*i*Plants:
THE WORLD'S PLANTS ONLINE

DESCRIBING THE DEMAND

APPENDIX 1

Final Report of Pilot Project: 1 April to 30 Nov 2004

Version 1.4

Author(s): Bob Allkin

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1. Introduction

1.1. The *iPlants* project

iPlants aims to produce an index of all the world's plant species together with, where possible, an image and a preliminary conservation assessment. This index will be made available online.

For further information please contact:

The *iPlants* Initiative,
c/o Alan Paton,
Royal Botanic Gardens Kew,
Richmond, Surrey, UK
TW9 3AB
information@iplants.org

1.2. Purpose of this document

This document aims to

1) summarise conclusions from the *iPlants* Document: "Use Scenarios"

2) present a few illustrative examples of the kinds of use to which an *iPlants* information service would be put

3) include any statistics available for these examples which demonstrate

a) the IMPACT that *iPlants* would have were it available.

b) the CURRENT COSTS of not having the *iPlants* system available

1.3. Outstanding Issues

The following issues are raised in this document and have yet to be addressed.

1. Need to include examples from all domains covered in the Use Scenarios doc.
2. Include DNA Bar-Coding text and example
3. Work in Progress on completing statistics / storyline for
    a. UNEP-WCMC
    b. CNIP
    c. ICRAF
4. Include full costs / stats for CITES

2. Is there a need?

People that are not involved directly with botany, including many scientists, often assume that there must already exist a list of the plants of the world. It seems so obvious that such an index should exist. This is particularly the case for those that grow up in temperate parts of the world such as Europe and North America with a long tradition of studying plants. A "rose" is a rose. Published field guides list all of the plants in Texas or France. People are surprised to learn that no such guides or even lists exist for most of the world, or that the published lists disagree with one another or that no one can say exactly how many plants there are.

Why haven't botanists done this before? What obstacles have there been? There are many factors, of course, of which we cite a few here:

a. the volume of the information involved,
b. the highly scattered nature of existing knowledge often being found in obscure local publications or in unpublished manuscripts from regional experts.
c. the complexity of the nomenclatural system with synonyms, homonyms and misapplied names complicating the interpretation of what is written.
d. the divergent views between specialists, both temporarily and geographically, which prevent botanists from giving a simple answer to a simple question
e. the absolute requirement for international collaboration both in order to access the plants and to be able to provide the necessary human resources

Conditions have changed, however, and it is now possible for *iPlants* to undertake this historic and momentous project because:

a. major institutions are committed to it and working together combining their significant resources – both human and archival
b. these institutions are gradually gaining the backing of the broader community
c. the internet provides a means by which such an index can be delivered easily and cheaply to millions of different classes of user around the world
d. technology now permits the necessary degree of integration (of data and process) to enable partners to share their existing resources.

While ordinary people may not realise that an index of the world's plants does not exist this is not true of those institutions and projects which provide information services for the pharmaceutical industry, for agroforestry, for health or conservation, to cite but a few. Such agencies are well aware that lack of an authoritative list of the world's plants containing all possible synonyms is a major obstacle to their providing reliable and comprehensive information about the use and conservation of plants.

iPlants has used the Pilot study to talk with the user community

1. to develop the business case (documenting the significance and extraordinary impact that provision of such a service would have in many walks of life) and
2. to get a more precise view of the particular demands for such a service that arise from a broad spectrum of users.

3. Defining the demand

For *iPlants* to fully meet its objectives it is necessary to develop a broad understanding and precise definition of the information needs of the target audience.

3.1. Knowing our target audience

One initiative has been to map and categorise the domains, sectors of society and broad activities upon which *iPlants* will impact - either directly or indirectly.

Beneficiaries include a broad range of industries, organisations and individuals. Within each sector there exist users with particular information demands or requirements. Our goal is to understand and document these requirements and ensure that our information services are designed accordingly.

3.2. Documenting "Use Scenarios"

iPlants has used the pilot study to document "Use Scenarios" for a few chosen key sectors (conservation, health and science) based upon existing literature and structured interviews with individuals in the chosen sectors. This approach is still under development and will be developed for other classes of user.

Our objectives are

a. to develop and record indicators of the significance and impact of having a central synonymised list of plants will have in each domain.
b. to document exactly how these users would employ such a list and their particular requirements for how it should be delivered.
c. to measure the current costs of NOT having such a list available
d. to find illustrative examples of where this list could have particular impact or of different ways in which it would be used.

This ongoing exercise has already informed the design of the Online Service, provided illuminating examples and generated statistics enabling us to better quantify the benefits and impact of implementing the *iPlants* System.

3.3. Support for new technologies

Modern technology offer many exciting possibilities for more direct and more flexible ways to access information about plants. DNA Bar-coding is one example. Ambitious programmes are currently being funded to explore the opportunities that this technology offers. One idea is that the precise structure of a short sequence of DNA sampled from within an organism can be sufficient to "identify" that plant from all others.

To be useful, however, the DNA barcode must be linked unambiguously and accurately to a plant name - this is the label by which the plant is known and the link to all available information about that plant including which other plants are most likely to be confused with it. The given name must also be linked to all of its synonyms, as it is this group of names which gives access to all of the information about that plant. *iPlants* will deliver such a list, complete and synonymised.

4. Direct use of the *iPlants* online information service

The following examples illustrate the potential benefits to diverse users of having access to the *iPlants* online information service.

4.1. Scenario 1) Conservation Practitioners

How should those engaged in conservation initiatives on the ground direct their efforts and focus available resources? Common starting points are a) to use a regional Red List to indicate either which species are under most threat or b) to prioritise threatened areas based upon rare species found there. Intervention programmes are then devised around these perceived priorities. But how reliable are the species lists that are used given that these are mostly constructed without access to an authoritative synonymised checklist of plants for the region?

Conservation professionals from 3 institutions in Botswana, in collaboration with staff from the Millennium Seed Bank (MSB – Royal Botanic Gardens, Kew) have been working (2002 – 2004) to design and implement a programme of conservation initiatives within Botswana. They are working to meet Target 8 of the Global Strategy for Plant Conservation and deliver a variety of outputs over the coming 4 years.

The IUCN (SABONET) Red List for Plants of Botswana was published in 2002. The published list contains 43 species either threatened or possibly so. It could be assumed that separate studies should be undertaken to design and implement appropriate intervention and conservation programmes for each of these 43 plants. Effort and resource would be divided among these taxa.

Careful evaluation of the published names, however, indicated a very different picture. 17 of the 43 names published in the Red List (40% of the total) had nomenclatural errors of one form or another.

Source of Error	No.	%
Errors in the spelling of the name	10	23
Synonym of threatened plant	1	2
Synonyms of non-threatened taxa	6	14
Total Errors	17	40

4.1.1. The impact

Spelling errors (23%) particularly inconvenience less experienced users effectively preventing them from finding published information about the plants.

More significant are those names included in the list which are not actually separate species at all but synonyms of other names (16%). In this example one name was a synonym of a threatened plant already in the list while six were synonyms of widespread and common plants. Thus the number of plants threatened in Botswana is significantly smaller than the IUCN list implies. Any conservation programmes based upon that list would have wasted 20% of the available resource and effort by focusing on plants inappropriately.

4.1.2. The cost of avoiding such errors

Not dealing with such errors is, therefore, clearly not an option for serious conservation initiatives. The potential negative impact is severe and far reaching. There are, however, costs associated with detecting and resolving such errors.

In the above example from Botswana, the conservationists involved were alert to the possible complications and decided to validate the published IUCN list before starting. They called upon the opinions of 20 different taxonomic specialists and had at their disposal the very significant library and collections available within Kew. Even with such support and resources at their disposal, staff spent 20 person-days to track down and resolve these nomenclatural issues. For conservation professionals working outside of a major botanical institution it would take far longer and many would probably go undetected. As the *iPlants* pilot was being carried out MSB staff detected a further error in the list, previously overlooked, indicating how difficult it can be to remain up-to-date and to detect all nomenclatural confusions within the literature.

4.1.3. The broader picture

Evidence from studies elsewhere indicates that the frequency of errors in the Botswana list is similar to those for other countries within Africa. Throughout Asia the situation is commonly worse while the figures for Latin America are variable - sometimes being better than this example would indicate but often being far worse.

In a recent study Kirschner and Kaplan (2002: "Taxonomic monographs in relation to global Red Lists" *Taxon* **51**, 155-158) provide a telling illustration of the pitfalls inherent in any attempt to assess the conservation status of taxa that are not well understood and circumscribed. Having completed taxonomic monographs of Juncaceae and Potamogetonaceae respectively, they prepared conservation status assessments of all the species recognised. They then compared their results with the listings for these families in the 1997 IUCN Red List of Threatened Plants. This is the most comprehensive compilation of plants assessed as threatened at global level, but the assessments are not included in the current IUCN Red List because they are based largely on in-country assessments of presumed endemics and on criteria that predate the new, more objective criteria adopted by the IUCN in 1994. Kirschner and Kaplan showed that a substantial proportion of the names Red Listed in 1997 are synonyms or taxonomically doubtful. More worryingly, even when nomenclatural changes and synonymy are taken into account, the accuracy of many of the assessments is highly questionable. For instance, only half of the Juncaceae names on the 1997 Red List refer to taxa now considered to be of conservation concern and a similar situation is seen in Potamogetonaceae: four of the nine Red Listed names are of widespread, not threatened, taxa.

The Millennium Seed Bank has found it necessary to place a member of staff working full-time within the Kew Herbarium exclusively to carry out research using the collections and administer interactions with the specialists consulted to solve nomenclatural problems that arise within their conservation programmes spread over 12 countries in Africa.

4.1.4. Conclusion

Lack of an authoritative synonymised index of the world's plants is therefore both a barrier to establishing effective conservation programmes throughout the world and a significant drain on resources.

4.2. Scenario 2) CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement signed by 166 National Governments. It aims to ensure that international trade in wild animals and plants does not threaten their survival. International, regional and national legislation and administrative mechanisms are in place to regulate trade and enforce the Convention.

Implementation of the Convention requires national CITES officials and enforcement agencies to have reliable and up-to-date information about plants that are covered by existing legislation (and of the alternative names that may be used in different pieces of legislation and elsewhere).

4.2.1. CITES Officers and Import Controls

Those that seek to import plants illegally will commonly use obscure synonyms or invent names in order to escape detection. Rarely will two spellings associated with a scientific name be identical.

CITES officials and enforcement agencies thus require a simple to use accessible reference source for ALL published plant names. When plant material is presented for import the officials would be able to confirm a) that the name exists and has not been invented, b) what are the synonyms of the name used by the importer and hence c) whether trade in a particular species is covered by CITES or other trade regulations.

Access to an image of a plant would further assist those implementing CITES at ports to verify that the material being imported in reality the plant species used on the import permits and other documentation.

Currently CITES officers are supported by UNEP-WCMC (see section below) which offers a list the names of plants that are found in legislation in published form (UNEP-WCMC, 2003) and as an on-line database.

Most plants are not covered by CITES and therefore are excluded from the WCMC list. Some names in that list are included only at generic level. Even for those plant species that are included the list of synonyms will be incomplete. The list, furthermore, is not entirely validated by systematic experts and, since it was created by putting together small lists created by diverse authors for different purposes and at different times, lacks coherence and a standard approach. These limitations great restrict the usefulness of the list to customs officers when tracking down a name presented to them by a plant trader.

4.2.2. The information needs of CITES scientific authorities

Implementation of CITES is supported by "Scientific Authorities" and "Management Authorities" established within signatory countries. These vary greatly in size and resource levels. Management Authorities issue CITES documents and Scientific Authorities provide the scientific advice on which the Management Authority decisions are based. All, however depend on a human network of specialists who answer questions about plants, names and identification.

The Conventions and Policy Section (CAPS) at the Royal Botanic Gardens, Kew is the UK Scientific Authority for CITES. CAPS supports the UK Government with scientific advice, researches plant trade data and produces a range of capacity building tools to be used by CITES authorities around the world.

Scientific authorities supporting customs in their respective countries need obviously also to check whether a name is OK or not and will probably be involved in the identification of plant material. They will also be required to make decisions about plants being traded for the first time. They will need to take decisions based on the best possible evidence. Decisions taken by one member state may then lead to import restrictions across other member states. This reinforces the need for coherence and a standardised approach.

Decisions will be based upon criteria such as whether the plant material is taken from the wild or propagated, whether trade in that plant is likely to cause problems and the conservation status of that plant in the wild. Additional information that would assist decision making includes:

- Maps and detailed global distributions of a plant species (which *iPlants* proposes supplying)
- Trade information (which *iPlants* could help by linking species to information sources)

4.2.3. Preparing Legislation

Preparation of sound unambiguous legislation requires proper use of each plant's modern accepted scientific name. There is no ready available recognised source for this and CITES authorities are currently involved in (repetitive) consultation of taxonomic specialists from around the world. A list such as *iPlants* is constructing would simply this enormously.

4.3. Scenario 3) The World Health Organisation

Technical staff in health services, the pharmaceutical industry or companies trading in, or developing, herbal and natural products seek information about particular plants identified as being of potential importance. How do they know that they are using the right name? How can they be certain to find all of the information published about that plant? An authoritative and synonymised index of the world's plants would enable them to answer these questions. Currently they can only answer them by consulting with plant taxonomists with specialist knowledge. One example will illustrate the point.

The World Health Organisation's Uppsala Monitoring Centre (WHO-UMC) collate and publish all cases of adverse reactions to drugs and herbal remedies reported to them by the world's "National Reporting Centres".

UMC receive adverse case reports which list the names of the plants implicated. These names are normally "pharmaceutical names" (as used in herbal pharmacopoeias which will often reflect the scientific name and the part of the plant used). To access information about all plants implicated in adverse reactions, therefore, UMC must first to map their "herbal plant names" list onto a list of scientific names. UMC have no way of knowing whether the plant names derived, and included within their database, are correct. Because of synonymy they do not know if the same plant is included in their database more than once. Nor can they find everything that is published about a particular plant since they do not know the majority of the names applied to it.

4.3.1. Cost of correction

UMC produce an annual report. They need to ensure that the names included are correct, up-to-date and complete (containing all possible synonyms).

In 2002, before producing their annual report, they underwent an exercise by submitting a draft list to Kew for validation. The draft list contained 428 plant names. 12 specialists at Kew were involved in checking the list for errors. Almost 25% of the names were found to have an error the sources of which are described in the following table. Given that UMC seek to provide information to other health services the consequences of misspelt names (which, therefore, will probably not be detected by systems searching their catalogue) are far more serious than is the case for the conservation example above.

Source of Error	No.	%
Errors in the spelling of the name	49	11.5
Synonyms of plants already in the list	5	1
Synonyms of plants not in the list	33	8
Unplaced – Unknown	16	4
Total Errors		24.6

Possibly of most interest here are the 16 names recorded within National Health Systems which are so incomplete or in error as to be unrecognisable by knowledgeable plant specialists. Any information or advice associated with these records becomes totally meaningless.

Some of the specialists also provided UMC with a list of commonly used synonyms for plants found in their catalogue and, consequently, we know that more than 25% of these species are known to be referred to by two or more alternative names.

Given the number of specialists involved and the administration costs we can estimate that the total cost of this exercise in cleaning up an existing list of 500 names was between 15,000 and 20,000 dollars. This figure, of course, can be repeated across hundreds of national and regional health bodies that either legislate for, or record cases of, poisoning or abuse using plant substances or alternatively that are charged with the regulation of appropriate use of herbal medicines. The human costs and health impacts of continuing with incomplete data or providing erroneous information is clearly significant.

The value of this exercise to WHO-UMC was underlined recently when have approached Kew again seek to repeat this exercise on an annual basis.

4.3.2. The European Medicinal Evaluation Agency

Within Europe the European Medicinal Evaluation Agency (EMEA) protects and promotes public and animal health by mobilizing scientific resources and controlling the safety of medicines for humans and animals through pharmaco-vigilance networks and by establishing safe limits. Similar networks exist in North America and elsewhere. These agencies must collate information about herbal remedies and potential side-effects and publish guidelines for appropriate use. The accuracy of their information and recommendations relies on access to all published information and hence on knowing all the names used for each plant and which names are in fact equivalent.

Where can they go to validate their plant name records? How much do they spend attempting to verify that the information that they provide is free of error? What are the consequences and impact of their not detecting all of the errors and gaps in their knowledge base?

5. Indirect use through existing information services

Hundreds of information services about plants already exist, each aiming to meet the particular needs of users from diverse domains. Obvious examples would be the Abstracting Services (e.g. CABI, Agricola, US Food and Drug Administration*)* or the Phytochemical Information Services (e.g. NAPRALERT, the Chapman and Hall Chemical databases or the Leffingwell and Associates Phytochemical Search Engine). There are many, many more.

iPlants is clearly not intending to meet all of these diverse needs. The great majority of existing information services, however, include within them plant names and their services would be greatly improved if the index of plant names upon which they are based were comprehensive, up-to-date and authoritative.

iPlants is exploring mechanisms by which its list of plant names could be supplied to the suppliers of such information services. During the pilot phase we have explored three example cases: one for the scientific community, one for the conservation community and one for the development community.

5.1. Scenario 1) GENBANK

5.1.1. Accuracy and completeness of Genbank's Information Service

A small study enabled us to gather metrics about the accuracy and comprehensiveness of the names underlying the current GenBank Information Service. The records in GenBank were explored for all plants from three families (Araceae, Arecaceae and Orchidaceae) and the names compared with the authoritative index now available for these families in Kew's Monocotyledon Database

2,594 different names were found in Genbank for these families. The following table shows the status of these names in the authoritative list:

Status in Monocot List	No. of Names	% of Total
Accepted name	2 210	85.2 %
Synonym *	275	10.6 %
Name does not exist	104	4.0 %
Recently published	5	0.1%

(*) Synonyms fall into a number of different classes (Illegitimate, Invalid, Orthographic, Unplaced and Synonym) with slightly different consequences.

The GenBank System does permits names to be linked one to another as synonyms. Indeed a few synonymies are already expressed within its own database. Its coverage of names (and synonyms), however, is obviously very limited and the names included have not been validated.

The broad conclusion from the above table is that (at least for these three families) 15% of the data records within GenBank are linked to names that either do not exist in the scientific literature or are not considered to be the current name for that plant.

5.1.2. Homonyms

A further complication facing the compilers of GenBank (and other service providers) is that of homonymy **-** that is where the same name (with a different authority) is used in the literature to refer to more than one different plant.

Of the 2 594 names in the above study, 90 were found to have homonyms. This is significant since GenBank rarely records the authority for a scientific name and thus is unable to distinguish between synonyms referring to different plant species (e.g. *Orchis militaris* has 5 homonyms, 1 of which is an accepted name – *Orchis militaris* L. The other 4 homonyms are synonyms of different species such as *Orchis militaris* Puccin. ex Parl. which is a synonym of *Dactylorhiza incarnata* subsp. *incarnata*).

These all appear as records of the same plant within GenBank.

5.1.3. Impact of Linking *iPlants* to Genbank

A logical analysis was undertaken of what outcome a user of the GenBank system should expect depending upon

What class of name they were searching with?

1) Correct accepted name
2) Correct synonym
3) Misspelt accepted name or synonym
4) Browse using Genus name
5) Browse using Family name

and what information was stored within GenBank and where it was stored.

1) No information stored
2) Info. stored under accepted name only
3) Info. stored under 1 synonym only
4) Info. stored under >1 synonym
5) Info. stored under 1 or >1 synonym AND an accepted name
6) Info. stored under non existent name (misspelt or wrong authority or whatever)
7) Info. stored under homonym of the same taxon
8) Info. stored under homonym of a different taxon

Analysis generated a table of 40 (5 * 8) possible outcomes depending on the class of name entered by the user and where the data was stored within GenBank.

The results table was derived first assuming that GenBank operates as it currently does.

	Data records stored for							
Name used for Search	**None**	**Accepted**	**Synonym**	**>1 Synonym**	**Accepted + Synonym**	**Non-existent**	**Homonym – same plant**	**Homonym – other plant**
Accepted	-	All	-	-	Partial		All	Partial + Incorrect
Synonym	-	-	All	Partial	Partial			
Misspelled name	-	-	-	-		Possible		
Browse Genus	-	All	-	-	Partial	Possible	All	Partial + Incorrect
Browse Family	-	All	-	-	Partial	Possible	All	Partial + Incorrect

"-"	indicates a "null" return
"All"	All records retrieved
"Partial"	Some records retrieved but not all.
"Incorrect"	Misleading response.

The results table was then derived again but this time assuming that the *iPlants* name index was available to the GenBank system.

Name used for Search	Data records stored for: None	Accepted	Synonym	>1 Synonym	Accepted + Synonym	Non-existent	Homonym – same plant	Homonym – other plant
Accepted	Intelligent null	All	All	All	All	All	All	All
Synonym	Intelligent null	All	All	All	All	All	All	All
Misspelled name	Intelligent null	Intelligent null	Intelligent null	Intelligent null	Intelligent null	Intelligent null	Intelligent null	Intelligent null
Browse Genus	Intelligent null	All	All	All	All	All	All	All
Browse Family	Intelligent null	All	All	All	All	All	All	All

"All"	All records retrieved
"Intelligent null"	Null response with additional information indicating the cause of a null response
	Shading indicates those outcomes in which the response is better than that available in the table above

We conclude that

1) using GenBank as it is today only 7 outcomes from a possible 40 will return all data records stored within the system AND avoid returning misleading records.
2) that 33 of the possible 40 outcomes would be improved (i.e. the return would be more complete or more accurate if GenBank were linked to *iPlants*.

5.2. Scenario 2) UNEP-WCMC

UNEP-WCMC maintain a database of c. 34,000 species of plant that are threatened or extinct. This list includes those plants that are CITES-listed (and mentioned within legislation or conventions). The database is available online and enables users to search by plant name or by country. The database does not set out to be complete for all plant species (only covering those considered to be threatened) and recognises on its front page that its coverage of synonymy is very incomplete.

Nevertheless the Threatened Plants List is an invaluable aid to those working in conservation and CITES related issues.

5.2.1. Impact of being incomplete

The list has become a standard reference for many institutions and individuals. They seek to know whether a plant is threatened or where it is or whether it is covered by CITES. The lack of a "complete" list of all plants and of having an incomplete list of names even for those plants that are included limits the usefulness of the list. When a user searches the site using a plant name and doesn't find it then three possible conclusions can be drawn:

a. the name does not exist or was spelt incorrectly
b. the name exists but the plant is not threatened
c. the name exists and is a synonym of a threatened plant but this name has not been entered into the database

The user can only determine which of these three conclusions is correct by undertaking further research.

5.2.2. Lack of accuracy and of not being up-to-date

One of the major sources for building the UNEP-WCMC list have been the IUCN Red List Books which (see above) can themselves include a high percentage of inaccuracies which would mislead policy makers or conservationists.
New plants and new plant names are being published all the time. Without investing considerable resources in maintaining the list the UNEP-WCMC list becomes increasingly incomplete and inaccurate.

5.2.3. Cost

The Threatened Plants list (see 1997 IUCN Red List of Threatened Plants) has a long history and has taken many years to build. It began in the 1960s when Peter Scott was the Chairman of the IUCN Species Survival Commission. Since then many organisations and thousands of individuals have contributed large amounts of data, much expertise and considerable staff time to build and maintain the list. It has passed through the hands of several organisations and has, at various stages, had a variable number of full time staff working to manage the database. *iPlants* is currently working in collaboration with UNEP-WCMC to calculate a more precise cost for this development effort.

Maintaining the list remains a significant burden to UNEP-WCMC. Harriet Gillet (its current manager) believes that when new records about the conservation status of a plant or its presence in CITES legislation are entered or existing records edited then more than 70% of the energy and time expended is generally spent in making sure that the nomenclatural details (author, place of publication and synonymy) and distribution records are both correct and complete. UNEP-WCMC welcome the opportunity to divest itself of this responsibility and to include the *iPlants* name index into its own Threatened Plants List.

5.2.4. A significant partnership

We are exploring what a syndicated system between *iPlants* and UNEP-WCMC might offer.

A) What does *iPlants* offer WCMC?

1. Regular updates to
   a. an authoritative index of names
      - complete for all species
      - complete for all synonyms
   b. global geographical distributions globally
   c. images and Preliminary Conservation Assessments
   d. reference sources

2. UNEP-WCMC avoid substantial maintenance costs.

3. The *iPlants* georeference data would be very useful for their Threatened Areas Programme and indeed a joint new information service could be offered as a result of sharing data available to the two partners.

B) What does UNEP-WCMC offer *iPlants*?

Apart from having another significant partner making the case for *iPlants* within the Conservation community, UNEP-WCMC also offer *iPlants*

1. continuation of the existing information service to the CITES community in a greatly improved manner. The joint service would
   a. use existing conventions and political arrangements
   b. facilitate *iPlants* role by
      - leaving UNEP-WCMC to manage the Version and Language control issues for CITES partners
      - avoiding the need to incorporate "political" views of taxonomic required in particular countries or legislation

2. Validation and completion of distribution data

3. Greater visibility

4. Joint initiatives to develop (and fund) novel information services

5.3. Scenario 3) Sustainable Development Programmes

It is increasingly recognised that sustainable development programmes, particularly in the tropics, depend upon more accurate information about the native plant species in that area. Local (common) names are the means by which agro foresters or local technical staff communicate with those living in the region. The scientific names, however, are the means by which these same technical staff can access information in the published literature and avoid some of the causes of errors of identity.

5.3.1. The Centro Nordestino de Informações sobre Plantas (CNIP)

The Centro Nordestino de Informações sobre Plantas (CNIP) offers information products and educational programmes about sustainable use of those species native to Northeast Brazil. CNIP was established in 1998 seeking to facilitate the sharing of scientific data among those scientists working on the plants of the region to interpret this information for use in community development initiatives. CNIP's goal was to be able to answer questions such as "Which trees are best for providing shade and charcoal", "which medicinal herbs can be used safely" "which native fruits survive in very dry regions". Before embarking on gathering the information for this, however, CNIP needed to be able to more basic questions such as "How many trees are there?" "Which palm species are found in Northeast Brazil?" and "Under what synonyms might information have been published about species X?"

How, for example, can agronomists discover all that is known (possibly in other countries) about the germination or harvesting properties of a particular fruit? How do foresters implementing wood utilisation programmes establish what alternative species might exist within a particular genus in the region?

To answer these more basic questions CNIP needed a synonymised checklist of the plants of Northeast Brazil. There was none and they had to build it.

5.3.2. Cost

CNIP sought collaboration from the international taxonomic community and have benefited from input from c 90 taxonomists from 28 countries. During the last six years CNIP and its partners have employed 2 senior scientists to supervise the project, 2 full time staff to administrate and organise the database and many students paid for by the Brazilian Government. They now have a checklist complete for 85% of all plant families. The Checklist currently available is Release 17 and contains more than 9000 species of plant.

Had the *iPlants* index been available in 1998 then CNIP would have been able to obtain from *iPlants* the list of plants recorded from Northeast Brazil, all their synonyms and the other information that *iPlants* is to offer.

The resource and effort that CNIP invested in building their checklist would have been available to gather information of more direct use to sustainable use. We cite CNIP as but one example. Many others such projects exist around the world and are building checklists themselves since none exists currently.

5.3.3. The World Agroforestry Centre

The World Agroforestry Centre (ICRAF) in Nairobi is one of the "Future Harvest" Centres and part of the Consultative Group on International Agricultural Research. ICRAF offer information services for agroforesters and others that work in development particularly in the arid tropics.

Amongst the information services that ICRAF offer organisations and individuals are two databases

- the agroforestry database and
- the tree seed suppliers' database

In order for these databases to be useful ICRAF have had to build (and continue to maintain – albeit only partially successfully) a separate "Botanic Nomenclatural Database" which underlies each of the databases which deliver information in the areas in which they have expertise. Understandably, given the expertise and size of the staff within ICRAF, the nomenclatural database is incomplete and full of inconsistencies.

Again their information services would benefit from access to an *iPlants* name index both directly from an improved (more complete and more accurate) service and indirectly by greatly reducing the build and maintenance costs of their core databases.

Appendix: Glossary

CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNIP	Centro Nordestino de Informações sobre Plantas
Compilation System	The software, people and procedures used to compile the *iPlants* online list of the plants of the world
Darwin Core	Darwin Core data structure (an agreed set of data elements for exchanging Natural History collections data)
DiGIR	Distributed Generic Information Retrieval project which has implemented an XML-based API to access specimen data based on the Darwin Core
DIVERSITAS	An international initiative aiming to promote integrative biodiversity science, linking biological, ecological and social disciplines in an effort to produce socially relevant new knowledge.
GBIF	Global Biodiversity Information Framework. Making the world's biodiversity data freely and universally available. GBIF works cooperatively with and in support of several other international organizations concerned with biodiversity.
GenBank	Online database of sequence data at the US National Center for Biotechnology Information
GSPC	The Global Strategy for Plant Conservation. Convention on Biological Diversity adopted the Global Strategy for Plant Conservation (decision VI/9), including 16 outcome-oriented global targets for 2010.
GTI	The Global Taxonomic Initiative. Established by the Conference of the Parties to the Convention on Biological Diversity to address the lack of taxonomic information and expertise available in many parts of the world, and thereby to improve decision-making in conservation, sustainable use and equitable sharing of the benefits derived from genetic resources.
IOPI	International Organization for Plant Information. Manages a series of cooperative international projects that aim to create and link databases of plant taxonomic information.
iPlants	The ***iPlants initative***
IPNI	International Plant Names Index. An internet accessible listing of all published plant names with their authors and place of publication. Additional nomenclatural information such as basionym, date of publication and type collections are supplied for some names where available.
ITIS	Integrated Taxonomic Information System. Designed to supply authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world.

ICRAF	The World Agroforestry Centre, Nairobi. A "Future Harvest Centre" Part of the Consultative Group on International Agricultural Research
IUCN	International Union for the Conservation of Nature
K	See Kew
Kew	The Royal Botanic Gardens, Kew, London, UK
LUCID	Knowledge management tool for diagnosing biological organisms
MBG	The Missouri Botanical Garden, St. Louis, MO, USA
MO	See MBG
NatureServe	A US non government agency networking science to conservation
NY	See NYBG
NYBG	The New York Botanical Garden, New York, USA
NYVH	The New York Botanical Garden's Virtual Herbarium
RBG Kew	See Kew
Sp2000	The Species 2000 initiative Has the objective of enumerating all known species of plants, animals, fungi and microbes on Earth as the baseline dataset for studies of global biodiversity.
Tropicos	Online Botanical Database of the Missouri Botanical Garden
UNEP	United Nations Environment Programme.
WCMC	World Conservation Monitoring Centre (Cambridge)