國菌類學會 (British Mycological Society) 分布地圖的電腦化資料庫。最近由NCC及JNCC 經費補助的關於英格蘭及威爾斯的沙丘菌類植物相調查資料則為前項資料庫增補了不少資料 (Rotheroc 1986, 1987a, 1987b, 1989, 1990, 1991, 1992, 1993)。另外, 有些郡也有菌類志 (如Clark 1980)。雖然“英國菌類地圖”的第一個部份已在進行, 但菌類的分布及保育現況的資料仍不完整。進一步的菌類文獻資料整理工作, 已由JNCC經費補助, 由國際菌類研究所於1993年開始著手進行。

(4) 藻類

許多藻類的分布及現況很少被研究, 然而有一本包括分布地圖的輪藻手冊, 已由不列顛群島植物學會 (Botanical Society of the British Isles) 出版 (Moore, 1986)。NCC及JNCC的海洋保育檢討小組已累積了大量的海草及其生態的資料, 有超過840種的海底藻類, 其中超過150種已包含在一份臨時的分布地圖 (Norton 1985)。海水藻類植物志正由自然歷史博物館 (Natural History Museum) 編印中 (Dixon & Irvine 1977; Irvine 1983; Fletcher 1987; Christensen 1987; Burroes 1991; Maggs & Hammer Sand 1993)。全部的輪藻種類及650種海水藻類的電腦資料庫已保存在生物資料中心 (BRC) 的電腦。

大不列顛河流資料庫，包括1980年代由NCC所調查的河流大型藻類資料記錄，均由各保育主管單位保存中。

(5) 瀕絕物種名錄

英國及愛爾蘭的輪藻、苔蘚、及地衣的瀕絕物種名錄已由Plantlife與NCC/JNCC、DoE NI及愛爾蘭共和國公共事務辦公室 (Office of Public Work) 簽約完成編纂。這項工作促成了英國及愛爾蘭輪藻紅皮書的出版 (Stewart & Church 1992)。接下來就是準備苔蘚及地衣紅皮書的出版 (Stewart & Church 編撰中 a, 編撰中 b)。而一個暫時的英國菌類瀕絕物種名錄最近也已起草 (Ing 1992)。

(6) 低等植物多樣性登錄

JNCC於1993年開始建立一個以分布地點為基礎的低等植物資料庫。這個資料庫對照整理了苔蘚、地衣、菌類及淡水藻類的資料，以找出英國低等植物的重要分布地點，並調查研究物種和棲地的關係，以增進對物種現況的了解。

(二) 維管束植物

1. 定義

維管束或謂高等植物有真正的根、莖、葉，且顧名思義，有特化的輸導組織。包括了蕨類、擬蕨類 (蕨類植物門) 及種子植物。種子植物又分為顯花植物 (被子植物) 及裸子植物。

2. 資源

Kent (1992) 列出不列顛群島71種原生蕨類及2,226種 (包括800至900個種內分類群) 的野生原生種子植物。野外也有超過1,000種的外來種。雖然我們的原生維管束植被只占不到全歐洲的20%，英國卻是歐洲西北部、露西塔尼亞及地中海等植物帶的混合，有國際重要性的植物組成，例如西部海洋及大西洋高山植物社會。我們有很多的維管束植物種類位於總分布範圍的邊緣，有些被認為是在英國特有的亞種。即使其種類數目相對地較少，英國植物相仍是極具演化及生態上的意義。

3. 最新資訊

(1) 最近的調查及出版

英國的維管束植物已詳細深入調查了很久，參與的有專業科學家及業餘

植物學者，其中最重要的是不列顛群島植物學會（BSBI）的成員，這個學會在自然保育協會（Nature Conservancy）的財務資助下，出版了“英國植物圖鑑”（Atlas of the British Flora）（Perring & Walters 1962），隨後並有其增訂本（Perring & Scoll 1968）及蕨類圖鑑之出版（Jermy *et al.* 1978）。這些圖鑑及一些已被廣泛使用的較新的植物志（Clapham, Tutin & Moore 1987; Stau 1991），提供了大量的關於維管束植物的一般分布及生態的出版資訊。“不列顛維管束植物紅皮書”（Perring & Farrel 1983）及“愛爾蘭的維管束植物紅皮書”（Curtis & Mc Gough 1988）也提供了物種稀有度的資訊。1962年出版的英國植物圖鑑，在最近由NCC/JNCC、BRC、及BSBI聯合進行三個計畫將其部分修訂，第一個是將英國劃成許多10公里見方方格，每九個取一個由BSBI的研究人員進行調查，以建立一個維管束植物的監測基準；第二個計畫是出版一本“英國稀有植物圖鑑”（Stewart, Pearman & Preston, 編印中）。最後一個計畫由國家河川部支援部分經費，將出版一本“水生植物圖鑑”。從1974至1991年間，英格蘭、蘇格蘭及威爾斯的稀有植物調查由NCC進行組織策畫。另外一個耕地雜草的調查也已實施（Smith 1989）。許多一般性植物調查也已由NCC及一些新的法定主管單位進行。這些調查可供修訂英國紅皮書參考，現正由JNCC進行中（Wigginton 編撰中）。

另一個較大規模的調查是“1990鄉野調查”（Countryside survey 1990）（Bar *et al.* 1993），它是由陸域生態研究所（ITE）與環境部及NCC/JNCC簽約負責進行，將調查記錄大不列顛508個一公里見方之方格。

在北愛爾蘭，具體而詳細的維管束植物調查工作自1986年才開始，包括了主要生育地調查，有些由官方自行進行，（如低地之沼澤、普通沼澤及林地），另外則有委託DoE NI進行（如湖泊及沿海生育地）。

（2）資料庫

英國最大的針對單一物種的電腦資料庫已形成BRC資料庫的一部分，由JNCC及ITE共同管理，位於Monks Wood。BRC擁有用來編纂BSBI圖鑑、全國稀有植物圖鑑、及水生植物圖鑑之所有資料。它也包括了BSBI的監測資料。BRC的資料庫總共有350萬筆資料，大部分是志工提供的。另一個很大的電腦資料庫是在ITE，內含“1990鄉野調查”的資料。

一些較小的資料庫分散在大學、地方性資料中心、博物館、自然歷史學

會、業餘植物研究團體（如BSBI郡記錄）、保育協會（如Wildlife Trust）及法定主管單位。雖然這些資料庫未必全部電腦化，但這已是趨勢。有一個不列顛稀有維管束植物的電腦資料庫由JNCC掌管，並與CCW、EN、SNH連線。

三、稀有種

（一）稀有度的基本觀念

對稀有度的認知會因時間及空間之不同而有差異。例如，*Luronium natans*在威爾斯東部、英格蘭西北部及英國中部地區的一些運河相當普遍，但以整個大不列顛的角度來看，它是稀有種類。以全歐洲的層次來看，它是特有的且稀有到足夠資格列入伯恩公約及歐體棲地及物種保育公約（EC Habitats and Species Directive）的保護名單中（請看“國際指定物種”章節）。相反的，*Ononis reclinata*在英國很稀有，已在其分布範圍的北界，但在全歐洲它卻未受威脅（Smith 1988），並且廣泛分布到北非及中東。某一物種的地區性的族群會隨時間有很大的變化，例如英國的兩種榆樹*Ulmus procera*及*U. glabra*因為荷蘭榆樹病而數量減少。而最近突然暴增的原產澳洲的沼澤植物*Crassula helmsii*，則是因其可裝飾水族箱而引進，並讓它逸入野外。影響一個物種的稀有度或豐富度的原因很多，包括棲地大小、個體數量、運動能力、生育地可利用時間、傳佈能力、掠食者及病源的作用等。Rabinowitz（1981）根據分佈範圍、生育地專一性、及單一族群大小，將稀有度歸為為8個類型如表1。

表1. 稀有度的型式（根據Rabinowitz 1981）

分布範圍	廣泛				狹隘			
	寬		窄		寬		窄	
棲地適應性								
地區性族群大小	大	小	大	小	大	小	大	小

用這個模型，理論上除了第一個類型（分佈廣泛，棲地適應性寬，地區性族群大）之外，稀有種可在所有的類型內出現，而最後2個類型（分佈狹隘，棲地適應性窄）內的原生種很自然是稀有。然而即使在第一個類型內，其物種也可能因空氣污染或氣候改變等廣泛的影響而變成稀有。

這些基本觀念與保育計畫有相當的關聯。假如目標是生物多樣性的保育，積

極地介入以來防止物種滅絕是適當的。

有些情況很清楚，例如一個稀有種生長在沼澤地區，因生育地乾燥而瀕危，很明顯的要挽救此物種必須恢復這個沼澤的水文平衡。但是在其他情形下，可能要很小心，例如為使昂貴的改善行動有充份的理由，我們必須很確定，族群個體數目的減少是長期的趨勢，而非短期內的震盪現象，而且這個趨勢必須是可藉保育措施而逆轉的，並且其原因經過充分了解。在全球溫室效應下，想對原分布在極地之高山物種進行域內保育可能是徒勞無功的。

為了有效保育生物多樣性，稀有度也必須考量種內的層次。最近的植物志確認了一些亞種和變種的多樣性，這些亞種和變種在生物地理及生態的觀點上十分重要。然而在研擬可行的種內分類群的保育策略前，很多的分類學及遺傳學的工作須先完成。

(二) 紅皮書的物種 (Red Data Book Species)

紅皮書 (RDB) 之“瀕危”、“易危”、“稀有”等分類等級是由國際自然保育聯盟 (IUCN) 所定義的 (如附錄2)。這些定義正由IUCN重新審訂中。不列顛紅皮書物種則是由法定主管單位所定義，如果一物種在英格蘭、蘇格蘭、威爾斯等地所劃分之10公里方格，僅出現在其中1至15個中，就列為紅皮書物種 (Perring & Farrell 1983)。在愛爾蘭也採用相同規範，如在10公里見方方格出現1至10個則列為紅皮書物種。下次修訂不列顛維管束植物紅皮書物種時，這個方法會一起修訂。並且將來也許不會再嚴格依照出現方格之數目標準，而會強調威脅、衰退、族群動態及其稀有度因子。

在英國約1,000種苔蘚中，有223種被列入不列顛紅皮書，192種列入愛爾蘭紅皮書 (Stewart & Church 編撰中 a)。1,700種地衣中，超過300種被認為其稀有度已夠資格列入不列顛及愛爾蘭紅皮書中 (Stewart & Church 編撰中)。估計至少20,000種的菌類中約580種菌類被列入暫時的英國紅皮書。不列顛群島33種輪藻中的17種已被列入不列顛輪藻紅皮書中，12種列入愛爾蘭的紅皮書物種中 (Stewart & Church 1992)，這些都顯示了水污染對這類藻類所造成的威脅。317種維管束植物已列入不列顛紅皮書物種名錄中，似乎有更多將被列入目前籌編中的第三版內 (Perring & Farrell 1983)。愛爾蘭的紅皮書則列入159種維管束植物。

(三) 國家級稀有物種 (Nationally Scarce species) (大不列顛)

國家稀有種是法定保育主管單位所定義的，這類原生植物的稀有度未到列入

紅皮書的標準，但在大不列顛只出現在 100個或更少的10公里見方方格內。愛爾蘭則沒有此一等級。在大不列顛約有260種維管束植物，300種苔蘚及350種地衣列入此等級。

(四) 地區性重要物種

植物被列入地區性重要物種有幾個理由。在英格蘭、蘇格蘭、威爾斯及北愛爾蘭，最近已開始考慮到“地區性”分布的問題，這似乎改變了CCW，EN及SNH對稀有度的觀點。

在大不列顛，“區域性稀有維管束植物”已被定義（Nature Conservancy Council 1989），意指在NCC區域中只在15個或更少的1公里見方方格中出現，但既非紅皮書物種也非國家級稀有物種。“郡”稀有植物名錄正由BSBI及Wildlife Trust編輯中，這對地方性的紅皮書有實際貢獻。“郡”的稀有植物（不包括紅皮書物種及國家級稀有物種）是指那些在郡或同等行政組織中只在3個或更少的地點被記錄到，這裡的地點的定義是指一個區域不超過一公里見方（一個“可動”的一公里乘以一公里的方格，不一定與全國性的區塊吻合）。一個物種在全國是普遍的，但到地方的層次可能因其侷限而殘餘的分布而變得極有價值（如榛樹 *Corylus avellana* 在歐克尼及薛特藍群島）。一個普通的物種也可能有區域性的重要性，因為當地族群可能有異於其他地區族群的遺傳組成。例如蘇格蘭松的變種 *Pinus sylvestris* var. *scotica*，是原生的蘇格蘭植物，就異於歐陸的其他變種（Clapham, Tutin & Moore 1987）。

(五) 特有種

在英國有數目不詳的特有低等植物，及約12種特有維管束植物（附錄1）。但這不包括某些特別的屬（*Alchemilla*, *Euphrasia*, *Hieracium*, *Limonium*, *Rosa*, *Rubus*, *Sorbus*, *Taraxacum*），這些屬有不少特有種，但其性狀常並不穩定。雖然不如其他國家多，但這些特有種是我們原生植被的重要成分，且大部分均列入英國紅皮書中。

(六) 特別立法保護的物種（列入表8的物種）

1981年的野生物及鄉野法（Wildlife and Countryside Act）之表8列出了在英國要特別保護的植物（附錄3），他們可分為二類：一是在大不列顛有滅絕危險的，二是有國際義務須特別保護的。它們一般是紅皮書物種，也有一些是在英國很普遍，但國際上要求保護的種類。現有107種維管束植物，33種苔蘚，26種地

衣，2種輪藻屬於此類。

北愛爾蘭也有一個同等的野生物法（Wildlife Order, 1985），在其表8中列入56種維管束植物（附錄4），這個附表正重新修訂中。

（七）國際指定物種

國際指定物種是伯恩公約（Bern Convention）及歐體棲地及物種保育公約（EC Habitats and Species Directive）所公布列名的受威脅物種。在該名錄上的英國物種如附錄5。英國的國務大臣得考慮配合該名錄而對野生物及鄉野法，以及北愛爾蘭之野生物法表8進行修正。

伯恩公約的簽約國必須保護公約附錄 I 中所列之植物物種免於被採集、砍伐、拔取及買賣。歐體棲地及物種保育公約也規定要同樣保護列於其附表IVb的植物。所以，配合國際上之指定，野生物及鄉野法表8列出了在大不列顛需加強保護的種類。只有4種列於歐體棲地及物種保育公約附表IVb及伯恩公約附錄 I 的植物是北愛爾蘭原生的。維管束植物 *Trichomanes speciosum* 及 *Saxifraga hirculus* 已列於北愛爾蘭野生物法的表8之中；低等植物 *Petalophyllum ralfsii* 及 *Drepanocladus vernicosus* 是否會被列入則仍在審議中。

歐體棲地及物種保育公約附表 II b 列出一些植物，爲了保育它們，必須指定“特別保育區域”（Special Areas of Conservation, SACs），並持續地經營、監測。附表 V b 則列出一些較廣泛分布的植物像是 *Sphagnum* 及好石灰質的海水藻類。簽約國認爲必要時，應採取行動，以確保附表 V b 所列物種之開發利用可以和保育相容。一個執行瀕危物種國際貿易公約（CITES）的EEC法規，負責管制植物在歐洲共同體各國之輸出及輸入（例如全部的蘭科植物）。

世界保育監測中心（World Conservation Monitoring Center, WCMC）正與世界保育聯盟（IUCN）密切合作，編輯第一本全球的受威脅植物的名錄（Walter, 編撰中），目前被列入WCMC瀕絕物種名錄資料庫且分布於英國的種類列於附錄6。

（八）立法劃定保護區域的物種

於遴選並指定“特殊科學研究地點”（Sites of Special Scientific Interest, SSSI）時常會考慮當地是否有稀有種。“生物特殊科學研究地點的選訂指南”（Guide lines for selection of biological SSSIS）（Nature Conservancy Council, 1989；Hadgetts 1992）列出了下列稀有度的不同類型以供決定之參考：表8、紅

皮書、國家級稀有、區域型稀有、特有、衰退、分布邊緣及在歐洲受威脅的物種。

四、群聚 (Assemblages)

稀有植物不該在與其伴生物種 (associates) 隔離的狀態下進行保育，而應完全融入其自然棲地。野生植被中即使是極普通的成分，但也有其內在的價值，因為它也是我們野生植物襲產的一部分。植物群聚的保育、生物多樣性的維持以及自然與半自然棲地的維護，都是基於這個理由而顯出其重要性。

很多不列顛低地已完成或正在進行廣泛的第一期“生育地調查”(England Field Unit 1990)，試圖精確標定出在保護區外的大環境 (Wider Environment) 內的良好野生物棲地。第一期調查由法定保育主管單位執行，有時由Wildlife Trust及地方機構等協同進行。另一個較大規模且較詳細的第二期自然及半自然棲地的調查，也由保育主管單位、業餘志工組織、陸域生態研究所、大學、水資源主管單位等完成。

第二期的調查有助於一個由NCC/JNCC資助的長期計畫，以完成“國家植群分類”(National Vegetation Classification, NVC)，它是一個大不列顛的自然及半自然植群的全面性分類 (Rodwell 1991, 1992a, 1992b, 出版中及編撰中)。雖然在有些特定棲地，特別是泥沼和沼澤地會把低等植物涵蓋在內，但是國家植群分類主要關注的是維管束植物。國家植群分類的電腦資料庫設在蘭卡斯特大學，包含了超過了30,000個樣區的植物記錄。國家植群分類並不包括愛爾蘭，但那裡的許多植物群落是很容易識別的。評估這套分類系統在北愛爾蘭之適用性的工作目前正進行中。

(一) 具全國重要性的“群落”

大不列顛具有自然保育重要性的國家植群分類群落已在“生物特殊科學研究地點之遴選指南”(NCC 1989)一書中有所列述。這些群落的所在地點也列在國家特殊科學研究地點之系列名錄中。重要的低等植物群落及其特殊科學地點之樣區遴選指南已由Hodgets (1992) 提供。

(二) 具國際重要性的群聚及棲地

低等植物

具國際重要性的低等植物群聚包括：

- * 大西洋林地的苔蘚、地衣、及菌類，特別是西部蘇格蘭。
- * 受大西洋影響的極地高山群落。
- * 泥沼的苔蘚類。

- * 一種愛爾蘭及蘇格蘭西部特有的蘚類群落。
- * Machair草原的苔蘚及地衣（只在西部愛爾蘭及蘇格蘭發現）及沙丘群落。
- * 岩石海岸的地衣及苔蘚群落。
- * 東南部英格蘭砂岩地的苔蘚群落。
- * 白堊低地及白堊懸崖的苔蘚及地衣群落。
- * 低地富含地衣的石楠叢，包含海邊懸崖頂的石楠叢。
- * 卡勒多尼亞松林的地衣及菌類群落。
- * 古老的溫帶草木區樹木及放牧林地的附生苔蘚及地衣。
- * 對污染敏感的附生群聚仍常見於英國西部，但在歐洲其餘地區則日漸減少或消失。
- * 嗜金屬的地衣群落（例如荒廢礦區）。
- * 鹹水瀉湖及河川出海口的藻類。
- * 海水藻類群落，包括*Ascophyllum nodosum* var. *mackaii*，狹窄潮間帶到海灣間的群落及白堊懸崖的微藻類群落。

（三）歐體棲地及物種保育公約（The European Community Habitats and Species Directive）

爲了執行歐體棲地及物種保育公約，棲地分類CORINE現已在全歐洲共同體被採用。每一個歐體國家必須針對具有歐洲重要代表性的棲地類型指定特別保育地區（Special Areas of Conservation, SACs），並將其列入公約附表 I。該公約附表 I 包括了83種出現在英國的棲地類型。其中22種被認爲是稀有到需優先加以考慮的棲地類型稱爲“優先棲地”（priority habitats），包括：

- * 海岸瀉湖。
- * 內陸含鹽份的*Puccinellia distans*草地。
- * 固定的（灰色的）沙丘。
- * 大西洋岸的*Calluna vulgaris*去石灰質的沙丘。
- * 去石灰質的*Empetrum nigrum*沙丘。
- * 沙丘的圓柏屬雜木林。
- * 乾燥的*Erica uagans*石楠叢。
- * *Erica ciliaris*及*Erica tetralix*濕石楠叢。
- * 乾燥的石灰質草地（*Fesiuco-Bromefalia*）對蘭花很重要。

- * 種類豐富的*Nardus*草原。
- * 活躍的突起的泥沼。
- * 活躍的blanket泥沼。
- * 石灰質的*Cladium mariscus*沼澤。
- * 石灰華泉水含苔蘚植被（*Cratoneuron*種類）
- * 高山*Carex arofusca*先驅群叢。
- * 石灰岩披覆地區。
- * *Tilia cordata*-*Acer campestre*峽口林地。
- * 卡勒多尼亞松林。
- * 天然泥沼林地。
- * *Taxus baccata*林地。
- * 殘餘沖積林地（*Alnus glutinosa*-*Prunus pectus*型）。
- * 地中海型暫時性池塘（池子冬天有水，夏天枯水；指標物種有*Mentha pulegium*, *Cyperus fuscus*, *Pilularia globulifera*, *Isoetes histrix*, *Filiformis*, *Juncus pygmaeus*）。

（四）拉姆薩爾公約（Ramsar Convention）

國際重要濕地及水鳥棲地公約（拉姆薩爾公約）要求指定並保護那些對各種物種（包括植物）很重要的地點。一個濕地如果合乎下列條件就被認為對植物是有國際性的重要性：

- * 支持相當種類的稀有、易危或瀕危的種或亞種植物，或是具相當個體數量的一或數個這些種類。
- * 由於植物相的品質及特質，維持該地區遺傳或生態多樣性具有特別價值時。
- * 它是植物在其生活史中特定階段的棲地，致具有特別價值時。
- * 它對一或數種特有植物或群落具有特別價值時。

指定重要的具代表性或稀有的溼地同時也適用在一般棲地。因此拉姆薩爾公約是濕地植物保育的有力手段。

五、立法

（一）大不列顛的立法

1981的野生物及鄉野法（Wildlife and Countryside Act）有許多章節可用來推

動植物及其棲地的保育。13 (1) b節規定，若未經許可，將任何野生植物拔除或移出其生育地是違法的。13 (1) a節則對表8所列的植物提供免於被採集、拔除及破壞的保護，除非是合法的行動而且確屬無法避免。13 (2) 節針對表列之植物限制買賣。與法定保育主管單位諮商後，JNCC應建議國務大臣每五年檢討一次表8（見附錄3），如有需要時得增加檢討次數。14節則規定，除非經申請核准並有執照，否則在野外種植或唆使他人種植表9所列的任何植物將是犯罪行爲。表9包含了會對英國原生生物造成威脅的外來物種。目前包含在表9之物種如附錄7。該法案其他章節授權保育單位，可以指定、保護並經營管理特殊科學研究之地點（Sites of Special Scientific Interest, SSSIs）及國立海洋自然保護區。1968年之鄉野法已修訂爲環境保護法（Environment Protection Act, 1990）之表9，它規定保育單位可以和特殊科學研究地點（SSSI）鄰接之土地訂定經營協議。根據蘇格蘭自然遺產法（Natural Heritage 1991）表10之規定，SNH可以和其他各種土地訂定經營協議，以有效保護棲地。

更大範圍的環境立法也與自然保育密切相關。例如環境保護法（Environmental Protection Act, 1990），就包含了控制污染及基因改造生物的釋出的條款，其他例子還有城市及鄉村計畫法（Town and Country Planning Acts）。

（二）北愛爾蘭的立法

在北愛爾蘭有二部立法相等於不列顛野生動物及鄉野法（Wildlife and Countryside Act 1981）。北愛爾蘭野生動物法（N. Ireland Wildlife Order 1985）即涵蓋了物種保護。北愛爾蘭自然保育及適意土地法（Nature Conservation and Amenity Land Order, 1985）授權環境部指定特殊科學研究區域（Areas of Special Scientific Interest, ASSIs）及國立海洋自然保留區。野生動物法的第14條直接相對於野生動物及鄉野法之第13節。野生動物法的表8列出被保護的植物（附錄4），表9列出了未獲執照不得種植於野外的外來物種（附錄7）。

（三）國際的立法

前面已討論過相關之國際公約及其指定。國內立法必須遵守前述之伯恩公約（Bern Convention）、歐體棲地及物種保育公約（EC Habitats and Species Directive）、拉姆薩爾公約（Ramsar Convention）之規定。

六、保育之優先次序

下述係依照重要性將物種及棲地分級。各保育單位應就植物復育、監測及其他活動之廣大領域定出優先順序，而且必須考慮到下列因素：威脅、減少/或穩定、復原之潛能及地方的配合等。對所有保育單位而言，一個明顯的優先是充份執行法定義務，像是對歐體棲地及物種保育公約的承諾及義務。

(一) 物種等級：

1. 在英國為原生且是國際性瀕危的物種。（如伯恩公約之附錄I、歐體棲地及物種保育公約附表II及附表IV、及WCMC/IUCN的受威脅種）*。
2. 1981野生動物及鄉野法表8及1985北愛爾蘭野生動物法表8（第一部分）所列之物種，但不包含1所列者*。
3. 大不列顛及愛爾蘭紅皮書中之分類群（不包括於1或2者）*。
4. 大不列顛之全國稀有物種*。
5. 歐體棲地及物種保育公約附表V所列之物種。
6. 地方重要性的原生物種*。
7. 一般原生物種。

* 特有分類群一般會在這些等級中列為優先。

(二) 植物群落及棲地等級

1. 國際性瀕危的群聚及棲地（例如：歐體棲地及物種保育公約之附表I所列的優先棲地類型；國際濕地公約（拉姆薩爾公約）針對植物物種或一般生育地觀點所篩選之濕地；其他具有國際重要性的低等植物群落）。
2. 在英國為稀有但非國際性瀕危之國家植群分類的群落及低等植物群落。
3. 歐體棲地及物種保育公約之附表I所列之非優先生育地類型，而且不包含於第2項者。
4. 國家植群分類之群落及低等植物群落，經依照特殊科學研究地點選擇指南（SSSI selection guidelines）之檢討後需保育（Nature Conservancy Council 1989；Hodgetts 1992），而不包含在前面第1、2、3各項者。
5. 大環境（Wider Environment）的棲地及特殊對象（例如：灌木樹籬）。

七、策略之執行

法定保育單位能執行的保育策略，列於下面段落，它共有十個項目，各相對於“生物多樣性：英國保育行動計畫”（HMSO 1994）一書中所提及的原則、方針或目標。

其中屬於該書所列之特定目標，或對達成該目標有重大貢獻之行動皆用*標示。絕大部分的行動都涉及法定權責長期之執行承諾。雖然有很多其他工作（例如第一期之調查及SSSI之例行監測）是由有關的保育主管單位來執行並間接和植物保育有關，但在此只列出和植物物種及群聚保育有特別直接關係之行動。

附錄8說明這十項保育策略目標對保育機構所執行的一般性活動與重要創新行動之貢獻程度。附錄9簡要說明這十個目標相互間之關聯及其對有效的植物保育的貢獻。它說明了志工及專業人員在增進健全的保育行動所需之知識上所做的努力，以及國際保育浪潮如何影響英國的行動。

（一）調查及監測

目標是在2000年前，完成所有優先物種的全國性調查，並建立有效的物種監測系統。此目標符合“英國保育行動計畫”所說應根據完善的知識來進行保育之基本原則。

要有效完成此目標，要先完成物種紀錄之共同標準（*）並訂出維管束及非維管束植物之監測標準方法。有關歐體棲地及物種保育公約（EC habitats and Species Directive）附表II及IV所列的物種、特有苔蘚類及維管束植物（附錄1）、野生物及鄉野法附表8的植物及紅皮書列出的維管束植物都應該列為全國性物種調查之優先完成工作。英國對歐體棲地及物種保育公約之執行承諾亦可透過對特別保育地區（Special Area of Conservation）之監測、附表II物種狀況之監測及附表V物種被利用情形之監測等而達成。為了提供對表8每5年修訂一次所需，瀕危物種的監測是必須執行的。外來入侵物種擴張的監測也是必須的。當有需要時，其他被選擇的物種也將在全國或地方的層次被調查及監測。BSBI監測計畫（Palmer & Bratton編印中）將被檢討並考慮再次執行之可能性。

當執行大部分的調查及監測工作時，法定保育單位將高度依賴志工的知識及投入。

（二）電腦化資料庫

設置一個全國性植物物種的電腦資料庫網路，使相關之專業及業餘保育單位可以很容易交換資料及資訊。生物資料庫之提供使用及協調方法的改進也是“英國保育行動計畫”的目標之一。

作為生物性記錄的廣泛策略之一，法定保育單位將持續推動地方及全國，專業或業餘的關於植物記錄的電腦網路的發展（*）。現有全國維管束及低等植物

資料庫，是由法定保育單位及生物資料中心（BRC）所聯合起來的，將繼續維持（*）並將改進資訊的使用方法（*）。JNCC的低等植物多樣性記錄計畫將擴充，並納入棲地相關資料及標示生物多樣性高的特定地點（*）。

（三）研究

目標是進行足夠的研究，使保育措施可以有更充足的資訊，更有效率。這個目標符合“英國保育行動計畫”一書中所說應根據完善知識來進行保育的原則。

特定瀕危物種的個體生態學、族群生物學及族群遺傳學的調查、植物群聚的功能性特徵、人類活動對植物的影響、以及高生物多樣性（或有復原潛力）的特別區域的調查均應繼續（*）。物種豐富度變異範圍之初步評估研究工作，已由JNCC的研究人員完成（Pienkowski 1993）。計畫中的新研究（目前尚未正式確定）包括可用為評估原生植被的特徵及環境健康程度指標之物種的決定方法、指定保育區域在植物保育上所扮演角色之評估、以及自然保育相關的進一步植群分類的工作。

（四）資訊宣導及傳播

目標是使植物現狀及保育的資訊，可以在各保育單位內及各界均很容易並且廣泛地傳播（經由資料庫而獲取以及網路傳播等將另外討論）。這個目標與“英國保育行動計畫”一書中所述應提昇公眾對保育生物多樣性之認知是一致的。

一些關於植物保育的書籍將在最近由JNCC出版，包括苔蘚植物紅皮書，（Stewart & Church 編撰中）、地衣紅皮書（Stewart & Church）、維管束植物紅皮書（Wigginton 編撰中）、全國稀有植物圖鑑（Stewart, Perman & Preston出版中）、BSBI監測計畫報告（Palmer & Bratton 出版中）及林地低等植物的經營指導大綱（Hodgetts 編撰中）等。對於還沒有紅皮書之分類群，我們將研訂出版之優先次序（*），同時在此之前，也會考慮有關菌類、海洋底棲藻類之出版。近來一些地區性保育單位也補助出版地方植物志。JNCC正計畫更新並出版有關移置（translocations）、重建（re-establishments）、引種（introductions）及再栽植（re-stocking）等工作之指導大綱（*）。

植物保育資訊的宣導也包括向政府提供建議，及參與訓練課程及討論會等，以改善主管機關、民間社團及研究單位間的資訊交流。

（五）地點選定、保護及經營管理

目標是在全英國選定足夠的地點，進行具全國及國際重要性物種、群聚及棲

地之保育。並以其內物種及棲地之利益為前提經營管理。這項目標也包括在“英國保育行動計畫”中。

所有依歐體棲地及物種保育公約完成鑑定的特別保育地區都將於2004年前被選定(*)，包括被選來補強現有 SSSI/ASSI範圍之不足的地點(*)。主管單位將負責進行與這些選定有關的工作。受保護地點的經營管理技術將改進以保育並提昇被選擇的棲地及物種(*)。針對各種不同棲地類型及植物物種的重要濕地也將依照國際濕地公約(拉姆薩爾公約)之規定選出(*)，主管單位將充份的扮演好保護這些具國際重要性濕地的角色。

(六) 物種行動計畫及復育方案

目標是持續現行的復育方案，其中有些是根據Whitton(1990)的推薦，另外並將創新方案，根據物種所受的威脅程度、生物學知識、復原潛力、及國際義務等選定優先物種。植物復原方案的長程目標是維持或復原受威脅物種的有效族群。物種行動計畫及復原方案也是“英國保育行動計畫”的目標之一。

歐體棲地及物種保育公約附表II中所列的植物，以及受威脅原生物種(附錄I)的保育行動計畫也正在準備中(*)。需要個別復育方案的物種將被鑑別出來，而且到2000年為止，每年將把更多的植物物種加入主管單位的現行復育方案內(*)。域內保育措施將包括適當的經營管理、繁殖及移置。域外保育措施包含持續的在植物園培植稀有物種，在邱植物園(Kew Garden)維持種子庫以及為保存低等植物活體的低溫技術及其他保存技術的研究等。在任何適當時機民間保育組織皆能參與其中。

(七) 大環境之保育(The Wider Environment)

目標是影響全體國民對大環境的使用及經營管理，以保育、復原並加強植物族群。保育大環境的一些目標也包括在“英國保育行動計畫”中。法定保育單位將試圖影響關於保護區外的鄉村之政策形成，使有利於植物保育。他們將持續對一些議題提供建議，包括海岸的經營管理(*)、森林政策(*)、淡水水質(*)以及農業及環境部門間的聯繫(*)。主管單位也將針對植物族群的利益、持續影響規畫政策及都市區域的野生物之經營管理。最近的一個行動例子是蘇格蘭自然襲產委員會(SNH)的“城市近郊保育計畫”(Countryside Around Towns programme)。

(八) 立法措施

目標是執行保育單位之法定權責，並使立法能更充份地促進植物保育。（法定地點的遴選和保護前已提及）。受威脅物種的保護也是“英國保育行動計畫”的目標。野生物及鄉野法（Wildlife and Countryside Act）所規定每5年應對表8物種進行檢討之工作將繼續（*），並會與民間保育組織充分諮商。關於表8物種的許可制度也將持續（*）。野生物及鄉野法表9所列物種及北愛爾蘭野生物法附錄7物種也會進行修訂。

（九）地方的參與

目標是提昇志工在植物保育的角色及地方社區參與植物保育（志工在全國性調查及監測計畫中的貢獻前面已提及）。這目標與“英國保育行動計畫”中所提，政府及主管單位應結合個人及社區一起來從事保育工作的原則是一致的。地方社區、地主及保育志工組織將得到經費補助或其他方式的鼓勵，來參與保護區及其他對植物物種重要區域的經營管理。主管單位的人員應儘可能地負責植物保育的教育工作，到學校或社區、社團演講。並鼓勵志工進行有目標的植物調查，滿足地方的需求。

（十）國際合作

目標是與其他國家合作，充份履行歐體棲地及物種保育公約及其他國際公約所賦予英國政府的義務，並試圖影響關於植物保育的國際性協議的形式和內容。這是“英國保育行動計畫”的目標之一，也是要英國對全歐洲及全球層次的保育都有所貢獻。

主管單位將於1995年完成歐體棲地及物種保育公約所訂定之特別保育地區的遴選，也將依規定報告公約中附表II、IV、V所列植物物種的狀態。主管單位也將繼續代表英國出席歐洲植物專家群會議，在全歐洲層次的植物保育扮演重要的角色（*）。認真執行並繼續改進國際濕地公約（拉姆薩爾）之植物及棲地的選擇規範（*）。英國植物在全歐洲的保育狀況之檢討工作也正籌劃中（*）。最後，主管單位將儘可能地致力於執行“生物多樣性公約”英國應採取的行動。

八、協調聯繫

（一）法定保育單位之成員

為貫徹執行本策略，保育單位必須配有適當之人員、時間、及其它資源，來進行植物研究、調查、監測、資訊宣導、地點選設、經營管理、保護等工作。保

育單位中植物生態學者的重要職責是加強彼此間以及和外界團體與個人的密切聯絡。保育主管單位的植物專家成員的職責略述如下：

1. 聯合自然保育委員會秘書處 (JNCC Support Unit)

- * 整合全國志工組織之植物調查及資料蒐集。
- * 維持大不列顛植物資料庫以及傳遞資料到地區性主管單位 (Country agency head quarters) 及其它保育組織。
- * 整合工作群 (見下) 及促進地區性主管單位和聯合自然保育委員會秘書處間之聯絡。
- * 聯絡全國各組織, 包括其活動影響全英國植物保育之各個志工團體 (例如: Plant life, BSBI, RSNC, RSPB, National Trust及低等植物保育協會等)。
- * 鑑別在大不列顛層次進行研究之需求; 委託並管理這項研究; 連繫研究單位、大學及植物園等。
- * 對照整理知識和經驗; 以編撰或監督出版全國性指導大綱、紅皮書等傳播植物保育資訊。
- * 與地區性主管單位諮商, 研訂物種及群聚監測之共同性規則。
- * 向政府及其他團體就英國及全球植物保育事項提出建言。
- * 在國際場合代表英國。
- * 就英國植物保育之目標提出詳細說明並不斷研究改進。

2. 地區性主管單位 (Country agencies)

- * 整合並執行北愛爾蘭、蘇格蘭、英格蘭、威爾斯等 (以下簡稱各地區) 地區性及各地地方性之植物調查、監測及資料蒐集。
- * 儘可能維持資料庫運作並傳送資訊給聯合自然保育委員會。
- * 在每個地區評定植物保育優先順序。
- * 在植物保育業務方面適當地聯繫聯合自然保育委員會秘書處。
- * 聯繫在各地區與植物保育有關之各組織, 包括志工團體。
- * 評鑑各地區及地方層次對研究和計畫的需求; 委託並管理研究計畫。
- * 在各地區整合並管理物種復育方案。
- * 與地主或土地占有人、地方性規劃單位等就各類土地之保護及經營管理進行聯繫。
- * 就各地區之植物保育議題向政府建言。

- * 在各地區協助促進植物保育的必要實務工作。
- * 對照整理植物保育之知識和經驗。
- * 就各地區植物保育之目標提出詳細說明並不斷研究改進。

(二) 其他研究機構之連繫

很多對植物保育的實質貢獻係由大學、研究單位、農業單位、植物園、博物館及其它組織所完成的。他們進行了植物研究、育種、遺傳探討，並進行稀有植物採集、標本館、種子庫等基礎工作。某些這類機構同時也是無價的分類學專業重心。對法定保育單位而言，與上述機構分享知識，並適當地委託工作，是很重要的。

(三) 志工組織的支持

若沒有志工組織的協助，政府保育單位將很難有效地進行調查、監測及實務層面的保育工作。志工組織需要得到政府保育單位的應有認可、支持及合作。要給予這些組織全面的財務支持並不恰當也不實際，但適當的資助是可能的，例如，進行調查監測，及自然保留區經營管理所需之費用。

(四) 工作小組

一個植物保育工作小組將要成立，成員將包括聯合自然保育委員會秘書處 (Joint Nature Conservation Committee's Support Unit)、威爾斯鄉野委員會 (The Countryside Council for Wales)、英格蘭自然委員會 (English Nature)、蘇格蘭自然遺產委員會 (Scottish Nature Heritage) 及北愛爾蘭環境部 (The Department of the Environment, Northern Ireland) 的官員及組成植物連線 (Plantlife Link) 各志工組織之代表。這個工作小組將由聯合自然保育委員會秘書處整合，每年至少集會一次。它將：

- * 就調查、監測及研究之需求進行評估。
- * 整合復育方案。
- * 檢討資料收集、保存、及交換的流程。
- * 檢討英國在全球植物保育的責任。
- * 進行本策略及民間保育組織所提保育策略的檢討。

九、誌謝

本策略的大部分是根據Lynne Farrell及Nick Hodgetts的工作成果，並承蒙其在本策略撰寫期間所提供的建議。我也要特別感謝Cranbrook伯爵、Keith Duff及Ian Taylor (EN)；Michael Usher教授及Vin Fleming(SNH)；及Andy Jones(CCW)所提供的寶貴意見。下列保育主管單位的學者專家也提供了許多重要資料：John Faulkner, Joe Furphy 及 Richard Weyl (DoE NI)；Mark Felton, Ian Mclean 及Chris Gibson(EN)；Chris Sydes, Ros Smith, Mike Matthew, Nigel Smith, Ian McGowan, Sandy Kerr, Stephen Ward, Angus MacDonald, Phil Lusby, Ro-Scott 及 Neale Taylor (SNH)；Ray Woods 及 Tim Blackstock(CCW)；Martin Wigginton, Keith Hiscock, Tim Reed 及 John Hopkins (JNCC 秘書處)。聯合自然保育委員會也提供建議並認可本策略。感謝Clive Stace教授提供關於特有維管束植物的資訊。

下列保育及植物相關志工組織的專家也提供了許多寶貴意見及協助：

Botanical Society of the British Isles	Franklyn Perring
	Robin Walls
British Bryological Society	Rod Stern
British Lichen Society	Kery Dalby
British Mycological Society	Bruce Ing
British Phycological Society	David John
British Pteridological Society	Clive Jermy
National Trust	Katherine Hearn
National Trust for Scotland	Charles Strang
Plantlife	Miles King
Royal Society for Nature Conservation	Tim Sands
Royal Society for the Protection of Birds	Gwyn Williams
	Ceri Evans
	James Cadbury
World Wide Fund for Nature(WWF UK)	Carol Hatton

十、參考文獻（請逕行參考原文）

附錄（因限於篇幅，只列出附錄名稱，詳細內容請逕行參考原文）

附錄1.大不列顛特有之苔蘚及維管束植物物種。

附錄2.IUCN紅皮書保育等級表。

附錄3.1981年野生物及鄉野法表8所包括之植物物種。

附錄4.1985年北愛爾蘭野生物法表8所包括之植物物種。

附錄5.英國植物物種保護的國際義務。

附錄6.世界保育監測中心（WCMC）認定在全球遭受威脅之英國原生植物。

附錄7.1981年野生物及鄉野法表9及1985年北愛爾蘭野生物法表9之植物物種。

附錄8.本策略之各項目標對保育主管單位的重要活動之貢獻。

附錄9.本策略各目標間之關聯圖。

附件 A.1994年自然保育相關法規。

附件 B.修訂後（1994年版）之植物紅皮書稀有等級。

附 件

A UK PLANT CONSERVATION STRATEGY :

A STRATEGIC FRAMEWORK FOR THE CONSERVATION
OF THE NATIVE FLORA OF
GREAT BRITAIN AND NORTHERN IRELAND

BY

MARGARET PALMER

ON BEHALF OF THE JOINT NATURE CONSERVATION COMMITTEE AND THE
DEPARTMENT OF THE ENVIRONMENT FOR NORTHERN IRELAND

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summary

This strategy sets out a framework for action by the statutory conservation agencies to conserve the native flora of the United Kingdom. It covers non-vascular as well as vascular plants, and includes species and assemblages, both rare and common. It briefly describes the wild plant resource of the United Kingdom and sets our flora in an international context. The vital role of conservationists and botanists in the voluntary sector is acknowledged. The aims of the strategy will be achieved by the statutory conservation agencies together taking action to:

- survey and monitor the state of the flora
- maintain databases
- carry out relevant research
- promote plant and habitat conservation through publicity
- designate, protect and manage sites for plant conservation
- prepare action plans and carry out recovery programmes for threatened species
- promote plant and habitat conservation in the 'wider environment'
- use legislative measures to protect species
- encourage local involvement in data-gathering and conservation
- comply fully with international responsibilities for plant conservation.

This strategy forms a contribution to the UK's action in accordance with the United Nations *Convention on biological diversity*.

background

Introduction

This document sets out a national strategy for the conservation of native plants, both rare and common, in the United Kingdom. The strategy is a framework for action by the statutory nature conservation agencies. It has been drawn up in consultation with staff of the Support Unit of the Joint Nature Conservation Committee (JNCC) and the four country agencies (the Countryside Council for Wales (CCW), English Nature (EN), Scottish Natural Heritage (SNH) and the Department of the Environment for Northern Ireland (DoE NI). It builds upon the former Nature Conservancy Council's (NCC's) *Rare vascular plants strategy* (Farrell 1991). The present strategy also covers non-vascular plants and incorporates JNCC's *Lower plant conservation strategy* (Hodgetts 1991). The existence of the UK plant conservation strategy does not preclude the formulation by CCW, EN, SNH or DoE NI of their own individual strategies, which would relate to the overview given here.

The proposals in this paper have received the endorsement of the Botanical Society of the British Isles (BSBI) and Plantlife Link, the umbrella body for voluntary organisations concerned with plant conservation in the UK. These organisations are producing their own plant conservation strategies, which will propose complementary action for the voluntary sector.

Aims of the strategy

The overall goal of this strategy is to achieve effective conservation of the native flora of the United Kingdom.

The main aims are:

- to maintain the character and diversity of the natural flora, including
 - typical assemblages
 - the natural distribution of species and assemblages
- to ensure the viability of species and assemblages, recognising
 - the risks of depletion of commoner species and assemblages
 - the need to enhance the security of threatened species and assemblages
 - the importance of the genetic status of some taxa

- the need to prevent the extinction of species over all of part of their natural range, or as components of naturally occurring assemblages
- the importance of the UK's flora in an international context
- the desire for enjoyment of wild plants in their natural surroundings.

Relevance of this strategy to the Convention on Biological Diversity

The United Nations *Convention on biological diversity*, which the UK ratified in 1994, requires, amongst other things, action to:

- identify and monitor important components of biological diversity
- maintain databases
- promote relevant research
- promote understanding of the issues involved
- establish protected areas and develop guidelines for their selection and management
- promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species
- in support of *in situ* conservation, carry out *ex-situ* conservation and reintroduce species into their natural habitats
- develop or maintain legislation for the protection of threatened species
- support local populations in carrying out remedial action in degraded areas
- co-operate with other Contracting Parties over conservation.

Article 6A of the Convention requires each contracting party to develop national strategies for the conservation and sustainable use of biological diversity, or to adapt for this purpose existing plans or programmes. The Government has responded to this challenge by publishing *Biodiversity: The UK Action Plan* (HMSO 1994). In this document, the need for involvement of individuals and communities, as well as governmental processes, is acknowledged, as is the principle of basing conservation on sound knowledge. The objectives laid down for conserving biodiversity within the UK are as follows.

"1. To conserve and where practicable to enhance:

- a. the overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems;
- b. internationally important and threatened species, habitats and ecosystems;
- c. species, habitats and natural and managed ecosystems that are characteristic of local areas;
- d. the biodiversity of natural and semi-natural habitats where this has diminished over recent past decades.

2. To increase public awareness of, and involvement in, conserving biodiversity.
3. To contribute to the conservation of biodiversity on a European and global scale."

The Government's targets for the next 20 years, which will contribute to the achievement of these objectives and which are particularly relevant to the statutory agencies' roles in plant conservation, are:

- designation and management of protected areas
- conservation measures in the wider environment
- identification of prime biodiversity areas
- preparation of action plans for threatened species

coverage

This strategy covers plants growing in terrestrial, fresh water and marine situations and in the transitions between these biotopes.

Lower (non-vascular) plants

Definition

The range of organisms defined here as non-vascular (or lower) 'plants' is, in taxonomic terms, not confined to the kingdom Plantae, but also includes a wide diversity of other organisms commonly regarded as plants. This broad group therefore comprises not only bryophytes (mosses and liverworts), but also lichens, fungi and all kinds of algae.

Despite the fact that microscopic fungi such as moulds are extremely important components of ecosystems, it is unlikely that species-based conservation measures will ever be applied to fungi lacking relatively large, obvious fruiting bodies. For this reason, only macroscopic species are considered in this strategy. Microscopic algae, especially phytoplankton, are also of great ecological importance and it is hoped that their conservation will eventually be tackled, at least at community level.

(aiming to implement plans for at least 90% of the globally threatened and threatened endemic species within the next ten years)

- continuation and expansion of species recovery programmes
- establishment of priorities for Red Data Books for the main taxonomic groups
- updating and publicising guidelines on translocations, re-establishments, introductions and re-stocking
- continuation of legal protection for threatened species
- improvement of accessibility and co-ordination of datasets; provision of common standards for recording
- development of existing international conventions
- contribution to a sound scientific basis for conservation in Europe.

This plant conservation strategy provides a framework for action in accordance with the objectives laid down in the *Convention on biological diversity* and the UK Government's Action Plan. Many of the targets in the plant strategy are also in line with recommendations made in *Biodiversity challenge* (Butterfly Conservation *et al.* 1994), a consultation document produced by the voluntary conservation organisations.

The resource

The UK non-vascular plant flora consists of about 1,000 bryophyte species, approximately 1,700 lichens, at least 20,000 fungi and 15,000 to 20,000 species of algae. The UK has few endemic species of lower plant, but the country is particularly important in an international context. About 65% of the known European bryophyte flora occurs in Britain (Corley *et al.* 1981, Corley & Hill 1981, Grolle 1983), which has a unique blend of northern Atlantic, Mediterranean and Lusitanian elements. The UK's position at the junction of cold and warm temperate latitudes means that our coastal waters are rich in algal species, including about 840 species of macro-algae. Two thirds of the UK's seaweeds are endemic to the Atlantic coastline.

The special significance of non-vascular plants

Nutrient cycling

Fungi are important decomposers in natural systems, so they play a vital role in nutrient cycling. Blue-green algae and lichens with a blue-green algal symbiont are able to fix nitrogen and thus influence the fertility of biological systems.

Water retention

In an Atlantic woodland, the substantial biomass of bryophyte material plays an important part in holding and releasing moisture, thus contributing to the retention of a humid atmosphere. *Sphagnum* species form a vital component of bog vegetation, acting as a sponge, holding and releasing water to supply associated flush and riparian vegetation.

Colonisation and soil stabilisation

Lower plants are often the first plants to colonise newly-exposed ground formed as a result of natural or man-induced processes. These plants are important in creating and stabilising soil and preventing erosion.

Dominance in certain habitats

Sphagnum species are often dominant in bogs, so play an important role in peat formation. In some types of woodland, bryophytes and lichens are more important in terms of biomass than flowering herbs. Bryophytes and lichens are often the dominant vegetation in severely stressed situations such as exposed mountain summits or soils rich in heavy metals. Algae dominate in the sea, where kelp beds may be twice as productive as temperate grassland and often as productive as temperate forest. In clear, calcareous lakes, charophytes are often the principal benthic producers and in upland streams, bryophytes, lichens and algae form the major part of the aquatic vegetation.

Mycorrhizal systems

Mycorrhizal fungi are ubiquitous and important components of ecosystems, especially woodlands. There is evidence that many terrestrial green plants depend on fungal partners and that the decline of forest in Europe is linked with a decline in mycorrhizal agarics. The fungal component of a mycorrhiza may, for example, make nutrients such as phosphates and nitrates available to the vascular plant component, while deriving sugars from the vascular plant. This is particularly important in orchids, whose small seeds are incapable of sustaining themselves immediately after germination in the absence of a fungus. The presence of fungi is also vital for the survival of vascular plant such as the bird's nest orchid *Neottia nidis-avis* and yellow bird's nest *Monotropa hypopitys*, which lack chlorophyll.

Pollution indicators

The sensitivity of epiphytic lichens (e.g. *Lobaria* spp.) to atmospheric pollution is well known. Many other lichens, as well as montane, epiphytic and bog bryophytes, may also be sensitive to atmospheric pollutants. The sycamore tar-spot fungus *Rhytisma acerinum* is an excellent

indicator of sulphur dioxide pollution and the decline in toadstool production by mycorrhizal fungi in Europe may also be linked to atmospheric nitrogen deposition. Various algae, including charophytes and diatoms, are sensitive indicators of water quality. Lower plants such as seaweeds, freshwater macroalgae and bryophytes accumulate heavy metals and so can be used to monitor these pollutants.

Ecological indicators

Lower plants may be useful indicators of edaphic factors, nutrient status and other environmental features. For instance, calcareous bands in rock faces can be traced by the growth of calcicolous bryophytes such as *Tortella tortuosa* and an increase in the levels of nitrogen or phosphorus in fresh waters is usually accompanied by blooms of filamentous or planktonic algae. Lower plants can also be good indicators of habitat continuity. There is a suite of ancient woodland indicator species which are sensitive to loss of canopy cover and reduction in atmospheric humidity and/or have limited powers of dispersal. They include lichens such as *Thelotrema lepadinum* in lowland England, and probably some bryophytes and fungi. Clear felling results in the loss of these species, which fail to recolonise the disturbed sites or spread to new ones.

Economic value

There is a growing interest in the commercial collection of wild edible fungi, but few other lower plants are exploited for food. Many drugs now in use are derived from fungi: the best known are antibiotics such as penicillin and the alkaloid ergotamine, derived from the ergot *Claviceps purpurea* and used in treating migraine. Many biologically active compounds which may have potential uses in medicine, for instance as cancer inhibitors, have been identified in liverworts. Fungi have occasionally been used as biological control agents, for instance *Peniophora gigantea* in the control of the bracket fungus *Heterobasidion annosum* in conifer plantations.

Mosses are collected extensively for hanging baskets, and mosses and lichens are also used in floral decorations. Seaweeds have a long history of commercial exploitation in the British Isles and are still used widely as human food, fertiliser, and a source of pharmaceutical products such as alginates and agar. Deposits of maerl (calcareous marine algae) are commercially important as soil conditioners.

Current information

Bryophytes

Bryophytes have been subject to considerable recording activity over the past 200 years. This has culminated in the production of an atlas by the British Bryological Society (Hill, Preston & Smith 1991, 1992, 1994) using the computerised database at the Biological Records Centre (BRC), Institute of Terrestrial Ecology (ITE), which holds over 750,000 individual records. This database was also used to produce registers of sites of importance for bryophytes for a few English counties (Newton 1985; Hodgetts 1985, 1986; Hodgetts & Newton 1987). The British Bryological Society holds a 'census catalogue' of distribution by vice-county, updated annually. Other sources of data include NCC's Scottish woodlands survey (Averis 1991) and snowpatch survey (Rothero 1991), various county floras and many published papers. A list of threatened species and important sites in Europe has been drawn up by the European Committee for the Conservation of Bryophytes (Schumacker *et al.* 1993). Species endemic to the UK, and which therefore deserve special attention, are listed in Appendix 1.

Lichens

The British Lichen Society has a large computerised database used for species mapping. This, along with projects such as reports by the British Lichen Society on sites important for epiphytic, heathland and coastal lichens (Fletcher 1982, 1984, 1993), means that a reasonable assessment of the status of at least the larger forms is possible. Information on some of the 'microlichens' is less complete. A number of county floras have been published (e.g. Woods 1993) and full descriptions, distributional data and ecological information are given for all species in the *Lichen flora* (Purvis *et al.* 1992). A census catalogue of lichens in Welsh vice-counties is close to completion and an Irish census catalogue has been produced (Seaward 1984).

Fungi

The International Mycological Institute holds computerised data for the British Mycological Society mapping scheme. This has recently been supplemented by NCC and JNCC-funded projects to survey the dune mycoflora of England and Wales (Rothero 1986, 1987a, 1987b, 1989, 1990, 1991, 1992, 1993). There are also several county floras (e.g. Clark 1980). Although the first part of the *Atlas of British fungi* is in preparation, knowledge of the distribution, status and conservation of fungi is patchy. Further work by the International Mycological Institute on a literature database of fungi, funded by JNCC, commenced in 1993.

Algae

The distribution and status of many species of algae are poorly known. However, a handbook of stoneworts (charophytes), including distribution maps, has been published by the Botanical Society of the British Isles (Moore 1986). The Marine Conservation Review team in NCC/JNCC has accumulated a wealth of data on seaweeds and their ecology.

There are over 840 species of marine benthic algae and over 150 species are included in a provisional atlas (Norton 1985). A flora of marine algae is being produced by the Natural History Museum (Dixon & Irvine 1977, Irvine 1983, Fletcher 1987, Christensen 1987, Burrows 1991, Maggs & Hammersand 1993). Datasets for all the charophytes and 650 species of marine algae are held on computer at BRC. The Great Britain rivers database, which incorporates records of the larger algae of rivers surveyed by NCC in the 1980s, is held by the conservation agencies.

Red Data Lists

Red Data Lists of the charophytes, bryophytes and lichens of Britain and Ireland have been compiled by Plantlife under contract to NCC/JNCC, DoE NI and the Republic of Ireland's Office of Public Works. This work has led to the publication of a Red Data Book for the charophytes of Britain and Ireland (Stewart & Church 1992), with Red Data Books for bryophytes and lichens to follow (Stewart & Church in prep. a, in prep. b). A provisional Red Data List of British fungi has recently been drawn up (Ing 1992).

Lower Plants Biodiversity Register

In 1993 a site-based computer database of lower plants was initiated by JNCC. This exists to collate information on bryophytes, lichens, fungi and freshwater algae, in order to discover which sites in Britain are important for lower plants, to investigate species/habitat associations and to improve knowledge of the status of species.

Vascular plants

Definition

Vascular or higher plants have true roots, stems and leaves and, as their name implies, possess specialised conducting tissues. They comprise the ferns and their allies (pteridophytes) and seed-bearing plants. The latter are the flowering plants (angiosperms) and conifers and allied groups (gymnosperms).

The resource

Kent (1992) lists 71 native species of pteridophyte and 2,226 species (including 800 to 900 'microspecies') of wild, native, seed-bearing plant in the British Isles. There are

also over a thousand alien species established in the wild. Although our native flora represents less than 20% of Europe's flora, the UK has a blend of north-west European, Lusitanian and Mediterranean elements and holds internationally important plant assemblages such as oceanic western and Atlantic alpine communities. A number of our vascular plants are growing at the edge of their range, some recognised as endemic at sub-specific level. The evolutionary and ecological interest of the UK flora therefore compensates for the relatively low species number.

Current information

Recent surveys and publications

The UK vascular plant flora has long been studied in great detail, both by professional scientists and by amateur botanists, foremost amongst these being members of the BSBI. The society, with financial assistance from the Nature Conservancy, published the *Atlas of the British Flora* (Perring & Walters 1962). A supplement to this atlas (Perring & Sell 1968) and an atlas of ferns (Jermy *et al.* 1978) followed. These atlases, together with the widely used modern floras (Clapham, Tutin & Moore 1987; Stace 1991) provide a vast amount of published information on the general distribution and ecology of vascular plants. The Red Data Book of vascular plants in Britain (Perring & Farrell 1983) and the equivalent for Ireland (Curtis & McGough 1988) give information on national rarities.

The 1962 Atlas has been partially updated by three recent exercises carried out jointly by NCC/JNCC, BRC and the BSBI. In the first (Palmer & Bratton in press), one in nine of all the 10 km squares in Britain were surveyed by BSBI members, to establish a baseline for monitoring vascular plants. The second project will result in an atlas of Nationally Scarce plants in Britain (Stewart, Pearman & Preston in press). The last is part-funded by the National Rivers Authority and will produce an atlas of aquatic plants.

Surveys of rare vascular plants in England, Scotland and Wales were organised by NCC between 1974 and 1991. A

survey of arable weeds (Smith 1989) was also carried out and many general botanical surveys have been undertaken by NCC and the new statutory conservation agencies. These surveys will contribute to a revision of the British Red Data Book, at present being undertaken by JNCC (Wigginton in prep.).

Another large-scale survey is the Countryside Survey 1990 (Bar *et al.* 1993), carried out by ITE under contract to the Department of the Environment and NCC/JNCC, during which vegetation was recorded in 508 1 km x 1 km squares throughout Great Britain.

In Northern Ireland, substantial detailed work has been carried out only since 1986. This has involved surveys of major habitats, undertaken either in-house (e.g. for lowland raised bogs, blanket bogs and woodlands) or under contract to DoE NI (e.g. for lakes and coastal habitats).

Databases

The largest computerised UK database of single species records for vascular plants forms part of the BRC database, managed jointly by JNCC and ITE and housed at Monks Wood. BRC holds all the records used to compile the BSBI atlases, the Nationally Scarce plants atlas and the aquatic plants atlas. It also contains the data from the BSBI monitoring exercise. In all there are about 3.5 million records of vascular plants in BRC's database, the great majority donated by volunteer recorders. Another very large computerised database in ITE holds the *Countryside Survey 1990* data.

Numerous smaller datasets are held by universities, local records centres, museums, natural history societies, voluntary botanical societies (e.g. BSBI county recorders), conservation societies (e.g. Wildlife Trusts) and the statutory conservation agencies. By no means all of these datasets are on computer, but the trend towards holding data in an electronic form is increasing. A computerised database of rare vascular plants in Britain is held by JNCC and is accessed by CCW, EN and SNH.

rare species

The concept of rarity

The perception of rarity varies according to perspective, in both space and time. For example, floating water-plantain *Luronium natans* is fairly common in some canals in eastern Wales, the north-west of England and the Midlands, but in Great Britain as a whole it is a scarce species. At a European level it is endemic and rare enough to warrant protection under the Bern Convention and the EC Habitats and Species Directive (see section on *International designations for species*). Conversely, the small restharrow *Ononis reclinata* is very rare in the United Kingdom, where it is at the northern edge of its range, but it is not threatened in Europe as a whole (Smith 1988) and has a wide distribution through Europe to North Africa and the Middle East. Local or national populations of a species may change dramatically over time. Familiar examples of this in the UK are the decline in numbers of the common elm *Ulmus procera* and the wych elm *U. glabra*, as a result of Dutch elm disease, and the recent explosive spread of Australian swamp stonecrop *Crassula helmsii*, because of its use as an aquarium plant and its subsequent introduction to the wild.

Rarity or abundance of a species depends upon the size of the sites it can inhabit, their number, their carrying capacity, the time over which the sites remain habitable, the dispersal ability of the species, and the effect of predators and pathogens (Harper 1981). Rabinowitz (1981) recognised seven forms of rarity which are related to range, habitat specificity and local population size. Combination of these three attributes produces eight categories, as shown in Table 1.

Using this model, rare species may theoretically be found in

all categories except the first (large range, wide habitat specificity and large local population size). The last two categories (small range and narrow habitat specificity) contain endemics which are 'naturally' rare. Even species in the first category could, however, become rare if they are subjected to pervasive influences such as atmospheric pollution or climate change.

Such concepts are of great relevance to conservation planning. If an aim is the conservation of biodiversity, active intervention to prevent extinction may be appropriate.

Some situations are clear-cut. If a rare species inhabits a fen endangered through desiccation, it is obvious that, to save the species, the water balance of the site must be restored. In other cases a more cautious approach is needed. To justify expensive remedial action it must be clear that a decrease in numbers is a long-term trend rather than a normal short-term fluctuation in population size. The trend must be reversible and its cause appreciated-it may be futile to attempt to conserve an Arctic alpine species *in situ* in the face of global warming.

In order to conserve biodiversity effectively, rarity at a finer level than species should also be considered. Modern floras (Clapham, Tutin & Moore 1987; Stace 1991) recognise the diversity of sub-species and varieties, some of which are of great importance from the standpoint of biogeography and ecology. There is still, however, a great deal of work to be done on taxonomy and genetics before sensible conservation policies can be produced for many groups of plants at sub-specific level.

Table 1. Forms of rarity (after Rabinowitz 1981)

	Table 1. Forms of rarity (after Rabinowitz 1981)							
Range	Large				Small			
Habitat specificity	Wide		Narrow		Wide		Narrow	
Local population size	Large	Small	Large	Small	Large	Small	Large	Small

Red Data Book species

The Red Data Book (RDB) categories 'Endangered', 'Vulnerable' and 'Rare' are defined by the International Union for the Conservation of Nature (Appendix 2). These definitions are at present under review by the IUCN. Britain's Red Data Book species have been defined by the statutory conservation agencies as those which occur in one to fifteen 10 km x 10 km national grid squares in England, Scotland and Wales (Perring & Farrel (1983). The equivalent criterion for the whole of Ireland is one to ten 10 km x 10 km squares. For the forthcoming revision of the vascular plant Red Data Book for Britain, the criteria are being revised. Numerical criteria will be less strictly applied and more emphasis will be placed on threat, decline, population dynamics and other aspects of rarity.

Of the approximately 1,000 species of bryophyte in the UK, 223 species are on the British Red Data List and 192 are on the Irish Red Data List (Stewart & Church in prep. a); of the 1,700 lichens, over 300 species are considered rare enough to qualify for the Red Data Book for Britain and Ireland (Stewart & Church in prep. b). About 580 species of fungi are included on a provisional Red Data List for the UK (Ing 1992), out of an estimated minimum of 20,000 species. Seventeen of the 33 species of charophyte in the British Isles are listed in the stonewort Red Data Book for Britain and 12 are listed for Ireland (Stewart & Church 1992), an indication of the threat caused by water pollution to this group of algae. 317 vascular plant species are listed in the Red Data Book for Britain (Perring & Farrell 1983), although it is likely that more will be included in the third edition now in preparation. The Irish Red Data Book (Curtis & McGough 1988) lists 159 vascular plants.

Nationally Scarce species (Great Britain)

Nationally Scarce species are defined by the statutory conservation agencies as native plants which are not rare enough to be included in the Red Data Book, but occur in one hundred or fewer 10 km x 10 km squares in Great Britain. There is no equivalent of this category for Ireland. There are about 260 Nationally Scarce vascular plants in Britain and approximately 300 bryophyte and 350 lichen species are regarded as Nationally Scarce.

Locally important species

Plants are regarded as locally important for a number of

reasons. Within England, Scotland, Wales and Northern Ireland, there are recent moves to take account of 'national' distributions. This is likely to alter perspectives on rarity for the Countryside Council for Wales, English Nature and Scottish Natural Heritage.

For Great Britain, a 'regionally rare' vascular plant is defined (Nature Conservancy Council 1989) as a species found in fifteen or fewer localities (1 km x 1 km squares) within an NCC Region, but which has neither Red Data Book nor Nationally Scarce status.

'County' Rare Plant Registers are being compiled by the BSBI and Wildlife Trusts. These will be essential contributions to local Red Data Books. 'County' rarities are plants (excluding Red Data Book and Nationally Scarce species) recorded from three or fewer localities in a county or equivalent administrative unit. A locality is defined as an area not exceeding one square kilometre in extent (i.e. a 'moveable' 1 km x 1 km square, not necessarily corresponding to a national grid square). A species which is extremely common nationally may be highly valued at a local level because of its unusually restricted or relict distribution (e.g. hazel *Corylus avellana* in Orkney and Shetland). A common species may also be of local importance because it is genetically distinct from the species in the rest of its range. An example of this is the Scots pine *Pinus sylvestris*, which has a variety *scotica*, the native Scottish plant, which is different from the continental variety (Clapham, Tutin & Moore 1987).

Endemic species

In the UK there are an unknown number of endemic lower plants and about a dozen endemic vascular plant species (Appendix 1), excluding those in some 'critical' genera (*Alchemilla*, *Euphrasia*, *Hieracium*, *Limonium*, *Rosa*, *Rubus*, *Sorbus*, *Taraxacum*) which contain many more, some of them unstable. Although not nearly as numerous as in many countries, endemics form an important element of our flora and the majority are included in UK Red Data Books.

Species given special legal protection ('Schedule 8' plants)

Schedule 8 of the Wildlife and Countryside Act, 1981 lists plants which are afforded special protection in Great Britain (Appendix 3). The criteria for including species in the Schedule are twofold: plants must be in danger of extinction in Great Britain or there must be an international obligation for their protection. The plants

would normally be Red Data Book species, although a plant which is relatively common in Britain might require protection for international reasons. Currently, there are 107 species of vascular plant, 33 bryophytes, 26 lichens and 2 stoneworts on the British Schedule.

The equivalent schedule for Northern Ireland is Schedule 8 of the Wildlife (Northern Ireland) Order, 1985, which contains 56 vascular plant species (Appendix 4). The Schedule is currently under review.

International designations for species

International designations, which the Secretary of State may consider in making amendments to Schedule 8 of the Wildlife and Countryside Act and of the Wildlife (Northern Ireland) Order, are the lists of threatened plants in the Bern Convention (*Council of Europe Convention No. 104-Convention on the conservation of European wildlife and natural habitats*) and the European Community Habitats and Species Directive (*Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora*). The UK species on these lists are given as Appendix 5.

Signatories to the Bern Convention are required to give protection against picking, collecting, cutting, uprooting and sale to plants listed on it Appendix I. The EC Directive requires similar protection for plants listed on Annex IVb. Schedule 8 of the Wildlife and Countryside Act now contains all the species needing protection in Great Britain as a result of these international designations.

Only four species listed on the EC Directive Annex IVb or on Bern Appendix I are native to Northern Ireland. The vascular plants *Trichomanes speciosum* and *Saxifraga hirculus* are included in Schedule 8 of the Wildlife (Northern Ireland) Order; the lower plants *Petalophyllum ralfsii* and *Drepanocladus vernicosus* are under consideration for scheduling.

Annex IIb of the EC Directive lists species for which Special Areas of Conservation (SACs) should be designated, managed and monitored. Annex Vb of the Directive is a list of more widespread plants such as *Sphagnum* and maerl (calcareous marine algae). If a member state deems it necessary, it must take measures to ensure that taking and exploitation from the wild of Annex Vb species is compatible with their being maintained at a favourable conservation status.

An EEC regulation implementing the *Convention on international trade in endangered species* (CITES) regulates the import and export of some plants, including all orchids, to

and from the European Community.

The World Conservation Monitoring Centre (WCMC), in close collaboration with the World Conservation Union (IUCN), is producing the first comprehensive Red List of threatened plants of the world (Walter in prep.). The species currently included on WCMC's Red List database and which occur in Great Britain are given as Appendix 6.

Species protection through statutory site designations

The presence of rare plant species or combinations of species is taken into account during the selection and designation of Sites of Special Scientific Interest. *Guidelines for selection of biological SSSIs* (Nature Conservancy Council 1989; Hodgetts 1992) list the following categories of rarity for consideration: Schedule 8, Red Data Book, Nationally Scarce, regionally rare, endemic, declining, edge of range and threatened in Europe.

assemblages

Rare plants should not be conserved in isolation from their associates, but rather in the full context of their natural habitats. Moreover, the commoner elements of our flora are also of intrinsic value as part of our heritage of wild plants. The conservation of plant assemblages is important for both these reasons, as well as for maintaining biodiversity and the integrity of natural and semi-natural habitats.

Much of lowland Britain has been or is being covered by broad (Phase 1) habitat survey (England Field Unit 1990), which seeks to pinpoint good quality wildlife habitat in the 'wider environment' outside protected sites. Phase 1 survey has been carried out by the statutory conservation agencies, sometimes in partnership with Wildlife Trusts, local authorities and others. A large amount of more detailed (Phase 2) survey of natural and semi-natural areas has also been accomplished by the conservation agencies, voluntary bodies, ITE, universities, water authorities and others.

Phase 2 survey has contributed to a long-term project, funded by NCC/JNCC, to produce the National Vegetation Classification, a comprehensive classification of the natural and semi-natural vegetation of Great Britain (Rodwell 1991, 1992a, 1992b, in press, in prep.). The NVC is principally concerned with vascular plants, although lower plants are well covered in certain habitats, notably mires and heaths. The computerised database for the NVC is housed in Lancaster University and contains plant lists from over 30,000 quadrats. The NVC does not cover Ireland, but many of the communities are easily recognisable there. Work is in progress to assess the appropriateness of this classification to Northern Ireland.

Nationally important communities

The NVC communities of significance for nature conservation in Great Britain are identified in *Guidelines for selection of biological SSSIs* (Nature Conservancy Council 1989) and sites supporting these communities are represented in the national series of Sites of Special Scientific Interest. Important communities of lower plants and guidelines for the selection of SSSIs for these are given by Hodgetts (1992).

Internationally important assemblages and habitats

Lower plants

Internationally important assemblages of lower plants include:

- bryophytes, lichens and fungi of Atlantic woodlands, especially those of western Scotland
- Atlantic-influenced arctic-alpine communities
- bryophytes of raised and blanket mires
- the northern Atlantic hepatic mat, a liverwort community unique to Ireland and the west of Scotland
- bryophytes and lichens of machair grassland (found only in western Ireland and Scotland) and dune communities
- lichen and bryophyte assemblages of rocky sea coasts
- bryophyte communities of sandstone formations in south-eastern England
- bryophyte and lichen communities of chalk downland and chalk cliffs
- lowland lichen-rich heath, including maritime cliff-top heath
- lichen and fungus assemblages of Caledonian pine forest
- epiphytic bryophytes and lichens of ancient parkland trees and pasture woodlands
- pollution-sensitive epiphyte assemblages still frequent in the western UK but which have declined or disappeared elsewhere in Europe
- metallophyte lichen communities (e.g. on old mine waste)
- algae of brackish lagoons and estuaries
- marine algal communities, including maerl beds, *Ascophyllum nodosum* var. *mackaii* beds, communities of tide-swept narrows associated with sea lochs/loughs and communities of micro-algae on chalk cliffs.

The European Community Habitats and Species Directive

The habitat classification CORINE is now in use throughout the European Community for the implementation of the EC Habitats and Species Directive. A series of Special Areas of Conservation (SACs) must be designated in each EC country to protect the CORINE habitat types considered to be of European importance and listed on Annex I of the Directive. Annex I includes 83 habitat types which occur in the UK. Of these, 22 are

regarded as rare enough to deserve special consideration as 'priority habitats'. They are:

- coastal lagoons
- inland salt meadows with *Puccinellia distans*
- fixed (grey) dunes
- eu-Atlantic decalcified fixed dunes with *Calluna vulgaris*
- decalcified fixed dunes with *Empetrum nigrum*
- dune juniper thickets
- dry coastal heaths with *Erica vagans*
- wet heaths with *Erica ciliaris* and *Erica tetralix*
- dry calcareous grasslands (*Festuco-Brometalia*) important for orchids
- species-rich *Nardus* grasslands
- active raised bogs
- active blanket bogs
- calcareous fens typified by *Cladium mariscus*
- tufa springs with moss vegetation (*Cratoneuron* species)
- Alpien pioneer formations with *Carex atrofusca*
- limestone pavements
- *Tilia cordata-Acer campestre* ravine woodlands
- Caledonian pine forest
- bog woodland (natural types only)
- *Taxus baccata* woodland
- residual alluvial woodland (*Alnus glutinosa-Prunus padus* type)
- Mediterranean temporary ponds (pools wet in winter, dry in summer; indicative species *Mentha*

pulegium, Cyperus fuscus, Pilularia globulifera, Isoetes hixtrix, Cicendia filiformis, Juncus pygmaeus).

The Ramsar Convention

The *Convention on wetlands of international importance especially as waterfowl habitat* (the Ramsar Convention) requires the designation and protection of sites of importance for a wide range of species, including plants. A wetland is considered internationally important for plants if:

- if supports an appreciable assemblage of Rare, Vulnerable or Endangered species or subspecies of plant, or an appreciable number of individuals of any one or more of these species
- it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora
- it is of special value as the habitat of plants at a critical stage of their biological cycle
- it is of special value for one or more endemic plant species or communities.

Designation of important representative or rare wetlands is also required on general habitat grounds. The Ramsar Convention is therefore a powerful vehicle for the conservation of wetland plants.

legislaion

Legislation in Great Britain

The Wildlife and Countryside Act, 1981 has many sections which can be used to further the conservation of plants and their habitats.

Section 13(1) b of the Wildlife and Countryside Act makes it illegal, without authorisation, to uproot (or remove from the site) any wild plant. Section 13(1)a affords protection against picking, uprooting and destruction, for plant listed on Schedule 8, unless the damage is a result of a lawful activity and could not reasonably have been avoided.

Section 13(2) gives scheduled plants protection against sale. JNCC, in consultation with the other statutory conservation agencies, is required to advise the Secretary of State on reviews of Schedule 8 (Appendix 3) at five-yearly intervals, but reviews can be initiated more frequently if necessary.

Section 14 of the Wildlife and Countryside Act makes it an offence, without a licence, to plant or cause to grow in the wild any plant listed in Schedule 9. This schedule contains alien species which pose a threat to Britain's wildlife. Species at present included in Schedule 9 are listed in Appendix 7.

Other Sections of the Act empower the conservation agencies to designate, protect and manage Sites of Special Scientific Interest (SSSIs) and National and Marine Nature Reserves. The Countryside Act, 1968, as amended by Schedule 9 of the Environmental Protection Act, 1990, makes it possible for conservation agencies to enter into management agreements on land adjoining SSSIs. Under Schedule 10 of the Natural Heritage (Scotland) Act, 1991, SNH may enter into management agreements more widely still.

Broader environmental legislation is often relevant to nature conservation. Examples are the Environmental Protection Act, 1990, which contains clauses on the control

of pollution and the release of genetically modified organisms, and Town and Country Planning Acts.

Legislation in Northern Ireland

In Northern Ireland there are two pieces of legislation broadly equivalent to Britain's Wildlife and Countryside Act, 1981. The Wildlife (Northern Ireland) Order, 1985 covers species protection. The Nature Conservation and Amenity Lands (Northern Ireland) Order, 1985 empowers the Department of the Environment to designate Areas of Special Scientific Interest (ASSIs) and National and Marine Nature Reserves. Article 14 of the Wildlife Order

is the direct equivalent of Section 13 of the Wildlife and Countryside Act. Schedule 8 of the Wildlife Order lists protected plants (Appendix 4) and Schedule 9 contains alien species which may not be planted in the wild without a licence (Appendix 7).

International legislation

International designations have been discussed previously. Domestic legislation is the vehicle of compliance with the Bern Convention, the EC Habitats and Species Directive and the Ramsar Convention.

priorities

Plant species and communities are ranked by importance in the following table. Individual conservation agencies will prioritise within and between these broad categories for species recovery, monitoring and other activities, and will need to consider factors such as threat, decline/stability,

recovery potential and local perspectives. One obvious priority for all the conservation agencies is to fulfil statutory duties such as commitments under the EC Habitats and Species Directive.

Species

Ranking

1. Internationally threatened species native to the UK (Bern Convention Appendix I; EC Habitats and Species Directive Annexes II and IV; WCMC/IUCN list of threatened species)*.
2. Species listed on Schedule 8 of the Wildlife and Countryside Act, 1981 and Schedule 8 (Part I) of the Wildlife (Northern Ireland) Order, 1985, but not included in 1*.
3. Red Data Book taxa in Great Britain and Ireland not covered by 1 or 2*.
4. Nationally Scarce species (Great Britain)*.
5. Species listed on Annex V of the EC Habitats and Species Directive.
6. Locally important native species*.
7. Common native species.

*Endemic taxa would normally be given priority within these categories.

Plant assemblages and habitats

Ranking

1. Internationally threatened assemblages and habitats (e.g. priority habitat types on Annex I of the EC Habitats and Species Directive; wetlands qualifying under the Ramsar Convention for plant species or on general habitat grounds; other internationally important lower plant assemblages).
2. NVC communities and lower plant assemblages which are rare in the UK but not considered internationally threatened.
3. Non-priority habitat types on Annex I of the EC Habitats and Species Directive not covered by 2.
4. NVC communities and lower plant assemblages recognised as requiring conservation on grounds of representativeness in the SSSI selection guidelines (Nature Conservancy Council 1989; Hodgetts 1992) and not covered by 1, 2 or 3.
5. 'Wider environment' habitats and features (e.g. hedgerows).

implementation

The range of actions which can be undertaken by the statutory conservation agencies to implement this plant conservation strategy is laid out in the following sections as a series of ten objectives, each linked to a principle, objective or target set out in *Biodiversity. The UK Action Plan* (HMSO 1994). Specific targets identified in *The UK Action Plan*, or activities which contribute significantly to these targets, are identified by (*). Most of the activities involve statutory duties and/or continuing commitments. Only action directed specifically towards the conservation of plant species and assemblages is mentioned, although many other duties carried out by the conservation agencies (e.g. Phase 1 survey, routine SSSI monitoring) contribute indirectly to plant conservation.

Appendix 8 illustrates the contribution made by the ten plant strategy objectives to important general activities and key initiatives carried out by the conservation agencies. Appendix 9 summarises the ways in which the ten objectives are linked and contribute to effective plant conservation. It illustrates how the efforts of both volunteers and professionals contribute to the pool of knowledge which is an essential basis for sound action, and how the groundswell of international opinion also influences our activities in the UK.

Survey and monitoring

The objective is to complete, by the year 2000, national surveys of all priority species, and to have put in place effective systems of species monitoring. This objective conforms with *The UK Action Plan* principle of basing conservation on sound knowledge.

To achieve this objective effectively, work on instituting common standards for species recording (*) will be completed and monitoring protocols for vascular and non-vascular plants will be drawn up. Priority will be given to the completion of national surveys of species listed on Annexes II and IV of the EC Habitats and Species Directive, endemic bryophyte and vascular plant species (Appendix I), Schedule 8 plants and Red Data Book vascular plants. Commitments under the EC Directive will be met for monitoring Special Areas of Conservation, the status of Annex II species and the exploitation of Annex V species. In order to inform the five-yearly reviews of Schedule 8 listings, the necessary

monitoring of threatened species will be carried out. The spread of invasive alien species will also be monitored. Other selected species will be surveyed and monitored at a national or local level, as the need arises. The BSBI Monitoring Scheme (Palmer & Bratton in press) will be reviewed and the possibility of repeating it will be considered.

For most of these survey and monitoring exercises, the statutory conservation agencies will rely heavily on the expertise and effort of the voluntary sector.

Computerised databases

The objective is to establish a national network of computerised databases for plant species, to facilitate the exchange of data between professional and voluntary agencies concerned with wildlife conservation. Improvement of access to, and co-ordination of, biological datasets is a target in *The UK Action Plan*.

As part of a broader strategy for biological recording, the statutory conservation agencies will continue to push for the development of a computerised network of local and national plant recorders, both amateur and professional (*). Existing computerised national databases of vascular and lower plants, held jointly by the agencies and BRC, will be maintained (*) and access to information held in them will be improved (*). JNCC's Lower Plant Biodiversity Register will be enlarged by trawling in site-related data and used to pinpoint areas of high biodiversity (*).

Research

The objective is to carry out sufficient research to enable conservation measures to be undertaken in a well-informed and effective manner. This objective conforms to *The UK Action Plan* principle of basing conservation on sound knowledge.

Work will continue on the autecology, population biology and genetics of selected threatened species; on functional attributes of plant assemblages; on the impacts of human activities on plants; and on distinguishing areas of high, or potentially restorable, natural biodiversity (*). Initial assessments of the current range of variation in species richness have been carried out by JNCC staff (Pienkowski

1993). Proposed new studies (for which there is at present no firm commitment) are the determination of a set of species for use as indicators of the character of the native flora and of the health of the environment; an assessment of the role of designated areas in plant conservation; and further work on vegetation classifications relevant to nature conservation.

Dissemination of information

The objective is to make information on the status and conservation of plants readily and widely available, both within and outside the statutory agencies. (Dissemination of information through access to, and networking of, databases is covered elsewhere.) This objective is in line with the requirement in *The UK Action Plan* for increasing public awareness of the need to conserve biodiversity.

A number of books relevant to plant conservation will be published in the near future by JNCC. These include Red Data Books for bryophytes (Stewart & Church in prep. a), lichens (Stewart & Church in prep. b) and vascular plants (Stewart, Pearman & Preston in press); a report on the BSBI Monitoring Scheme (Palmer & Bratton in press); and guidelines for the management of woodlands for lower plants (Hodgetts in prep.). Priorities will be established for the production of Red Data Books for taxonomic groups lacking them (*), before embarking on further publications of this nature, and fungi and marine benthic algae will be considered. Some of the country conservation agencies currently grant-aid the publication of local floras. JNCC is proposing to update and publish guidelines on translocations, re-establishments, introductions and re-stocking (*).

Dissemination of information on plant conservation also includes provision of advice to Government and participation by staff in training courses and conferences, in order to improve the flow of information between the agencies, voluntary societies and research institutes.

Site designation, protection and management

The objective is to designate sufficient sites throughout the UK to provide adequate legal protection for nationally and internationally important plant species, assemblages and habitats, and to manage these sites for the benefit of the habitats and species they contain. Targets for the designation and management of protected sites are included in *The UK Action Plan*.

All Special Areas of Conservation identified under the EC Habitats and Species Directive will be designated by the year 2004(*), including sites chosen to cover gaps in existing SSSI/ASSI coverage (*). The agencies will carry out all the duties required of them in connection with these designations. Management of protected sites will be improved to conserve and enhance the habitats and species for which they were chosen (*). Ramsar sites will be selected for a range of habitat types and plant species (*) and the agencies will fulfil their roles in protecting these wetland sites of international importance.

Species action plans and recovery programmes

The objective is to continue existing recovery programmes, some of which are based on recommendations made by Whitton (1990), and to initiate new ones for selected species, prioritised on the basis of threat, biological knowledge, recovery potential and international obligations. The long-term goal of plant recovery programmes is to maintain or restore viable populations of threatened species. Species action plans and recovery programmes are targeted in *The UK Action Plan*.

Proposals for action to conserve plants on Annex II of the EC Habitats and Species Directive and threatened endemic species (Appendix 1) will be prepared (*). Species requiring individual recovery programmes will be identified and further plant species are likely to be added to the agencies' existing recovery programme each year until 2000 (*). *In situ* conservation measures will include site management, propagation and translocation, as appropriate. *Ex-situ* measures will consist of continued cultivation of rare species in botanic gardens, the maintenance of the seed bank at Kew Gardens and possibly the investigation of low temperature and other preservation techniques for live storage of lower plant material. Voluntary conservation organisations will be involved in recovery programmes whenever appropriate.

The wider environment

The objective is to influence the use and management of the wider environment in order to conserve, restore and enhance plant populations. A number of targets for conservation of the wider environment are included in *The UK Action Plan*.

The statutory conservation agencies will seek to influence policy formulation for the countryside outside protected areas, for the benefit of plant conservation. They will

continue to provide advice on a wide variety of issues, including management of the coastline (*), forestry policy (*), fresh water quality objectives (*) and linkage between agricultural and environmental objectives (*). The agencies will also continue to work to influence planning policy and wildlife management in urban areas, for the benefit of plant populations. A current example of such action is SNH's *Countryside Around Towns* programme.

Legislative measures

The objective is to carry out all the statutory duties required of the conservation agencies, and to make full use of legislation to further the conservation of plants. (Statutory site designation and protection have been mentioned previously). Protection of threatened species is a target in *The UK Action Plan*.

The statutory five-yearly reviews of Schedule 8 of the Wildlife and Countryside Act will continue (*), in consultation with voluntary organisations. Licensing operations in respect of Schedule 8 species will continue (*). Schedule 9 of the Wildlife and Countryside Act and the Wildlife (Northern Ireland) Order (Appendix 7) will be reviewed.

Local involvement

The objective is to promote the role of voluntary bodies and the involvement of local communities in plant conservation. (Voluntary effort directed at nation-wide survey and monitoring projects has been covered previously). This objective is in line with the principle in *The UK Action Plan* of involving individuals and communities in conservation, as well as Government and its agencies.

liaison

Statutory conservation agency staff

To enable this strategy to be implemented, the conservation agencies will make available adequate staff time and other resources for specialist botanical work, survey, monitoring, dissemination of information and site designation, management and protection. One of the important duties for plant ecologists within the agencies is liaison with each other and with external bodies and individuals.

Some of the duties of specialist botanical staff in the conservation agencies are listed below.

Local communities, land owners and voluntary conservation organisations will be encouraged through grants and in other ways to participate in the management of protected sites and other areas of importance for plants. Where possible, statutory agency staff will contribute to education on plant conservation, by talking to schools, colleges and societies. Encouragement will be given to volunteers to undertake targeted botanical survey, to satisfy local needs.

International perspectives

The objectives are to co-operate with other countries and to contribute to the fulfilment of international obligations laid on the UK Government through directives and conventions, while seeking to influence the form and content of international agreements involving plant conservation. An objective of *The UK Action Plan* is for the UK to contribute to conservation on European and global scales.

The statutory agencies will complete by 1995 their input to the selection of Special Areas of Conservation under the EC Habitats and Species Directive and will report, as required, on the status of plant species on Annexes II, IV, and V of the Directive. The agencies will continue to be represented on the Council of Europe Group of Experts on Plants and thus will take an active part in plant conservation at a European level (*). Ramsar site selection criteria for plants and habitats will be interpreted and developed (*). A review of the European status of British plants is proposed (*). Finally, the agencies will contribute further, as appropriate, to the UK's action in relation to the *Convention on biological diversity*.

JNCC Support Unit

- co-ordinating plant survey and data collection by national voluntary organisations
- maintaining GB plant databases and disseminating data to country agency headquarters and other organisations
- co-ordinating the working group (see below) and facilitating liaison between country agencies and the JNCC Support Unit
- liaising with national organisations, including voluntary bodies (e.g. Plantlife, BSBI, lower plant societies, RSNC, RSPB, National Trust) whose activities affect plant conservation at a GB or UK level
- identifying needs for research at a GB level; commissioning and managing this research; liaising with research institutes, universities, botanic gardens etc.

- collating knowledge and experience; disseminating information about plant conservation in the UK by writing, and supervising the production of, national guidelines, Red Data Books, etc.
- in consultation with country agencies, drawing up monitoring protocols for species and assemblages
- providing advice to Government and other bodies on matters relevant to plant conservation in a GB or international context
- representing the UK in international fora
- specifying and refining further objectives for plant conservation at a GB level.

Country agencies

- co-ordinating and carrying out plant survey, monitoring and data collection at country and local levels
- maintaining databases and passing information to JNCC when appropriate
- assessing plant conservation priorities within each country
- liaising with the JNCC Support Unit, as appropriate, on matters concerning plant conservation
- liaising with other organisations, including voluntary bodies, whose activities have a bearing on plant conservation in the country
- identifying projects and research needs at country and local levels; commissioning and managing research
- co-ordinating and managing species recovery programmes within each country
- liaising with landowners/occupiers, local planning authorities and others over site protection and management
- advising Government on matters relevant to plant conservation at an individual country level
- promoting required practices for plant conservation within each country
- collating knowledge and experience on plant conservation
- specifying and refining further objectives for plant conservation within each country.

Links with research establishments

Substantial contributions to plant conservation are made by universities, research institutes, agricultural institutions, botanic gardens, museums and other organisations which carry out fundamental activities such

as botanical research, plant breeding, genetic studies and the maintenance of rare plant collections, herbaria and seed banks. Some of these establishments are also centres of invaluable taxonomic expertise. It is important that the statutory conservation agencies share knowledge with these organisations and, where appropriate, commission work from them.

Support for voluntary organisations

Without the help of the voluntary organisations, it would be very difficult for the statutory agencies to be effective in carrying out survey, monitoring and practical aspects of plant conservation. Voluntary bodies need due recognition, support and co-operation from the statutory conservation agencies. Whilst it is inappropriate and impracticable for statutory agencies to give comprehensive financial support to these organisations, modest funding is often possible, for instance as contributions towards the expense of survey and monitoring projects and in the form of grants for management work on nature reserves.

Working group

A Plant Conservation Working Group will be established, composed of officers from the Joint Nature Conservation Committee's Support Unit, the Countryside Council for Wales, English Nature, Scottish Natural Heritage, the Department of the Environment (Northern Ireland) and representatives of the voluntary organisations comprising Plantlife Link. This Working Group will be co-ordinated by the Support Unit of JNCC and will meet at least once a year. It will:

- assess needs for survey, monitoring and research
- co-ordinate recovery programmes
- review progress on data collection, storage and exchange
- review the UK's responsibility for plant conservation in the international field
- carry out reviews of this plant conservation strategy and those of the voluntary conservation organisations.

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Appendix 1. Bryophyte and vascular plant species endemic to Great Britain

Red Data Book species

Liverwort

Cephaloziella nicholsonii R (England)

Mosses

Brachythecium appleyardiae R (England)
Bryoerythrophyllum caledonicum R (Scotland)
Bryum lawersianum Ex (Scotland)
Ditrichum cornubicum E (England)
Pictus scoticus ? K (Scotland)
Pohlia scotica R (Scotland)
Sphagnum skyense K (Scotland)
Thamnobryum angustifolium E (England)
T. cataractarum V (England)
Tortella limosella Ex (Scotland)
Weissia mittenii ? Ex (England)

Vascular plants

Athyrium flexile ? K (Scotland)
Bromus interruptus ? Ex (England)
Calamagrostis scotica ? V (Scotland)
Centaurium latifolium ? Ex (England)
Cerastium nigrescens ? R (Scotland)
Cochlearia micacea ? R (Scotland)
Coincya wrightii R (England)
Epipactis youngiana ? K (England, Scotland)
Fumaria occidentalis R (England)
Sagina boydii ? Ex (Scotland)
Senecio cambrensis R (England, Scotland, Wales)

Key

Red Data Book categories: R=Rare
V=Vulnerable
E=Endangered
K=Insufficiently known
Ex=extinct in the wild

?=debate exists over taxonomic status

Nationally Scarce species

Moss

Bryum dixonii (Scotland)

Vascular plants

Gentianella anglica
(ssp. *anglica* & ssp. *cornubiensis*) (England)
Primula scotica (Scotland)
Ulmus plotii ? (England)

Notes

1. Authorities:
vascular plants - Stace (1991 and pers. comm.)
bryophytes - Hill, Preton & Smith (1991, 1992, 1994)
Red Data Lists - Perring & Farrell (1983)
- Stewart & Church (in prep. a)
2. Lesser-known critical genera of vascular plants (*Alchemilla*, *Euphrasia*, *Hieracium*, *Limonium*, *Rosa*, *Rubus*, *Sorbus*, *Taraxacum*) are not included here. There are many 'microspecies' in these genera, many of them ill-defined and some unstable.
3. *Cotoneaster integerrimus* var. *anglicus* has recently been proposed as a new species, *Cotoneaster canbricus* (Fryer & Hylmo 1994), endemic to Wales.
4. *Fumaria purpurea* is endemic to Great Britain, Northern Ireland and the Channel Islands. None of the species listed on the previous page occurs in Northern Ireland.
5. Three bryophyte species are apparently endemic to the UK and the Republic of Ireland. These are the liverworts *Fossombronia fimbriata* and *Plagiochila britannica* and the moss *Barbula tomaculosa*. *P. britannica* is the only one of the three species which occurs in Northern Ireland.
6. Two liverwort species, *Telaranea murphyae* and *T. longii*, have been recorded only in Great Britain. However, it is suspected that these species are introductions to Great Britain, which remain undiscovered in their country of origin.

7. Varieties and hybrids are not listed here, but subspecies (other than in critical genera) recognised by Stace as endemic to the British Isles and recorded from the UK are:
Anthyllis vulneraria ssp. *corbierei*
(England and Channel Islands)
Arenaria norvegica ssp. *anglica*
(England)
Cerastium fontanum ssp. *scoticum*
(Scotland)
Coincya monensis ssp. *monensis*
(GB and Isle of Man)
Dactylorhiza incarnata ssp. *coccinea*
(UK and Rep. of Ireland)
D. incarnata ssp. *pulchella*
(UK and Rep. of Ireland)
D. majalis ssp. *occidentalis*
(Scotland and Rep. of Ireland)
D. majalis ssp. *cambrensis*
(GB)
Fumaria capreolata ssp. *babingtonii*
(UK and Rep. of Ireland)
Gentianella amarella ssp. *hibernica*
(Ireland)
G. amarella ssp. *septentrionalis*
(England and Scotland)
Helianthemum canum ssp. *laevigatum*
(England)
Herniaria ciliolata ssp. *cilio lata*
(England and Channel Islands)
H. ciliolata ssp. *subciliata*
(Channel Islands)
Linum perenne ssp. *englicum*
(England and Scotland)
Pilosella flagellaris ssp. *bicapitata*
(Scotland)
Scleranthus perennis ssp. *prostratus*
(England)
Rumex acetosa ssp. *hibernicus*
(UK and Rep. of Ireland)
Tephrosieris integrifolia ssp. *maritima*
(Wales)
8. There are numerous 'near-endemic' species not listed here, for which the UK is of great importance because it contains the majority of the world population.

Appendix 2. Red Data Book categories as defined by IUCN.

Red Data Book categories are used by the World Conservation Union (IUCN), the World Conservation Monitoring Centre (WCMC) and the Species Survival Commission (SSC) to indicate the degree of threat to individual taxa in their wild habitats. These categories are used for both plants and animals. The categories as defined here are currently being revised by the IUCN.

Extinct (Ex)

Taxa that are no longer known to exist in the wild after repeated searches of type localities and other known or likely places.

Endangered (E)

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Vulnerable (V)

Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.

Rare (R)

Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Indeterminate (I)

Taxa known to be Extinct, Endangered, Vulnerable or Rare but where there is not enough information to say which of the four categories is appropriate.

Insufficiently Known (K)

Taxa that are suspected but not definitely known to belong to any of the above categories because of the lack of information.

Out of Danger (O)

Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken, or because the previous threat to their survival has been removed.

Not threatened (nt)

Taxa that are not in any of the above categories.

No information (?)

Taxa for which there is no information.

Appendix 3. Plants included in Schedule 8
of the Wildlife and Countryside Act, 1981.

Mosses

Acaulon triquetrum
Barbula cordata
B. glauca
Bartramia stricta
Bryum mamillatum
B. schleicheri
Buxbaumia viridis
Cryphaea lamyana
Cyclodictyon laetevirens
Ditrichum cornubicum
Drepanocladus vemicosus
Grimmia unicolor
Hypnum vaucheri
Micromitrium tenerum
Mielichhoferia mielichhoferi
Orthotrichum obtusifolium
Plagiothecium piliferum
Rhynchostegium rotundifolium
Saelanic glaucescens
Scorpidium turgescens
Sphagnum balticum
Thamnobryum angusifolium
Zygodon forsteri
Z. gracilis

Liverworts

Adelanthus lindenbergianus
Geocalyx graveolens
Gymnonitron apiculatum
Jamesoniella undulifolia
Leiocolea rutheana
Marsupella profunda
Petaophyllum ralfsii
Riccia bifurca
Southbya nigrella

Lichens

Bryoria furcellata
Buellia asterella
Caloplaca luteoalba
C. nivalis
Catapyrenium psoromoides

Catillaria laureri
Cladonia stricta
Collema dichotomum
Gyalecta ulmi
Heterodermia leucomelos
H. propagulifera
Lecanactis hemisphaerica
Lecanora achariana
Lecidea inops
Nephroma arcticum
Pannaria ignobilis
Parnelia minarum
Parmentaria chilensis
Peltigera lepidophora
Pertusaria bryontha
Physcia tribacioides
Pseudocyphellaria lacerata
Psora rubiformis
Solenopsis liparina
Squamarina lentigera
Teloschistes flavicans

Stoneworts

Chara canescens
Lamprothamnium papulosum

Vascular plants

<i>Ajuga chamaepitys</i>	Group pine
<i>Alisma gramineum</i>	Ribbon-leaved water-plantain
<i>Allium sphaerocephalon</i>	Round-headed leek
<i>Althaea hirsuta</i>	Rough marsh mallow
<i>Alyssum alyssoides</i>	Small alison
<i>Apium repens</i>	Creeping marshwort
<i>Arabis alpina</i>	Alpine rock-cress
<i>A. stricta</i>	Bristol rock-cress
<i>Arenaria norvegica</i>	Norwegian sandwort
<i>Artemisia campestris</i>	Field wormwood
<i>Atriplex (Halimione)</i>	
<i>pedunculata</i>	Stalked orache
<i>Bupleurum baldense</i>	Small hare's ear
<i>B. falcatum</i>	Sickle-leaved hare's ear
<i>Carex depauperata</i>	Starved wood-sedge
<i>Centaurium tenuiflorum</i>	Slender centaury

<i>Cephalanthera rubra</i>	Red helleborine	<i>Melampyrum arvense</i>	Field cow-wheat
<i>Chenopodium vulvaria</i>	Stinking goosefoot	<i>Mentha pulegium</i>	Pennyroyal
<i>Cicerbita alpina</i>	Alpine sow-thistle	<i>Minuartia stricta</i>	Teesdale sandwort
<i>Clinopodium menthifolium</i> (<i>Calamintha sylvatica</i>)	Wood calamint	<i>Najas flexilis</i>	Slender naiad
<i>Coincya (Phynchosinapis)</i> <i>wrightii</i>	Lundy cabbage	<i>N. marina</i>	Holly-leaved naiad
<i>Corrigiola litoralis</i>	Strapwort	<i>Ononis reclinata</i>	Small restharrow
<i>Cotoneaster integerrimus</i>	Wild cotoneaster	<i>Ophioglossum lusitanicum</i>	least adder's-tongue
<i>Crassula aquatica</i>	Pigmyweed	<i>Ophrys fuciflora</i>	Late spider orchid
<i>Crepis foetida</i>	Stinking hawk's-beard	<i>O. sphegodes</i>	Early spider orchid
<i>Cynoglossum germanicum</i>	Green hound's-tongue	<i>Orchis militaris</i>	Military orchid
<i>Cyperus fuscus</i>	Brown galingale	<i>O. simia</i>	Monkey orchid
<i>Cypripedium calceolus</i>	Lady's-slipper	<i>Orobanche artemisiae-</i> <i>campestris(loricata)</i>	Oxtongue broomrape
<i>Cystopteris dickieana</i>	Dickie's bladder fern	<i>O. caryophyllacea</i>	Bedstraw broomrape
<i>Dactylorhiza lapponica</i>	Lapland marsh orchid	<i>O. reticulata</i>	Thistle broomrape
<i>Damasonium alisma</i>	Starfruit	<i>Petroraghia nanteuillii</i>	Childing pink
<i>Dianthus gratianopolitanus</i>	Cheddar pink	<i>Phyllodoce caerulea</i>	Blue heath
<i>Diapensia lapponica</i>	Diapensia	<i>Phyteuma spicatum</i>	Spiked rampion
<i>Epipactis youngiana</i>	Young's helleborine	<i>Polygonatum verticillatum</i>	Whorled Solomon's seal
<i>Epipogium aphyllum</i>	Ghost orchid	<i>Polygonum maritimum</i>	Sea knotgrass
<i>Equisetum ramosissimum</i>	Branched horsetail	<i>Potentilla rupestris</i>	Rock cinquefoil
<i>Erigeron borealis</i>	Alpine fleabane	<i>Pulicaria vulgaris</i>	Small fleabane
<i>Eriophorum gracile</i>	Slender cottongrass	<i>Pyrus cordata</i>	Plymouth pear
<i>Eryngium campestre</i>	Field eryngo	<i>Ranunculus</i>	
<i>Filago lutescens</i>	Red-tipped cudweed	<i>ophioglossifolius</i>	Adder's-tongue spearwort
<i>F. pyramidata</i>	Borad-leaved cudweed	<i>Rhinanthus serotinus</i>	Greater yellow-rattle
<i>Fumaria reuteri (martinii)</i>	Martin's ramping-fumitory	<i>Romulea columnae</i>	Sand crocus
<i>Gagea bohemica</i>	Early star of Bethlehem	<i>Rumex rupestris</i>	Shore dock
<i>Gentiana nivalis</i>	Alpine gentian	<i>Salvia pratensis</i>	Meadow clary
<i>Gentiana verna</i>	Spring gentian	<i>Saxifraga cernua</i>	Drooping saxifrage
<i>Gentianella anglica</i>	Early gentian	<i>S. cespitosa</i>	Tufted saxifrage
<i>G. ciliata</i>	Fringed gentian	<i>S. hirculus</i>	Yellow marsh-saxifrage
<i>G. uliginosa</i>	Dune gentian	<i>Scirpus triquetus (triquetrus)</i>	Triangular club-rush
<i>Gladiolus illyricus</i>	Wild gladiolus	<i>Scleranthus perennis</i>	Perennial knawel
<i>Gnaphalium luteoalbum</i>	Jersey cudweed	<i>Scorzonera humilis</i>	Viper's-grass
<i>Hieracium attenuatifolium</i>	Weak-leaved hawkweed	<i>Selinum carvifolia</i>	Cambridge milk-parsley
<i>H. northroense</i>	Northroe hawkweed	<i>Senecio paludosus</i>	Fen ragwort
<i>H. zetlandicum</i>	Shetland hawkweed	<i>Stachys alpina</i>	Limestone woundwort
<i>Himantoglossum hircinum</i>	Lizard orchid	<i>S. germanica</i>	Downy woundwort
<i>Homogyne alpina</i>	Purple colt's-foot	<i>Teucrium botrys</i>	Cut-leaved germander
<i>Lactuca saligna</i>	Least lettuce	<i>T. scordium</i>	Water germander
<i>Limosella australis</i>	Welsh mudwort	<i>Thlaspi perfoliatum</i>	Perfoliate penny-cress
<i>Liparis loeselii</i>	Fen orchid	<i>Trichomanes speciosum</i>	Killarney fern
<i>Lloydia serotina</i>	Snowdon lily	<i>Veronica spicata</i>	Spiked speedwell
<i>Luronium natans</i>	Floating water-plantain	<i>V. triphyllos</i>	Fingered speedwell
<i>Lychnis alpina</i>	Alpine catchfly	<i>Viola persicifolia</i>	Fen violet
<i>Lythrum hyssopifolia</i>	Grass-poly	<i>Woodsia alpina</i>	Alpine woodsia
		<i>W. ilvensis</i>	Oblong woodsia

Appendix 4. Plants included in Schedule
8 of the Wildlife (Northern Ireland)
Order, 1985

Part I. Plants with full protection

Vascular plants

<i>Adoxa moschatellina</i>	Moschatel
<i>Ajuga pyramidalis</i>	Pyramidal bugle
<i>Andromeda polifolia</i>	Bog-rosemary
<i>Calamagrostis stricta</i>	Narrow small-reed
<i>Carex magellanica</i>	Tall bog-sedge
<i>C. pauciflora</i>	Few-flowered sedge
<i>Centaureum littorale</i>	Seaside centaury
<i>Cirsium helenioides</i>	Melancholy thistle
<i>Dactylorhiza (Dactylorhiza) traunsteineri</i>	Narrow-leaved marsh-orchid
<i>Dryas octopetala</i>	Mountain avens
<i>Elatine hypodipiper</i>	Eight-stamened waterwort
<i>Eleocharis parvula</i>	Dwart spike-rush
<i>Epipactis palustris</i>	Marsh helleborine
<i>E. phyllanthus</i>	Green-flowered helleborine
<i>Erica vagans</i>	Cornish heath
<i>Erigeron acer</i>	Blue fleabane
<i>Frangula alnus</i>	Alder buckthorn
<i>Geranium sylvaticum</i>	Wood crane's-bill
<i>Gymnocarpium dryopteris</i>	Oakfern
<i>Hammarbya palubosa</i>	Bog orchid
<i>Hierochloa odorata</i>	Holy-grass
<i>Hordelymus europaeus</i>	Wood barley
<i>Hottonia palustris</i>	Water-violet
<i>Hypochaeris glabra</i>	Smooth cat's-ear
<i>Lathyrus palustris</i>	Marsh pea
<i>Limonium binervosum</i>	Rock sea-lavender
<i>Limosella aquatica</i>	Mudwort
<i>Lycopodiella inundata</i> (<i>Lycopodium inundatum</i>)	Marsh clubmoss
<i>Melampyrum sylvaticum</i>	Small cow-wheat
<i>Mentha pulegium</i>	Pennyroyal
<i>Mertensia maritima</i>	Oysterplant
<i>Monotropa hypopitys</i>	Yellow bird's-nest
<i>Neottia nidus-avis</i>	Bird's-nest orchid
<i>Ophrys apifera</i>	Bee orchid
<i>Orchis morio</i>	Green-winged orchid
<i>Orobancha hederacé</i>	Ivy broomrape

<i>Pilularia globulifera</i>	Pillwort
<i>Polystichum lonchitis</i>	Holly fern
<i>Primula veris</i>	Cowslip
<i>Pseudorchis albida</i>	Small-white orchid
<i>Orthilis (Ramischia) secunda</i>	Serrated wintergreen
<i>Ranunculus fluitans</i>	River water-crowfoot
<i>Rubus chamaemorus</i>	Cloudberry
<i>Saussurea alpina</i>	Alpine saw-wort
<i>Saxifraga aizoides</i>	Yellow saxifrage
<i>S. hirculus</i>	Yellow marsh-saxifrage
<i>S. oppositifolia</i>	Purple saxifrage
<i>Silene acaulis</i>	Moss campion
<i>Sisyrinchium bermudiana</i>	Blue-eyed grass
<i>Spiranthes romanzoffiana</i>	Irish lady's-tresses
<i>Stachys officinalis</i>	Betony
<i>Teesdalia nudicaulis</i>	Shepherd's cress
<i>Trichomanes speciosum</i>	Killarney fern
<i>Trollius europaeus</i>	Globe flower
<i>Viola persicifolia</i>	Fen violet

Part II. Plants with protection against sale

<i>Primula vulgaris</i>	Primrose
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Appendix 5. International obligations for the protection of UK plant species

EC Habitats & Species Directive-*Conservation of natural habitats and of wild fauna and flora (92/43/EEC)*

- Annex II b designation of protected areas for plant species (!=priority species)
 Annex IVb special protection necessary for plant species
 Annex V b exploitation of plant species to be subject to management if necessary

Bern Convention-*Convention on the conservation of European wildlife and natural habitats*

- Appendix I special protection for plant species

CITES-*Convention on international trade in endangered species*

- Appendix I trade permitted only in exceptional circumstances
 Appendix II trade subject to licensing
 Regulation (EEC) No. 3626/82, which applies CITES in the European Community, treats all species of orchids as if they were listed on Appendix I (category C1). Only native species are listed here although CITES regulations also apply to many other species.

Wildlife and Countryside Act, 1981 and Wildlife (Northern Ireland) Order, 1985

- Schedule 8 special protection for wild plants.

Species	EC Habitats & Species Directive	Bern Convention	CITES	Wildlife & Countryside Act(GB), Wildlife(NI) Order
	Annex	Appendix	Appendix	Schedule
Non-vascular plants				
<i>Lithothamnium corallioides</i> (maerl)	Vb	—	—	— *
<i>Phymatolithon calcareum</i> (maerl)	Vb	—	—	—
<i>Marsipella profunda</i> (liverwort)	I IIVb	I	—	8 GB*
<i>Petalophyllum ralfsii</i> (liverwort)	IIb	I	—	8 GB
<i>Buxbaumia viridis</i> (moss)	IIb	I	—	8 GB*
<i>Drepanocladus vernicosus</i> (moss)	IIb	I	—	8 GB
<i>Leucobryum glaucum</i> (moss)	Vb	—	—	—
<i>Sphagnum</i> -all species (bog mosses)	Vb	—	—	8 GB <i>S. balticum</i> only
<i>Cladonia</i> subgenus <i>Cladina</i> -all species (lichen)	Vb	—	—	

Species	EC Habitats & Species Directive	Bern Convention	CITES	Wildlife & Countryside Act(GB), Wildlife(NI) Order
	Annex	Appendix	Appendix	Schedule
Vascular plants				
<i>Lycopodium</i> -all species (clubmosses)	Vb	-	-	-
<i>Trichomanes speciosum</i> (Killarney fern)	IIb,IVb	I	-	8 GB, NI
<i>Apium repens</i> (creeping marshwort)	IIb,IVb	I	-	8 GB*
<i>Cypripedium calceolus</i> (lady's-slipper)	IIb,IVb	I	II (CI)	8 GB*
<i>Galanthus nivalis</i> (snowdrop) (possibly native in a few places in Wales and W. England)	Vb (if native)	-	II	- *
<i>Gentianella anglica</i> (early gentian)	IIb,IVb	I	-	8 GB*
<i>Liparis loeselii</i> (fen orchid)	IIb,IVb	I	II (CI)	8 GB*
<i>Luronium natans</i> (floating water-plantain)	IIb,IVb	I	-	8 GB*
<i>Najas flexilis</i> (slender naiad)	IIb,IVb	I	-	8 GB*
Orchidaceae (all orchids)	**	-	II (CI)	8 11 species GS 9 species NI
<i>Rumex rupestris</i> (shore dock)	IIb,IVb	I	-	8 GB*
<i>Ruscus aculeatus</i> (butcher's broom)	Vb	-	-	- *
<i>Saxifraga hirculus</i> (yellow marsh-saxifrage)	IIb,IVb	I	-	8 GB, NI
Extinct				
<i>Bromus interruptus</i> (interrupted brome grass)	-	I	-	
<i>Spiranthes aestivalis</i> - (summer lady's tresses)	IVb	I	II (CI)	

* Species absent from or not native to Northern Ireland.

** Orchid-rich, dry, calcareous grasslands are listed on EC Directive Annex I as a priority habitat.

Appendix 6. Plants native to the UK and considered by the World Conservation Monitoring Centre to be threatened at world level

	International status	UK status
Bryophytes		
<i>Brachythecium appleyardiae</i>	Rare	Rare
<i>Bryoerythrophyllum caledonicum</i>	Rare	Rare
<i>Bryum lawersianum</i>	Extinct	Extinct
<i>Cephaloziella nicholsonii</i>	Rare	Rare
<i>Ditrichum cornubicum</i>	Endangered	Endangered
<i>Lejeuned mandonii</i>	Rare	Vulnerable
<i>Pohlia scotica</i>	Rare	Rare
<i>Thamnobryum angustifolium</i>	Endangered	Endangered
<i>T. cataractarum</i>	Vulnerable	Vulnerable
<i>Tortella limosella</i>	Extinct	Extinct
<i>Weissia mittenii</i> ?	Extinct	Extinct
Lichens		
<i>Collema dichotomum</i>	Vulnerable	Vulnerable
<i>Schismatomma graphidioides</i>	Rare	Rare
Fungi		
<i>Boletus satanas</i>	Rare	Rare
<i>Poronia punctata</i>	Indeterminate	Endangered
<i>Tulostoma niveum</i>	Vulnerable	Vulnerable
Vascular plants		
<i>Artemisia norvegica</i>	Rare	Rare
<i>Bromus interruptus</i> ?	Extinct	Extinct
<i>Calamagrostis scotica</i> ?	Vulnerable	Vulnerable
<i>Centaurium latifolium</i> ?	Extinct	Extinct
<i>Cerastium nigrescens</i> ?	Rare	Rare
<i>Cochlearia micacea</i> ?	Rare	Rare
<i>Coincya wrightii</i>	Rare	Rare
<i>Euphrasia cambrica</i>	Rare	Rare
<i>E. campbelliae</i>	Rare	Rare
<i>E. heslop-harrisonii</i> ?	Rare	Rare
<i>E. rivularis</i> ?	Rare	Rare
<i>E. rotundifolia</i>	Rare	Rare
<i>E. vigursii</i> ?	Rare	Rare
<i>Fumaria occidentalis</i>	Rare	Rare
<i>Limonium recurvum</i> ?	Endangered	Endangered
<i>Rumex rupestris</i>	Vulnerable	Vulnerable
<i>Sagina boydii</i> ?	Extinct	Extinct
<i>Senecio cambrensis</i>	Rare	Rare
<i>Trichomanes speciosum</i>	Rare	Endangered

Source for international status: World Conservation Monitoring Centre Threatened Plants Unit listing, August 1994.

?=debate exists over taxonomic status

Appendix 7. Plant species included in Schedule 9 (Part II) of the Wildlife and Countryside Act, 1981 and Schedule 9 (Part II) of the Wildlife (Northern Ireland) Order, 1985

A. Wildlife and Countryside Act Schedule 9

<i>Asparagopsis armata</i>	hooked asparagus seaweed
<i>Codium fragile tomentosoides</i>	green seafringers
<i>Fallopia japonica (Polygonum cuspidatum)</i>	Japanese knotweed
<i>Heracleum mantegazzianum</i>	giant hogweed
<i>Laminaria japonica</i>	Japanese kelp
<i>Macrocystis angustifolia</i>)
<i>M. integrifolia</i>) giant kelps
<i>M. laevis</i>)
<i>M. pyrifera</i>)
<i>Pilea californica</i>	red Californian seaweed
<i>Porphyra</i> spp. except	laver seaweeds
<i>P. amethystea</i>	(except native species)
<i>P. leucosticta</i>	
<i>P. linearis</i>	
<i>P. miniata</i>	
<i>P. purpurea</i>	
<i>P. umbilicalis</i>	
<i>Sargassum muticum</i>	Japanese seaweed
<i>Undaria pinnatifida</i>	wakame

B. Wildlife (Northern Ireland) Order Schedule 9

<i>Acaena</i> (all species)	pirri-pirri bur
<i>Fallopia (Reynoutria) japonica</i>	Japanese knotweed
<i>F. (Reynoutria) sachalinensis</i>	knotweed
<i>Heracleum mantegazzianum</i>	giant hogweed
<i>Macrocystis pyrifera</i>	giant kelp
<i>Sargassum muticum</i>	Japanese seaweed
<i>Spartina</i> (all species)	cord-grass

These schedules list species of plants which may not be planted or otherwise caused to grow in the wild without a licence.

Appendix 8. The contribution made by the objectives in this strategy to important activities of the conservation agencies

General activities and key initiatives

Plant strategy objectives

	Environmental audit	Advice to Government	Data sharing	Site protection	Wider environment enhancement	Species recovery programmes	Community and volunteer involvement	Contribution to international conservation	Contribution to UK action for biodiversity
Survey monitoring	++	++	-	++	++	++	++	+	++
Computerised databases	++	++	++	++	+	+	+	+	++
Research	+	+	-	++	++	++	+	+	++
Dissemination of information	+	+	+	-	+	+	++	+	++
Site-based measures	-	+	-	++	-	+	+	++	++
Species recovery	-	-	-	-	-	++	++	+	++
Wider environment	+	++	-	+	++	-	++	++	++
Legislative measures	-	++	-	++	++	+	-	++	++
Local involvement	+	-	+	++	+	++	++	+	++
International perspectives	-	++	+	++	++	-	-	++	++

++=highly relevant +=moderately relevant -=little or no relevance

Addendum A. The Conservation (Natural Habitats, etc) Regulations, 1994

This Statutory Instrument (no. 2716) came into force on 30 October 1994, in response to the EC Habitats and Species Directive. Two of the Regulations concern special protection for plant species.

Regulation 42

The species of plant listed in Annex IV(b) to the Habitats Directive whose natural range includes any area in Great Britain are listed in Schedule 4 to these Regulations.

Schedule 4 European protected species of plants

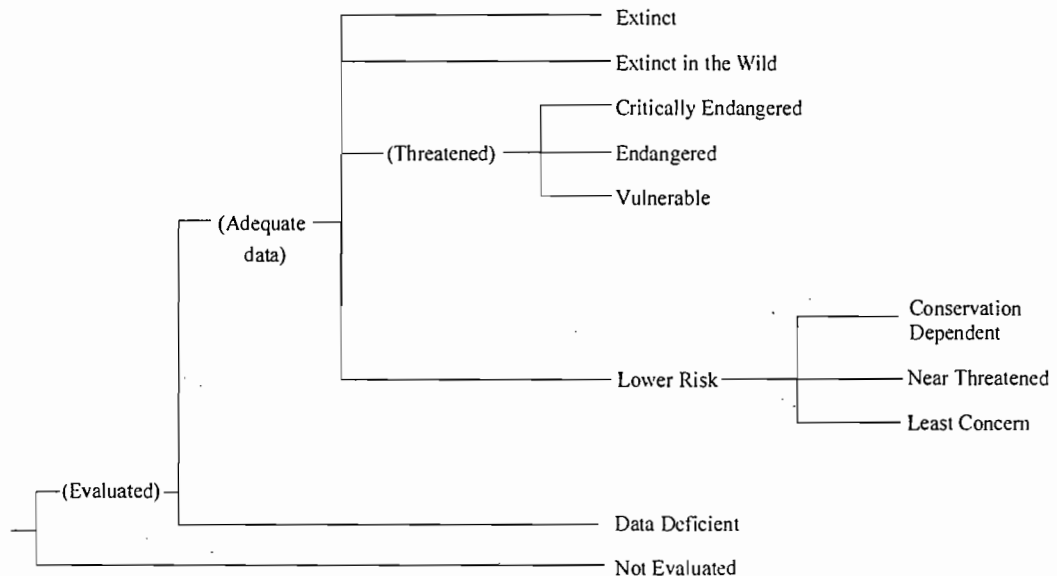
Common name	Scientific name
Dock, shore	<i>Rumex rupestris</i>
Fern, Killarney	<i>Trichomanes speciosum</i>
Gentian, early	<i>Gentianella anglica</i>
Marshwort, creeping	<i>Apium repens</i>
Naiad, slender	<i>Najas flexilis</i>
Orchid, fen	<i>Liparis loeselii</i>
Plantain, floating-leaved water	<i>Luronium natans</i>
Saxifrage, yellow marsh	<i>Saxifraga hirculus</i>

Regulation 43

- (1) It is an offence deliberately to pick, collect, cut, uproot or destroy a wild plant of a European protected species.
- (2) It is an offence to keep, transport, sell or exchange, or offer for sale or exchange, any live or dead wild plant of a European protected species, or any part of, or anything derived from, such a plant.
- (3) Paragraphs(1)and (2) apply to all stages of the biological cycle of the plants.

Addendum B. Revised National Red Data List for plants

The IUCN published revised global Red List categories in 1994*. The structure of the new categories is as follows:



The five criteria which are used to allot species to the Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) categories indicate the level of risk of extinction in the wild. These criteria are quantitative and indicate:

- A- population reduction
- B- limited extent of occurrence or area of occupancy in combination with fragmentation, decline or fluctuation
- C- low numbers in combination with decline
- D- very small or restricted population
- E- analysis of the probability of extinction within a specified time

Application of these criteria at a Great Britain level produces a provisional new Red Data List (CR, EN and VU categories) of about 190 vascular plants, 120 bryophytes, 150 lichens, 10 stoneworts and 130 non-lichenised ascomycete and basidiomycete fungi.

* The World Conservation Union. 1994. *IUCN Red List Categories. Prepared by the IUCN Species Survival Commission. As approved by the 40th meeting of the IUCN Council, Gland, Switzerland.* IUCN.

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