

Session 2

Communication Among Weeds Specialists

A FEASIBILITY STUDY INTO THE CREATION OF A DATABASE ON WEEDS AND INVASIVE PLANT SPECIES.

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ABSTRACT

At present, data on all categories of weeds and invasive plant species is fragmented around the globe. There is no single institution, or collective organisation, that acts as a repository for information generated by scientific research in this field. Therefore a feasibility study was set up to identify the sites that are currently storing the relevant data, and review the possibility of creating a database for weeds and invasive plant species worldwide. Data on all categories of *weeds* was collated, and a broad consensus of opinion on database creation was achieved. The majority of those consulted stressed the need for improved coordination of current research and greater availability of research data. A priority objective was identified: to set up a network of the existing databases, thus facilitating greater communication within the *weeds* research community.

INTRODUCTION

There is insufficient knowledge of the current status of weeds and invasive plant species internationally and no accessible database storing information on all the relevant plant species worldwide. The research reported here set out to review the possibility of creating a database that could be used by anyone who needed to extract relevant plant data. Such a database could provide baseline data, against which changes in the distribution and importance of invasive plants and weeds, due to human intervention or climate change, could be measured. The stated objectives of the project at its outset were to:

- A. Evaluate existing knowledge of weed databases.
- B. Recommend a format and structure for a database of tropical and subtropical weeds and species with potential to be invasive.
- C. Produce a prototype database containing information on at least two invasive species.
- D. Recommend channels of dissemination to allow widespread use of the database.

Throughout this study the definitions of "weeds" and "invasive plant species" were constantly being assessed in the context of this research. Some researchers (particularly ecologists) may include all "exotic" or "alien" plants within the "invasive" bracket, though in practice the majority of local plant scientists are not able to research all of the species that this group would include.

The term "weeds" is generally better defined; although only more recently has it been associated with invasive plants. There are no obvious, clear rules to guide the classification of these plants; especially as a plant species may be invasive in one environment and yet endangered in its indigenous habitat, or alternatively a plant might still be invasive within its indigenous habitat. Likewise, one person's weed may be another's rare flowering plant, or perhaps even provide the habitat for a biological control agent. There are many permutations.

Consequently, this paper does not attempt to define either invasive plants, or weeds, but as the invasive plant species are clearly a sub-set of weeds, and in many parts of the world, notably Australia, the term "weeds" is now used for both agricultural and environmental invaders, then this generalised use of *weeds* is used here. In this paper, the term *weeds* (in italics) refers to both agricultural and environmental weeds, i.e. any type of invasive plant.

ACTIVITIES

Whilst a comprehensive literature search was carried out, extensive consultation of all researchers and organisations worldwide that have an interest in *weeds* was undertaken. Relevant sources of botanical data were researched and opinions on database construction were sought from weed scientists and those with database expertise.

Simultaneous to the literature search and researcher consultation, an investigation was made into the possibility of recovering the data from the book "A Geographical Atlas of the Worlds Weeds" (Holm *et al.*, 1979) which had been stored on magnetic tape. This work was carried out at the Oxford Forestry Institute (OFI). The data from the book was transferred to a database format and then manipulated into tables, which enabled further work to be carried out on the stored data.

In addition, an "on-line" list server group *Weeds of the World* was set up at the OFI, to allow interested researchers to discuss their findings or queries on specific plant species.

DATABASES AND COMMUNICATION GROUPS

During the course of the research contact was made with a wide range of institutions and individuals with relevant databases or communication groups on weeds and invasive plants. These are listed below. This group is not definitive, but possibly constitutes the majority of key players in this field of research. Where information has been obtained successfully a brief description is given, together with an appropriate contact person.

Weed databases

There are a number of key weed databases worldwide; some operated on a commercial basis. Some of the better known databases are listed below:

1. *HYPP (HYpermedia pour la Protection des Plantes)* - western Europe
HYPP is a plant protection encyclopedia for cultivated plants, to be used by farmers, students, research workers, development teams, technical staff and industry. It is distributed in CD-Rom

form. *Contact:* Mr Peter Lutman, IACR Rothamstead, Harpenden, Hertfordshire, AL5 2JQ, UK. Tel: +44-1582-763133

2. FAO Weed Databases

Weeds of Asia. Contains 750 weeds, each on a separate page, compiled using the Macintosh Hypercard program. At present this database is still an unedited draft form; as further weed lists need to be incorporated. *Contact:* Dr Bruce Auld, Agricultural Research and Veterinary Centre, Forest Road, Orange, New South Wales 2800, Australia. Fax: +61-63913899

Weeds of the Pacific. A list of weeds in the Pacific, in a similar format to the *Weeds of Asia.* *Contact:* Dr Semisi Pone, Plant Protection Adviser, South Pacific Commission, Private Bag, Suva, Fiji. Fax: +679-370-021

Weeds of the Near East and North America. *Contact:* Mr Petros Amerikanos, (address unknown), Cyprus. E-mail: ari@athena.cc.ucy.ac.cy

Weeds of economically important crops. *Contact:* Dr Ricardo Labrada, Weed Officer, AGPP, FAO, Rome, Italy. E-mail: Ricardo.Labrada@fao.org

3. *Malherb.* Identification and control of agricultural weeds of France, distributed in CD-Rom form. *Contact:* Mr Jean-Pierre Longchamp, Institut National de la Recherche Agronomique, Laboratoire de Malherbologie, BV 1540, F-21034 Dijon cedex, France. Tel: +33-80-63-31-87 Fax: +33-80-63-32-62 E-mail: lonchamp@epoisses.inra.fr

4. Computer software for weed identification.

WEEDS (*Weeds Expert Educational Diagnostic System*). Over 900 weed species.

SOWEEDS (*SOuthern Weeds Expert Educational Diagnostic System*). Over 900 weed species.

NCWEEDS (*North Central Weeds Expert Educational Diagnostic System*). Over 780 species.

NEWEEDS (*North Eastern Weeds Expert Educational Diagnostic System*). Over 780 species.

Contact: Weed Diagnostic Lab., PSES Department, University of Idaho, Moscow ID 83844-2339, USA. Tel: +1-208-885-7831 Fax: +1-208-885-7760

5. *North American Weeds.* This database contains over 1,300 North American agricultural weeds listed in the seventeen most commonly used weed books for N. America. It is constructed in the XID Authoring System produced by Dr Old's company, XID Services. Designed for weed identification and contains distribution maps. *Contact:* Dr Richard Old, On-Site Analysis, PO Box 272, Pullman, Washington 99163. Tel & Fax: +1-509-332-2989

Flora databases

1. *Rare and Endangered Plant Species.* This database uses *BG-Base* computer software (see section on other relevant databases) and has now incorporated other flora databases of islands and timber plants and it has been renamed *Plants of Conservation*. The entry of 83,000 plant species in this database are currently being completed, and of these over 40,000 plants are listed as endangered. *Contact:* Dr Harriet Gillett, Species Officer (Plants), World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, UK. Tel: +44-1223-277314 Fax: +44-1223-277136 E-mail: harriet.gillett@wcmc.org.uk

2. *BG Recorder* and *BG Data.* The computer software *BG Recorder* is a plant records database management system for botanic gardens. It was begun in 1987 for conservation interests and used by the *Botanic Gardens Conservation International* (BGCI) as part of their system for monitoring

living plant collections in botanic gardens worldwide. *BG Recorder* provides a standard list of 728 plant families, and another country list; in which to record genus (attached to family) all plant names, accessions and also the plants file (storing plant data). Synonyms are recorded in a text field, and plants can be grouped horticulturally. An ITF (International Transfer Format) is provided with the original BG Recorder software and contains 33 data fields. This information is then entered into a larger database, *BG Data*, at BGCI. *Contact*: Mrs Diane Wyse-Jackson, Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond Surrey, TW9 3BW, UK. Tel: +44-181-332-3593/4/5 Fax: +44-181-332-5956

3. *ECOFLOA*. This is an ecological flora database of the British Isles. The stored data consists of over 1,770 species of higher plants that occur in the British Isles, together with the bibliography of sources. Information includes species (family, genus, specific name, authority and vernacular name), together with synonymy, over 130 ecological characteristics, distribution in Britain (by vice-county), distribution in Europe (by country), mycorrhizal associations and fungal diseases. The database is available through the *Bath Information and Data Services* (BIDS) and a license has to be taken out with BIDS to obtain entry (BIDS, Bath University, Claverton Down, Bath, BA2 7AY, Avon, UK. Tel: +44-1225-826267). *Contact*: Prof Alistair Fitter, Department of Biology, University of York, York, YO1 5DD, UK. Tel: +44-1904-432837
E-mail: ahfl@unix.york.ac.uk

4. *Plants of Southern Africa* (PRECIS - Pretoria Computer Information System). This system is a flora database compiled from information stored within the PRECIS Flora Project. The database is menu driven and comprises five tables that house: 347 family names; 3358 genus names; 24731 names in current use; 13882 synonyms; 863 naturalised taxa; 5964 literature references; 1056 national tree numbers; provincial and national distributions. At present the database is being expanded to include: life forms; life cycle; plant height, altitude; habitat; flower colour; diagnostic characters. The database was developed using *Data Ease* and is distributed using a run-time model, *Version 4.53*. *Contact*: Mr Trevor Arnold, PRECIS, National Botanic Institute, Postbag X101, Pretoria 0001, South Africa. Tel: +27-12-8043200 Fax: +27-12-8043211

5. *Naturalised Plants of New Zealand*. A database of the *Flora of New Zealand* (25,000 spp approximately), containing 2,300 spp native plants, 20,000 spp cultivated plants and 2,200 spp adventive plants, has recently been created from local floras. It is based at Landcare, Christchurch and uses the computer software *Paradox*. Fields from the *ECOFLOA* database have been established in this database, and it is hoped that it will be expanded, if further funds are obtained. *Contact*: Dr Peter Williams, Manaaki Whenua Landcare Research, Private Bag 6, Nelson, New Zealand. Tel: +64-(3)-548-1082 Fax: +64-(3)-546-8590 E-mail: williamsp@landcare.ac.nz

6. *Botanisch basisregister*. A Flora database of the Netherlands. *Contact*: Dr Walter Berendsjohn, RDP and Documentation, CDEFD Project, Botanischer und Botanisches Museum Berlin-Dahlem, Konigin-Luisse-Strasse 6-8, D-14191 Berlin, Germany.
Fax: +49-3083300-6186/6218 E-mail: wgb@fub46.zedat.fu-berlin.de

7. *Plants of the Fynbos*. This is a relatively simple database using *dbase IV*, but is being transferred to Access 2.0. The database searches are made by plant characteristics, e.g. seed storage. *Contact*: Drs David le Maitre & Brian van Wilgen, Jonkershoek Forestry Research Centre, Private Bag X5011, Stellenbosch 7599, South Africa. Tel: +27-21-883-9771
Fax: +27-21-883-83-8394 E-mail: bvwilgen@forjnk.csir.co.za

8. *Rock Creek National Park*. A small database detailing the biology and control of plants within Rock Creek Park. The database will soon be available on-line, in a "read only" file, though additions may be made from external sources through the main database. *Contact*: Dr Eden Crane, 5000 Glover Road, NW Washington, DC 20015, USA. Tel: +1-202-426-6834
E-mail: eden_crane@nps.gov

9. Databases of Missouri Botanical Gardens (USA).

TROPICOS. Within the *TROPICOS* database data is stored under the categories of Ferns, Gymnosperms, Angiosperms (Monocots and Dicots), Bibliography and Literature abbreviations. Details of *TROPICOS* and other databases at Missouri (*Flora of North America*, *Flora of China*, *West Central Africa Dataset*) can be accessed through the following URL:-

<http://straylight.tamu.edu/MoBot/database.html>

Alternatively, *Contact*: Dr Alan Tucker, Missouri Botanical Gardens, PO Box 299, Saint Louis, Missouri 63166-0299, USA. Tel: +1-314-577-5169 Fax: +1-314-577-9596

E-mail: tucker@mobot.org

10. *Flora Europea*. *Contact*: Royal Botanic Garden, Inverleith Row, Edinburgh, EH3 5LR, Scotland, UK. Tel: +44-131-5520382

11. *Plant Species of North America*. As part of the Biota of North America Project, distributional and nomenclatural data has been put together for all the plant species in North America. *Contact*: Dr John Kartesz, Department of Biology, CB3280 Coker Hall, University of North Carolina, Chapel Hill, North Carolina 27599, USA. Tel: +1-919-962-0578 Fax: +1-919-962-1625

Invasive Species databases

1. *SAPIA - Southern Africa Plant Invaders Atlas*. The concept of the Southern Africa Plant Invaders Atlas (SAPIA) was derived from two other atlas's, one on birds and one on species of *Proteaceae*. The project is one year into its five year duration and so far the majority of time has been given to devising atlas data sheets and guidebooks for voluntary groups submitting the data. SAPIA is designed to be usable by a wide range of people including Botanists, Conservationists, National Parks Officers, Foresters, "Hackers", Railways and other industries and organisations. However, the data will only be recorded to an accuracy of 15 minutes (0.25 degree) grid squares. At present the Department of Agriculture use audit sheets to monitor farm production and these sheets include a section on alien/invasive plant species. The data collected will act as a baseline survey and be stored in the database *Data-ease*. It is hoped that this exercise will be repeated at a later date to monitor change in plant invasions. The information collected for this atlas will ultimately be linked in with the PRECIS (Pretoria Computer Information Service) database of the flora of South Africa. *Contact*: Dr Lesley Henderson, National Botanic Institute, Postbag X101, Pretoria 0001, South Africa. Tel: +27-12-8043200 Fax: +27-12-8043211

2. *Invasive Woody Species*. A database of known invasive woody species worldwide, incorporating data fields within plant biology, life forms, habitat, and literature records. *Contact*: Dr Pierre Binggeli, 6 Strandmore, Portrush, BT56 8AH, N. Ireland, UK. Tel: +44-1265-823842

3. *Bushweed 2: Database of Environmental Weeds of Australia*. This database was compiled by Swarbrick and Skarrett (1994) over a 5 year period and funded by Gatton College (now part of the University of Queensland). *First Choice* database was used to record data. The end-users of

the database were designed to be the National Parks or bush managers. *Contact:* Dr John Swarbrick, 15 Katoomba Crescent, Toowoomba, Queensland 4350, Australia. Tel: +61-76-32-5859

4. *Hawaiian Alien Plants.* A rudimentary database of Hawaiian alien plants, is being created. This follows the interest being shown in invasive environmental weeds of natural areas in Hawaii, described by Smith (1992). There followed a national call in the United States to deal with invasive species and widespread databases to be developed. These will be distributed on CD-rom, and models predicting invasiveness will be created. At present many biological species have very little information on them so the database will also highlight the deficient areas, leading to the call for further research and further funding. *Contact:* Prof Clifford Smith, Department of Botany, University of Hawaii, 3190 Maileway, Honolulu, HI 96822, USA. Tel: +1-808-956-8218/3932 Fax: +1-808-956-3923 E-mail: cliff@uhccux.uhcc.hawaii.edu

5. *Weeds in New Zealand Protected Natural Areas.* Designed for environmental weeds management, this database is a compilation of forms by "experts" and of published data. It contains 67 species comprising three datasheets per species: Taxon, Impacts and Management, Chemical Control. *Contact:* Dr Susan Timmins, Department of Conservation, PO Box 10-420, 58 Tory Street, Wellington, New Zealand. Tel: +64-4-471-0726 Fax: +64-4-471-3279 E-mail: sard@nzonline.ac.nz

6. *Invaders - weed distribution database* (North West USA). The *Invaders* software is a computerised catalogue of plant names and an enhanced electronic atlas of weed distribution data. The software is designed for all "vegetation program managers" from weed researchers to Federal land managers. Developed as a shareware program (run time module) it contains three different programs: Mapping, plotting distributions; Data Entry, taxonomy; Interactive Paradox, query database. *Contact:* Dr Peter Rice, Division of Biological Sciences, University of Montana, Missoula, MT 59812-1002, USA. Tel: +1-406-243-2671 Fax: +1-406-243-4184

7. *Naturalised flora of Western Australia.* This database, created using *Paradox* (soon to be imported into Access 2.0), has 1,023 entries and is continually being up-dated taxonomically. Data fields include Natural name, Family, Common name, Distribution (world/Australia/W. Aus.), Notes, References and accession number. *Contact:* Dr Gillian Perry, WA Herbarium, Department of Conservation and Land Management, PO Box 104, Como, Western Australia 6152, Australia.

8. *WAHERB* and *WACENSUS.* *WAHERB* is a herbarium species database, and *WACENSUS* is a database with entries from *Census of Australian Vascular plants.* *Contact:* Mr Patrick Piggott, WA Herbarium, Science and Information Division, Department of Conservation and Land Management, PO Box 104, Como, Western Australia 6152, Australia. Tel: +67-9-3340495 E-mail: patrickp@ozemail.com.au

Other relevant databases

1. *BG-Base.* This database is designed for managing biological information in four categories - taxonomy, distribution, conservation and collections management (living and preserved). Initiated in 1985 at the request of the Arnold Arboretum of Harvard University (Boston, USA) and the World Conservation Monitoring Centre (WCMC, Cambridge, UK), it is used around the world in over 50 botanical, horticultural and zoological (adapted) research institutions. *BG-Base* consists

of several modules with extensive linkages between these modules. These modules manage information on living plant collections: herbarium and other museum specimens; gene banks; nomenclature; taxonomy; bibliography; images; gazetteers; distributions; floristic and faunistic surveys; protected areas; conservation status; institutional and individual contacts; and membership, education and development programs. *BG-Base* comprises some 3,500 data fields spread over 150 tables and was constructed using the relational database system *Advanced Revelation* to run under DOS on IBM compatibles. This database was built to meet the needs of all plant biologists who might possibly wish to record data and is therefore an extremely versatile database that could be adapted for use with any plant data. *Contact:* Dr Kerry Walter, Royal Botanic Gardens, Inverleith Row, Edinburgh, EH3 5LR, Scotland, UK.

Tel: +44-(0)131-552-7171 Fax: +44-131-5520382 E-mail: kwalter@rbge.org.uk

2. *International Legume Database and Information Service (ILDIS)*. A global database of over 18,000 species of legumes including many weeds. A phytochemical database is also linked to ILDIS. *Contact:* Prof Frank Bisby, Biodiversity and Bioinformatics Research Group, Department of Biology, University of Southampton, Southampton, SO16 7PX, UK. Tel: +44-1703-595000 Fax: +44-1703-592444 E-mail: F.A.Bisby@southampton.ac.uk

3. *SEPASAL - Survey of Economic Plants for Arid and Semi-arid Lands*. *Contact:* Dr Francis Cook, Centre for Economic Botany, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, UK. Tel: +44-181-940-1171 Fax: +44-181-332-5278 E-mail: F.Cook@rbg.org.uk

4. *Index Kewensis*. *Contact:* Dr M Lock, Royal Botanical Gardens, Kew, Richmond, Surrey, TW9 3AB, UK. E-mail: m.lock@rbgkew.org.uk

5. *National Agricultural Pest Information System (NAPIS) - USA*. *Contact:* USDA-APHIS, C/O Dr Randy Westbrook, USDA-APHIS Plant Protection and Quarantine, Whiteville Plant Methods Development Center, Highway 1002, Old Lumberton Road, PO Box 279, North Carolina 28472, USA. Tel: +1-910-648-4115 Fax: +1-910-648-4770 E-mail: a348stwhite@attmail.com

6. *ERIN (Environmental Resources Information Network) Databases (Australia)*. ERIN was established in 1989 by the Australian Government as a national facility with a goal to provide geographically-related environmental information. The ERIN databases store information on environmental issues ranging from endangered species to drought and pollution. This includes data on plant and animal species. *Contact:* Dr Matt Bolton, (address unknown) Australia. (ERIN can be viewed on-line at the URL: <http://kaos.erin.gov.au/erin.html>)

7. *Crop Protection Compendium*, CAB International. *Contact:* Dr Peter Scott, Head of Division, Crop Protection and Genetics, CAB International, Wallingford, Oxon OX10 8DE, UK. Tel: +44-1491-832111 Fax: +44-1491-833508

8. *Plant Databases, Biological Records Centre (Britain)*. *Contact:* Dr Paul Harding, Biological Records Centre, Institute of Terrestrial Ecology, Monks Wood, Huntingdon, Cambridgeshire, PE17 2LS, UK