

INTERNATIONAL TRANSFER FORMAT

FOR

BOTANIC GARDEN PLANT RECORDS

(VERSION 2.00 - DRAFT 3.2)



ITF2 - May, 1997

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Acknowledgments of ITF2
Foreward

To be written
To be written

Editorial

The main question that should be answered is why in the late 1990's is an International Transfer Format for Botanic Gardens (ITF) still needed. Data can be browsed over the World Wide Web, downloaded and reused, imported and exported to and from databases, spreadsheets, word processing documents, other formats and back again. So why do Botanic Gardens require guidance on data exchange?

The answer to that is the need for clearly defined botanic garden fields. Whether data is imported directly to a test database, and then manipulated by the receiver, or whether it is exchanged using the proposed ITF format, users still have to know exactly which data section refers to what field. This is why an International Transfer Format for Botanic Garden Plant Records is still a valid today as to when it was first proposed ten years ago.

The International Transfer Format for Botanic Garden Plant Records (version 01.00) published in 1987 was a inflexible document with 3 types of record. Each record was exactly 362 characters long, and every field had a fixed position that had to be send or spaced out so that the next field began in the correct position. Even for experienced programmers it was easy to make an mistake within the field spacing, causing all subsequent records to be out of sequence.

The International Transfer Format for Botanic Garden Plant Records (version 2) is much more flexible. By using a field name as a preface to identify which data belongs to that field, the sender has a choice of sending as much or as little data per record as they feel comfortable doing so. If at a later stage, the receiver needs more information, then it too can be sent with a minimum of effort - an institution identifier and an accession identifier is always required, along with the any additional field names and information. (Any records transferred without the institutional and the accession identifiers would not constitute an ITF record).

If the sender and receiver are holding additional fields that are not covered in this publication, then that too can be transferred using the New Field Option, or else they can using the principles of the ITF2 to set up their own unique exchange format. The ITF2 is a suggested mechanism for exchanging plant records, identifying the most likely fields of interest for botanic gardens. It is as a guidance document to botanic gardens to help them maintain and exchange their unique databases, and aid them with their difficult task of maintaining the world's plant diversity.

The ITF2 fields are biased towards the information needed for the conservation and propagation of plants of 'conservation' interest. But the same principles can be applied to additional fields required for transference of more detailed propagation or tissue culture information. The editors have deliberately restricted the ITF2 fields in the interest of a 'manageable' publication - although others are allowed to disagree on that point!

Diane Wyse Jackson
Botanic Gardens Conservation International.

Introduction to the International Transfer Format Version 2.00

DEFINITIONS:

- Taxonomy: The science of classification as applied to living organisms; (Webster Dictionary)
Taxon: A single unique element to which the 'science of classification' has been applied.
Accession: Under the rules of the ITF - this applies to a plant or group of plants in an institution that has been acquired as a separate addition or element of its collection. There may be many accessions or examples of a single taxon in an institution, but a single accession cannot represent more than one taxon.

GENERAL RULE OF INFORMATION OF AN ITF RECORD

Each record must refer to an accession in an institution. One record is given to each accession only. However, any one accession may cover more than one *individual* specimen, for example if the accession is in the form of seed or of plants that have been raised from seed; or if several individuals have been collected from one site at one time; or in the case of micropropagation. It *must not*, however, cover individuals of the same taxon collected from different places in successive years.

Notes

The rules that follow make references to the International Code of Botanical Nomenclature (the "Tokyo Code") (Greuter *et al.*, 1993) and the International Code of Nomenclature for Cultivated Plants (the "Cultivated Code") (Trehane *et al.*, 1995). These are the agreed sets of rules by which botanists and horticulturists name plants. Both are cited in full under the references at the end of this manual .

The International Transfer Format for Botanic Garden Plant Records - Version 2.0 (ITF2)

Introduction

The International Transfer Format for Botanic Garden Records is an Internationally agreed standard format by which electronic information about living plants, as held by botanical institutions, particularly botanic gardens, may be interchanged between organisations.

The first version of the International Transfer Format for Botanic Garden Records (ITF version 01.00) was published in 1987. This version has been extensively revised during 1992, 1994, 1995 and 1996 to make it more relevant to the botanic gardens of the 1990s to become this draft of the ITF version 2.00 (ITF2). The ITF2 editors welcome all comments/advice on the proposed contents prior to its proposed publication in 1997, 10 years after the first version was printed.

Format of ITF2

There have been two major changes to the transfer format which have been incorporated into this second version of ITF, namely: (1) ITF2 allows for the interchange of variable length fields, and (2) ITF2 allows missing data to be omitted from the transfer file.

The transfer format of ITF2 is based on 'Information technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1)'. International Standard ISO/IEC 8824, 2nd ed. (1990)(ISO/IEC: Genève).

An **ITF Version 2.0 file** is the total contents of the information transferred. Each file begins with the file identifier 'startfile' and ends with the file identifier 'endfile'. Additional file header information is provided before any of the record data.

An **ITF Version 2.0 Record** includes all data associated with a single Accession Identifier included in the overall file. Each record begins with the opened brace character '{' and ends with the closed brace character '}'.

An **ITF Version 2.0 field** is the basic unit of information. The data of any record are grouped into several separate fields of information. Each field is prefaced by a unique field identifier. If the information pertaining to a certain field is to be transferred, then the appropriate unique field identifier must be interchanged with this information. Each field is always terminated (delimited) by a comma (.). The data within alphanumeric (text) fields are enclosed by double parentheses ("), whereas numeric fields are NOT enclosed by double parentheses. Fields are either 'required' for transfer in an ITF Record (in which case an ITF record is incomplete if excluded) or are 'optional'. For example, the 'Institution Code' field and the 'Accession Identifier' are always required in any valid ITF2 record.

Summary of the important features of an ITF2 file:

- a) Each field is prefaced by an unique identifier (this refers to the fields which describe the contents of the file, as well as to those which describe the information contained in each record);
- b) Each unique identifier must begin with a lowercase letter (a-z) and can not contain any spaces
- c) A transfer file begins with the file identifier 'startfile';
- d) Each record begins with the opened brace character '{';
- e) Each record ends with the closed brace character '}';
- f) Variable length fields are allowed;
- g) Fields may be omitted from the transfer file if there is no information available for that field;
- h) Alphanumeric data are enclosed by double quotation marks (");
- i) Numeric data are not enclosed by double quotation marks;
- j) Each field is terminated by a comma (.).
- k) Each transfer file ends with the file identifier 'endfile'.

Example of the start and end of an ITF2 file:

(See main text for a more complete description of each field)

startfile	
version	ITF version
numrec	number of records in this file
datefile	date to which the file refers
institute	full name of institution supplying information
contact	contact name
address	postal address
tel	telephone number
fax	fax number
email	email address
newfields	optional field to describe any new fields added to the ITF2 by the file compiler
fileaction	how the records in the file should be processed
pgcd	international page code descriptor
content	contents of the file and other comments
{	start of a record
insid	institution's IAPT/BGCI identification code; the IAPT code for the institution combines with the accession identifier to make a universal unique code for every garden's accession
accid	accession's identification or unique number
accspe	accession specimen numbers; the number of specimens referred to by the accession identifier
accsta	accession status; a flag to indicate whether or not the plant is a current accession
...	additional field information
...	additional field information
...	

```

}          end of record
{          start of next record
insid     institution's IAPT/BGCI identification code; the IAPT code for the institution combines
          with the accession identifier to make a universal unique code for every garden's accession
accid     accession's identification or unique number
...
|
|
...
}          end of next record
endfile   end of file

```

An example of a filled ITF2 interchange file

```

startfile
version   "ITF2",
numrec    50,
datefile  19951202,
institute "Royal Botanic Gardens of New South Wales (NSW)",
contact   "Joe Brown",
address   "Royal Botanic Gardens, Mrs Macquaries Road, Sydney NSW 2000, Australia",
phone     612 2318164,
fax       612 2517231,
email     "j.brown@rbgsyd.gov.au",
pgcd      483
content   "ITF2 exchange data of various species. The additional ASCII characters are also included
          to help file layout - Line feed/CR = ASCII decimal characters 10 13 after each unit of information and Tab
          = ASCII decimal character 9" to separate the transfer code and the field text.",
{
insid     "NSW",
accid     "390839",
fam       "Loranthaceae",
gen       "Amyema",
sp        "pendulum",
isprk    "subsp.",
isp       "longifolium",
vnam      "Smith, B.M.",
vdat     1995,
prot      "wild",
cou       "AUSTRALIA",
iso       "AU",
pru       "NSW",
sru       "Central W. Slopes",
loc       "Mount Bolton, Moura",
latdeg    33,
latmin    15,
latdir    "S",
londeg    148,
lonmin    24,
londir    "E",
cnam      "Jones, W.",
cdat     190103,
hab       "On Eucalyptus macrorrhyncha.",
misc     "Donated from a private collection in 1979.",
}
{
insid     "NSW",
accid     248836,
fam       "Asclepiadaceae",

```

```

gen      "Cynanchum",
sp       "pedunculatum",
vnam    "Williams, K.V.",
vdat    1992,
prot    "W",
cou     "AUSTRALIA",
pru     "WA",
sru     "Fortescue",
loc     "Mount Lois.",
alt     800,
latdeg  22,
latmin  06,
latdir  "S",
londeg  117,
lonmin  44,
londir  "E",
geoacy  100,
hab     "Summit of mountain. Red loam derived from iron-rich shale.",
cnam    "Wilson, A.",
cid     "1031",
cnam2   "Rowe, J.",
cdat    19910911,
cnot    "Rare. Scrambler. Flowers white; fruit green, twinned.",
}
endfile

```

Note: To facilitate easy reading here, the editors have inserted a tab between the transfer code and the field text, and have also inserted a line feed at the end of every field. These additional codes are optional and may be kept within a file transfer, provided the receiving institution wants to receive the record in this format.

The sending garden must be able to provide the file without the additional tab and line feed, and with a single space before and after each unique TRANSFER CODE. Although an ITF file is designed to 'stand-alone', communications between sending and receiving institutions prior and throughout the sending of any exchange format are recommended and may be essential to a successful file transfer. It may also be necessary to document which additional ASCII characters are being used in the **Description of File Content and other Comments** field. See example above.

An overview of the "International Transfer Format for Botanic Garden Plant Records - version 2" for the less experienced user.

The International Transfer Format for Botanic Garden Plant Records - version 01.00 (ITF1) was first published in 1987. To date there have been a minimum of 4 International Workshops on 3 continents to try and update the standard to version 2. Following intense discussions, the 69 were chosen as the most important data items attached to a single plant accession that were needed for transfer. 'Transfer' is defined as 'to move from one place to another' or 'valid for use by another'

The International Transfer Format for Botanic Garden Plant Records (ITF) is a means for transferring the data or recorded knowledge about a single plant accession from an originating institution to a receiving institution. Botanic gardens and other horticultural institutions swap plant material - it is not so easy to pass the data recorded about the same plant material on in a readable format. Yet plant provenance data or the keeping of 'accession records' is the key criteria as to what makes a botanic garden a '*botanic garden*' and not just a garden or park.

When an institution receives new plant material, it must be able to receive the data already attached to that plant accession, or risk losing the complete provenance of that plant. The original ITF (version 01.00) in 1987 outlined a 32 fields attached to a plant record in order to have complete provenance data. As institutions set-up their databases, based on the original ITF (version 01.00), it was decided that there were other fields that institutions wished to exchange as well as some flaws noted in version 01.00, ITF1 was based on fixed length fields, and the transfer format was difficult to set-up, as every record and field started at a particular character position, which if entered wrongly once, placed every subsequent record out of sequence.

The International Transfer Format for Botanic Garden Plant Records - version 2.00 (ITF2) workshops were instigated to address the above criticisms. The following plant accession fields (if transferred) would give a very comprehensive plant accession record, but it is recognised that not every botanic garden wishes to keep such complete details about a single accession, and that institutions have the need to keep more detailed records about data items not covered in this publication.

This publication concentrates on data items pertaining to accession records. A valid ITF2 file consists of a file header, detailing the sending institutions contact information, and a series of one or more accession records that must have an Institution code, an Accession Identifier and as much as the plantname identifier fields transferred as possible.

Depending on whether data is entered against the variety of field names in a single accession record, dictates if the field is transferred or ignored. Likewise when receiving data, if a field is sent, but the receiving database does not have the data structure set-up to receive that data, it is recommended that the field is ignored.

The basis of an ITF2 file is that only relevant data is sent. The file is not cluttered up with empty fields. However, by outlining additional fields that workshop participants have identified as being useful in their databases, database administrators, curators and plant record officers may wish to re-validate their datasets and plan for future enhancements.

A key criteria to the data sent is the 'reason' for the sending of data; two key reasons for exchanging ITF files are:

- a) the receiving of an institution's accession records by an international organisation such as BGCi or WCMC enabling them to participate in a Biodiversity or Conservation Survey; as well as receiving additional information about the relevant plant names back into the sender's database.
- b) the sending of actual plant material with its provenance data attached in an electronic format.

There are other additional reasons for data exchange, some of which may not be as obvious at the two reasons given above. However the content of some fields, if transferred, will depend on the reason for the data exchange; **Accession Specimen Numbers** and **Accession Material Type Flag** are good examples of when the data sent may differ depending on the 'reason':

- if sent to participate in a Biodiversity or Conservation Survey; then the two fields would refer to the actual plant material held in the sending institution;

- if sending provenance data in an electronic format along with plant material, then the above two fields would refer to the actual plant material being sent with data, not to the material being held in the sending institution.

The success of an ITF transfer will depend equally on the combined skill and diligence of the contact person and the institution sending correct 'up to date' accession information, and the receiving institution to interpret and encode the data correctly into their database. Efficient communications between sending and receiving institutions is a vital component to the success of an ITF data exchange.

How to use this document:

- ITF2 is divided into a number of Sections (A -G) which has sub-divided the proposed fields into a number of units:
- Section A File Identification Data - fields describing the file being sent and who is the main contact sending this file.
- Section B Accession Data - The accession identifier combined with the Institution Identifier combines to make an unique world accession number. Further details about the number, status and type of specimens being sent.
- Section C Plant Name - Full details of the plant name. It should be noted that if Authorities should only be sent if requested as these fields do not constitute a true ITF record, because that information refers to the taxon not to the unique accession being referred to.
- Section D Verification Data - Details referring to the verification of the single accession record.
- Section E Source Data - Provenance details of the single accession record.
- Section F Place of Origin - Further Provenance details about the original source location of the accession and its collectors.
- Section G Additional Data - including the type of Breeding System of the Accession (under ITF1 this had a section of its own under the heading 'Sexuality'). Further details are included on perennation, the uses, propagation and cultivation of the accession

If you are not planning to transfer data in the immediate future, skip to Section B. By following the recommendations from this point on, your database will be compatible with other ITF users. Section B describes the types of fields you may want to use to record information about your collections. Following each field is a brief description on what types of information are appropriate for the field, and what, if any, standard formats or codes are required.

Setting Up Your Database:

- The difference between taxon and accession-based recording:

There is a lot of information that Botanic Gardens want to maintain. When setting up a database, the curator has to decide how to divide the information.

1. Some fields such as Taxonomic range of the Plant and the plant name itself and its authorities, applies to information about the species itself, and is therefore applicable to the all accessions of that species. These fields are therefore taxon based.
2. Other field pertain to the accession's information. Where was this particular plant collected, what were the conditions and by whom was it donated or collected by. These fields are accession based. This is the basis of an ITF record.
3. Finally, when an accession is collected, different propagation trials are carried out to help cultivate the plant successfully - therefore it is advisable to be able to split the same accession into different plant identifiers, and it is not always advisable to give each plant a separate accession identifier, as they all come from an original source. This information is still accession based, but based per individual plant growing in the garden. The sender has to know when sending information, whether they are sending information per accession (such as when seed is collected over a range of plants) or per accession plant (e.g. cuttings are taken from one plant in a unique location) and somehow convey this information electronically.

- ITF2 allows for 73 standardised fields. You may or may not need to keep all of this information. In fact, if this is your first plant collection database, it is highly recommended that you keep your database simple, and then add fields as experience and staffing levels dictate the necessity to expand your database. The more information you try to record, the more resources you will have to devote to maintaining the database over time.

Fixed Length versus Variable Length Fields:

- Fixed length fields have a set number of characters that can be held within this field. If more data is entered, it is not accepted and the field is truncated so that the data beyond the field specified length is forever lost. MICROSOFT ACCESS, FOXPRO and other DBASE type databases fields other than the Memo fields are based on fixed lengths.
- Variable length fields allow for any numbers of characters up to the record length itself to be entered in one field. The program may only be programmed to display a certain number of characters of the field, but the data is never lost and can be shown, after adjusting the window or report display lengths. ADVANCED REVELATION Database Management System is an example of variable field lengths.
- * If you are using a database that requires fixed length fields, recommended field lengths are provided for each of the fields in Annex 3 at the end of the book.

A Simple Database that is compatible with the ITF.

The following fields would be a good place to start when first setting up a database. Other fields can be added as needs are identified.

1. Accession Specimen Number
2. Accession Status
3. Family Name
4. Intergeneric Hybrid Flag
5. Genus Name
6. Interspecific Hybrid Flag
7. Species Epithet
8. Intraspecific Rank Flag
9. Intraspecific Epithet
10. Vernacular Name
11. Cultivar Name
12. Rank Qualified Flag
13. Identification Qualifier
14. Verification Level
15. Verifier's Name
16. Provenance Type Flag
17. Donor's Accession Identifier
18. Country of Origin
19. Primary Recording Unit
20. Locality
21. Primary Collector's Name
22. Collector's Identifier
23. Collector's date

Format of the text in an ITF version 2 file:

Every field name will be described in the following format.

The full field name
 The transfer identifier code
 The field description
 Rules of Syntax (if applicable)
 Rules of Information (if applicable)
 Guidelines (if applicable)

A. FILE IDENTIFICATION DATA

Start of ITF Version 2.0 File

Transfer code: **startfile**

Description: The beginning of the transfer file has the file identifier 'startfile' only.

Guidelines: To be found at the very start of an ITF file indicating the start of file.

Example: startfile

End of ITF Version 2.0 File

Transfer code: **endfile**

Description: The end of the transfer file has the file identifier 'endfile' only.

Guidelines: To be found at the very end of an ITF file indicating the end of file. The editors have placed it here for convenience of describing the field together with 'startfile'.

Example: endfile

ITF Version used of file

Transfer code: **version**

Description: The ITF Version used in the current ITF File.

Rules of Syntax: Alphanumeric, the version number prefaced by the acronym 'ITF' (all in uppercase).

Guidelines: The current version is ITF Version 2.0. Therefore, the entry in this field would be 'ITF2'. If the ITF transfer file was version number '2.1', then this information would be interchanged as 'ITF2.1'.

Example: version "ITF2",

Number of Records in File

Transfer code: **numrec**

Description: The total number of records expressed as an integer.

Rules of Syntax: Integer only.

Example: numrec 200,

Date of file

Transfer code: **datefile**

Description: The date of compilation of the current ITF file.

Rules of Syntax: Integer, year (4 digits) followed by month (2 digits) and then day (2 digits), without spaces between each.

1. In this notation, leading zeroes must be included for months and days, i.e. January is coded as '01' not '1' and the 4th day is coded as '04' not '4'.

Example: 19851109 9 November 1985
 19510203 3 February 1951

2. If the day of the month is not known, then the last two digits should be omitted.

Example: 190103 March 1901

3. If the day and month are not known, the last four digits should be omitted and just the 4 digit year information transferred.

Example: datefile 1963,

Guidelines: The ITF records the year as a full 4-digit number to facilitate the use of the system in the next century, as well as to track verifications from the previous century.

Name of Institution Supplying Information

Transfer code: **institute**

Description: The name in full of the institution sending the current ITF file.
Rules of Syntax: Free text
Example: institute "Botanic Gardens Conservation International (BGCI)",

Contact Name

Transfer code: **contact**

Description: The full name of the contact person within the institution.
Rules of Syntax: Free text
Example: contact "Diane Wyse Jackson",

Address of Institution sending File

Transfer code: **address**

Description: The full postal address of the sending institution.
Rules of Syntax: Free text
Guidelines: The address should be displayed as continuous text, no line breaks, only commas and spaces as required.
Example: address "Descanso House, 199 Kew Road, Richmond, Surrey, TW9 3BW, UK",

Telephone Number of Institution

Transfer code: **phone**

Description: The telephone number of the Contact Person.
Rules of Syntax: Numeric
Guidelines: The use of national and international codes depends on the circumstances of the sending and receiving institutions.
Example: phone "+ 44 181 332 5953/4/5",

Facsimile Number of Institution

Transfer code: **fax**

Description: The facsimile number of the Contact person.
Rules of Syntax: Numeric
Guidelines: The use of national and international codes depends on the circumstances of the sending and receiving institutions.
Example: phone "+ 44 181 332 5956",

E-mail Address of Institution

Transfer code: **email**

Description: The email address of the Contact person.
Rules of Syntax: Valid e-mail address format
Example: email "bgci@rbgkew.org.uk",

NB email addresses are changed more often than addresses, phone or fax numbers.

New Field Option

Transfer code: **newfields**

Description: This field allows the inclusion of data or standards that have not been included in this publication. The data is likely to be of specific interest to the sending and receiving institutions who wish to enhance the use of an ITF2 file by including additional fields.
Rules of Syntax: Alphanumeric. The field identifier 'newfields' is followed by a suggested unique field identifier (all lowercase) to be used in the transfer file; which is followed by a brief explanation in necessary; the syntax of the data (whether alphanumeric or numeric); and the reference to the standard used

in this newfield enclosed by round parentheses and within, each separated by a semi-colon and space - (refer example below).

If the data for any one standard are being transferred in several fields, then each unique field identifier is separated by a space followed by the necessary explanatory information in round parentheses.

If more than one newfield (based on different standards) are being used in the transfer file then each must be separated by a semi-colon and space (;) - refer to example below.

Since this field is alphanumeric (text), the data must be enclosed by double quotations (""); the data must not contain any line feeds or carriage returns; and the field must end with a comma (,).

Guidelines: If the **newfields** are to be accepted and are not, as yet, used by the receiving institution, the new datafields would have to be programmed into the receiving database, and amendments made to the receiver's ITF acceptance program.

Example:

newfields "pol (Pollinator; alphanumeric - scientific name of pollinator and authority at lowest level name or epithet); arch (Plant architectural models; alphanumeric; F. Hallé *et al.* 1978. 'Tropical trees and forests', Springer-Verlag: Berlin)",

File Action Flag

Transfer code: **fileaction**

Description: A field to indicate how the records of the file should be processed.

Rules of Syntax: Alphabetic; this field must consist of one of the values in the table below:

<i>Contents of Field</i>	<i>Meaning</i>
delete	delete all records in file from institutional database receiving transfer file
insert	all records in file to be added to receiving database
update	update relevant fields of all records in file in receiving database

Guidelines: This field should be used in conjunction with the **Description of File Contents and Other Comments** field (refer below).

The 'delete' option is used when previously received collections are known to be sufficiently inaccurate that it is recommended that the specimen's record be removed from the receiving institution's database. The reason for this would be explained in the **Description of File Contents and Other Comments** field (refer below).

The 'insert' option is used for new records being sent to the receiving database. This is the default value for all exchange data.

The 'update' option is used for records already held in the receiving database which have been modified and included in the current transfer file. This option would be used for returning redeterminations and other corrections to the receiving institutions.

Example: fileaction "update",

Page Code Descriptor

Transfer code: **pgcd**

Description: The International Page Code Number that is specified in the computer's disk operating system and which is normally used by the sending garden in the preparation of data.

Rules of Syntax: All valid international page code descriptors.

Guidelines: Different countries use different International Page Code Descriptors in the booting up of their local computers for the correct keyboard layout giving their local diacritic marks or accented characters. When a file is prepared with one International Page Code Number, but viewed with a different Page Code Number, the file can appear as corrupted, as the diacritics are interpreted with different symbols.

By knowing which Page Code Number the file was originally prepared in, the receiving institution can code conversion programs to receive the data more accurately.

Example: pgcd 850,

NB Data originally prepared with a Multilingual (Latin I) keyboard

Description of File Contents and other Comments

Transfer code: **content**

Description: A brief description of the content of the current ITF File.

Rules of Syntax: Free text

Guidelines: Tabs, line feeds, carriage returns or other additional non printing characters should not be included in an ITF2 file unless specifically noted in content.

Example: content "The additional ASCII characters are also included in this file to help layout - Line feed/Carriage Return = ASCII decimal characters 10 13 after each unit of information and Tab = ASCII decimal character 9" to separate the transfer code and the field text.",

Start of ITF Version 2.0 Record

Transfer code: {

Description: The single character { indicating the beginning of an ITF Version 2.0 Record.

Rules of Syntax: Must contain the symbol '{' only.

Guidelines: To be found at the start of an ITF record indicating the beginning of the data of each record.

Example: {

B. ACCESSION DATA

This section comprises of the fields Institution Code, Accession Identifier, Accession Specimen Numbers, Accession Status and Accession Material Type. The combined transfer codes of **insid** and **accid** provide a unique accession identifier for every cultivated plant record in the world and therefore without these two fields, the record would not be a valid ITF2 record..

Institution Code

Transfer code: **insid**

Description: The code for the Institution to which the plant record refers. In ITF1 this was the Botanic Garden 5 letter code, shortname GARDCODE.

Rules of Syntax: The code must consist of an entry of 1-5 upper case letters (A-Z). This field *must* be transferred for every accession record.

Rules of Information: The entry in the field must be the code of the Botanic Garden as defined by the International Directory for Botanic Gardens.

Guidelines: The codes were designed originally for herbaria (IAPT codes), but have been adapted and developed further for Botanic Gardens by BGCI. Codes for the majority of botanic gardens have been published in the International Directory of Botanical Gardens (1990) Heywood C.A., Heywood V.H. and Wyse Jackson P.S., published by Koeltz, Koenigstein.

If a garden does *not* have a code, and does not have an herbarium which has a code, it should write to Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond, Surrey, TW9 3BW, U.K. to agree on the code. BGCI is very happy for gardens to propose their own codes, but will insist that the value chosen has not been used already and is in accordance with its rules. Codes should be mnemonic for the location, e.g. ATLA or ATLI for the Atlantis Sunken Botanic Garden, rather than reflect the acronym, e.g. ASBG in this example. In particular, the use of BG should be avoided for Botanic Garden.

Gardens need to be very clear about whether or not their satellite gardens have separate codes from the parent garden. This is left at the discretion of individual gardens. Once a choice has been made, it clearly cannot be changed easily.

When inserting the accession information into a receiving database, the **Institution Code** combines with the **Accession Identifier** to make up the Donor's accession identifier for each record. This is to allow for accession transfer tracking through botanic garden community; ie TCD1994-210 refers to accession 1994-210 at Trinity College Botanic Garden, Dublin, Ireland.

Example: insid "TCD",

Accession Identifier

Transfer code: **accid**

Description: The unique identifier of the record, often called 'Accession Number', used internally by the garden to record each accession.

Rules of Syntax: Alphanumeric, the **Accession Identifier** field may consist of any characters in the ASCII character subset as defined in Annex 2. This field must be transferred for every accession record.

Rules of Information:

1. The Accession Identifier should be a unique set of characters that identifies each accession in the garden's own record system.
2. In the case of more than one sample of a single taxon from one collection site by the same collector - a single value of the Accession Identifier is permissible. It should be noted that once an accession has been recorded within the botanic garden setting, then subsequent collections of the same taxon from the collection site should be re-recorded as the Accession's date history will differ making it a new record.
3. The same values of the Accession Identifier should not be used again when plants die or are given away.
4. The Accession Identifier for a plant should not be changed during the life of that plant. It is, however, permissible to assign a new accession identifier to a plant after it has been propagated.

Guidelines: Many gardens include punctuation within their Accession Identifier, e.g. 82-BG-24-31. It is good practice for gardens to be consistent on the punctuation included in the ITF.

Example: accid "97-0345",

Accession Specimen Numbers

Transfer code: **accspe**

Description: The current minimum number of specimens identified by the Accession Identifier.

Rules of Syntax: Integers only.

Rules of Information: If the accession is dead, this field is not applicable.

Guidelines: This field is not differentiating between plant genotypes and plant clones. If 'clone information' is required, then **Accession Material Type** Flag can be transferred, and/or alternatively:

- a) a note can be added in the **Miscellaneous Notes** field;
- b) a sender/recipient agreed format for data exchange setup in **New Field Option** field;
- c) In **Description of File Contents and other Comments** field, it can be stressed that the sending garden's ITF is using this field to outline the number of clones attached to a single accession id. This may be unique to this ITF file only, and other ITF files sent from the same institution may be using **accspe** in its wider sense.

This will be one field that gardens may have difficulty in keeping up to date, as it should record the current minimum number of specimens, not the number that were originally given that accession identifier. If transferred, it is recommended that the receiving institution verifies that **Accession Specimen Number** transferred tallies with the Accession Specimen Numbers physically received by the institution, as discrepancies will certainly occur depending on the reason why an ITF file is sent. i.e. if a file is sent without living material, then this figure should record the minimum **Accession Specimen Numbers** that the garden is currently holding, but if sent with plant material, it should contain the minimum number being transferred to the other institution.

Example: accspe 1,

Accession Status

Transfer code: **accsta**

Description: A flag to indicate whether or not the plant is a current accession in the garden.

Rules of Syntax: If transmitted, then the Accession Status field must consist of one or more of the following characters:

<i>Syntax</i>	<i>Meaning</i>
C	Current accession in the living collection
D	Non-current accession of the living collection due to death
T	Non-current accession due to transfer to another record system, normally of another garden
S	Stored in a dormant state
O	Other' accession status - different from those above.

Guidelines:

1. In some systems, records of dead plants are left in the datafile and flagged as dead. In others, however, records of dead plants are put in a separate file or are deleted altogether; each of these two practices is quite suitable for the internal files. One advantage of keeping records of plants that appear dead is that roots may sprout or seedlings may appear years later.

2. Codes for material stored dormant in genebanks can be coded in this field. Field genebanks that are actively growing are to be assigned the code 'C'.

Example: accsta "C",

Accession Material Type Flag

Transfer code: **acct**

Description: A flag to indicate the type of material the current living accession is composed of.

Rules of Syntax: If transferred, the **Living Accession Material Type** must consist of at least one of the following characters:

<i>Syntax</i>	<i>Meaning</i>
P	Whole plant
S	Seed or Spore
V	Vegetative part
T	Tissue culture
O	Other

Guidelines: If the value in the **Accession Status** field is 'D', then this field should *not* be transmitted.

If the accession consists of a combination of the above states e.g. a whole plant and stored seed, a combination of the above codes may be sent e.g. acct 'PS',

However, it is recommended that gardens assign unique accession identifiers to material held in different states. This will be one field that gardens may have difficulty in keeping up to date, especially transferring the record to another institution when it should flag the type of living material being physically sent, not the material currently held at the sending institution.

Example: acct "S",

C. PLANT NAME

The full scientific (Latin) name of a plant includes the authors of the species and infraspecific names (where relevant). Such 'full' names are extremely useful, especially if the complete taxonomic name of the taxon is required; this option is possible in the ITF2 transfer file. However, if a full taxonomic name is not required, then an abbreviated ('limited') scientific name can be used to precisely refer to the taxon. This 'limited' option is also catered for in ITF2 and is transferred according to the following rules:

- 1 If only a species name is required then:
 - 1.1 *only* the genus name and the specific epithet are required. The authority is not required unless there is some possibility of confusion between this species and one or more of its homonyms.
2. If the record refers to an infraspecific taxon then:
 - 2.1 *only* the genus name, specific epithet and the lowest level infraspecific rank and infraspecific epithet are required. The authority is not required unless there is some possibility of confusion between this infraspecific taxon and one or more of its homonyms.

The module for the Plant Name is based on *Bisby, F.A. (1994) 'Plant names in botanical databases'*, Plant Taxonomic Database Standard No. 3 Version 1.00 (TDWG / Hunt: Pittsburgh).

Hybrids present considerable problems for handling of their names in a computer. The present system handles them, but not perfectly (refer **Intergeneric Hybrid Flag; Genus name; Interspecific Hybrid Flag; Species Epithet; Infraspecific Rank/Hybrid Flag; Infraspecific Epithet**). Annex I provides some notes on how hybrid names are constructed, with details on how to handle them in the ITF.

The present module does not contain any facility for synonyms, as this is not considered necessary for exchange of garden record data. Individual gardens may want to treat synonyms in different ways, depending on their needs. Since synonym information is taxon based, it has not been included in ITF2.

Although the application of vernacular (common) names is not as rigorously controlled as scientific names, they vary greatly and the same name may be applied to a number of taxa. However, institutions may wish to interchange this information and a suggested transfer is included (refer **Vernacular Names**).

The need for the names of higher groups such as suprafamilies and families are not required for the ITF, since each accepted generic name in the plant kingdom is unique. Furthermore, there is no agreement among taxonomists on the circumscription of plant suprafamilies and families. However, institutions may wish to interchange such data, especially if they are using the same higher classification system. Therefore, these fields are included (refer **Suprafamilial Group Name; Family Name**).

In ITF version 1, it was decided to exclude authorities of the botanical names from the ITF. (The authority, in a botanical context, is the name, usually abbreviated, of the botanist(s) who assigned and/or published the name of the plant.) The reason for using authorities is generally stated to prevent confusion between homonyms (the same name having been used for two different taxa; all but one of these names will be technically illegitimate.) Although this is important for technical taxonomy, its effects on garden records are small and usually obvious. However, it has been decided to include the authorities of species and infraspecific names in the transfer file if these data are required. To avoid the variation in the citation of the names of authors, it is recommended that a published standard for the citation of authorities be used. One such standard is Brummitt, R.K. & Powell, C.E. (1992) 'Authors of plant names' (Royal Botanic Gardens: Kew).

Identification Qualifiers

The following comments on 'Identification Qualifiers' are relevant to the ITF fields **Identification Qualifier** and **Rank Qualified Flag**.

Botanists sometimes add various terms, such as '?', 'cf.' and 'aff.', to the name of a plant to indicate a degree of uncertainty of identification. This is often the case where a plant is taxonomically critical or with garden plants that are of uncertain origin or that do not produce flowers or fruits. The term applies to the part of the name that immediately *follows* the term. They can be placed in front of any element of the name. It is important to note, however, that the meaning of the various terms is uncertain. There are no agreed definitions, and the distinctions between the various terms are small. So naturally those who identify plants should avoid using them wherever possible. But where they are used, garden record databases should include them so as to be able to record the uncertainty of the identification.

For conservation purposes, BGCI proposes to treat taxa qualified in this way as identified only to the level one above the rank qualified, i.e. a garden record of *Cypripedium* aff. *candidum* is treated not as a valid cultivation record of the threatened plant *Cypripedium candidum* but only as a record for the genus *Cypripedium*.

With infraspecific taxa and cultivars, no distinction is made between whether the term (e.g. 'aff.') is added before the rank of the qualified part of the name or after it. In other words, the ITF codes *Prunus maritima* aff. var. *gravesii* and *Prunus maritima* var. aff. *gravesii* are regarded as referring to the same taxon.

Suprafamilial Name

Transfer code: **supfam**

Description: The relevant suprafamilial name of the taxon referred to in the record.

Rules of Syntax: Alphabetic, any valid suprafamilial name with first letter in uppercase.

Guidelines: This field allows for material being sent for identification, particularly when even the family may not be known.

The Suprafamilial Name depends on the classification system employed. As each institution will decide its own classification system - this field and the next two fields may not always be a useful part of the interchange standard. However, it is simple to ignore this information when loading the data (if it is not required or is unsuitable), but it may be useful when reviewing the taxonomic system under which the data has been compiled when loading the file into a database.).

It should be noted that the Suprafamilial Rank is missing at this level, but this is because the data entered at Suprafamilial level has its 'rank' level implicit.

Example: supfam "Dicotyledonae",

Family Name

Transfer code: **fam**

Description: The family name appropriate to the **Genus Name** field entered in full.

Rules of Syntax: Alphabetic, any validly published plant family name with capitalisation of the first letter only.

Rules of Information: If the name of the family of the plant is unknown, then this field may contain the value UNKNOWN (in uppercase). In this case, the remaining name fields should *not* be transferred.

Guidelines: Since there is no universally accepted classification of plant genera into families, with several systems in use, the use of this field is optional. If institutions store family names or standard nomenclature in an abbreviated or encoded form, these must be expanded for transfer.

Example: fam "Leguminosae",

Suprageneric Rank

Transfer code: **supgenrk**

Description: A field to indicate the rank of the suprageneric name of the plant.

Rules of Syntax: Alpha; any valid suprageneric rank, below the rank of family and above the rank of genus, capitalisation of the first letter only.

Guidelines: This field must contain the full name of the rank of the suprageneric group, e.g. 'subfamily'.

Example: supgenrk "subfamily",

Suprageneric Name

Transfer code: **supgen**

Description: The supra-generic name of the plant, preceded by its rank, entered in full.

Rules of Syntax: Alphabetic, any valid suprageneric name, below the rank of family and above the rank of genus. Capitalisation of the first letter only.

Guidelines: If the name of the genus of the plant is unknown, then (if transferred) this field does provide a higher level of identification than does the **Family** name field alone.

Example: supgen "Papilionoideae",

```
Alternatively, within an ITF2, a sender has the choice of including tribes by sending the following example,
- the receiver would have the choice of accepting or refusing the additional fields.
startfile
(file information fields)
newfields "supgenrk2 (The tribe identifier within the subfamily); supgen2 (The tribe name)",
content "Because this file refers to Leguminosae - I wish to give both the subfamily name and the tribe
name so 2 new fields have been added for transfer purposes",
{
accid "97-123"
insid "TCD"
fam "Leguminosae"
supgenrk "subfamily",
supgen "Papilionoideae",
supgenrk2 "tribe",
supgen2 "Viciae",
gen "Vicia",
file details continue } endfile
```

Intergeneric Hybrid Flag

Transfer code: **genhyb**

Description: A field to indicate whether the name in the **Genus Name** field refers to an Intergeneric hybrid or an Intergeneric graft chimaera.

Rules of Syntax: If the accession is an intergeneric hybrid, then the Intergeneric Hybrid field must consist of one of the characters in the table below:

<i>Content of genhyb</i>	<i>Nature of Name in gen</i>
H	An intergeneric hybrid collective name
x	An Intergeneric Hybrid
+	An Intergeneric Graft Hybrid or Graft Chimaera

Guidelines:

1. The rules associated with these values are outlined under **Genus Name** field.
2. For interchange and data storage purposes, the value in this field for an intergeneric hybrid is a lowercase x not a multiplication sign (as specified in the International Code of Botanical Nomenclature), since the multiplication sign does not occur in the ASCII character set.
3. If an 'x' is placed in this field, then the genus name must be a valid intergeneric hybrid name, excluding the 'x'.

Example: genhyb "H",

Genus Name

Transfer code: **gen**

Description: The generic name of the plant, entered in full.

Rules of syntax: Alphabetic characters, any valid genus name, capitalisation of the first letter only.

1. The generic name must be a single word.
2. The first letter must be in uppercase (A-Z), the rest of the word in lowercase letters (a-z).
3. One or two hyphens are permitted in the word; no other characters other than the letters outlined above are permitted.

Rules of Information:

1. This field must contain one of the following:
 - 1.1 A validly published generic name under the International Code for Botanical Nomenclature (ICBN).

If the **Intergeneric Hybrid Flag** is *not* transferred, then this field must contain:

- 1.1.2 A non-hybrid name, validly published under the ICBN.

If the name of the genus of the plant is unknown, then:

- 1.1.3 This field should not be transferred. In this case, the remaining name fields should also not be transferred.

If the **Intergeneric Hybrid Flag** is H, then:

- 1.1.4 This field must contain a hybrid formula for an intergeneric hybrid name, validly published under the ICBN (*check*), e.g. *Rhododendron x Vaccinium*

If the **Intergeneric Hybrid Flag** is x, then:

- 1.1.5 This field must contain an intergeneric hybrid name, validly published under the ICBN (*check*), e.g. *Halimicistus* for x *Halimicistus sahuicii*.

If the **Intergeneric Hybrid Flag** is + (a plus sign), then:

- 1.1.6 This field must be the name of an intergeneric graft hybrid or graft chimaera, validly published under the Cultivated Code, e.g. *Crataegomespilus* for + *Crataegomespilus dardarii*.

Guidelines: One or two hyphens, no more, are permitted in generic names. All second-word elements (e.g. *Roya* in *Fitz-Roya*) should be made lowercase, e.g. as *Fitz-roya*. Other examples are *Saxe-gothaea* and *Drake-brockmania*.

Example: gen "Vicia",

Subgeneric Rank

Transfer code: **sgrk**

Description: A code to indicate the rank of data transferred in the **Subgeneric Group**.

Rules of Syntax: The value entered must be one of the values in the table below.

<i>Syntax</i>	<i>Meaning</i>
subgenus	A Subgenus
section	A Section
subsection	A Subsection
series	A Series
subseries	A Subseries

Guidelines: If the **Subgeneric Group Name** is not transferred, this field should not be transferred.

Example: sgrk “series”,

Subgeneric Group

Transfer code: **subgen**

Description: The subgeneric group of the plant entered in full.

Rules of Syntax: Alphabetic characters, any valid subgeneric group, capitalisation of the first letter only.

1. The subgeneric group must be a single word.
2. The first letter must be in uppercase (A-Z), the rest of the word in lowercase letters (a-z).
3. One or two hyphens are permitted in the word; no other characters other than the letters outlined above are permitted.

Rules of Information: This field must contain a validly published subgeneric group name. If the genus of the plant is unknown, then this field *must not* be transferred.

Guidelines: If the species epithet of the plant is unknown, then (if transferred) this field does provide a higher level of identification than does the Genus field alone.

Example: subgen “Vicia”,

Interspecific Hybrid Flag

Transfer code: **sphyb**

Description: A field to indicate if the **Species Epithet** field refers to a hybrid.

Rules of Information: If transferred, the **Interspecific Hybrid Flag** must consist of one of the characters from the table below, which refers to the following situations in the **Species Epithet** field:

<i>Content of sphyb</i>	<i>Nature of Name in sp</i>
H	A hybrid formula for an Interspecific hybrid
x	A Nothotaxon name for an Interspecific hybrid
+	An Interspecific graft hybrid or graft chimaera

If the **Species Epithet** field is *not* transferred, then this field *must not* be transferred.

Guidelines:

1. The rules associated with these values are outlined under **Species Epithet** field, see below.
2. The value stored in this field for a Nothotaxon name of an Interspecific hybrid is a lowercase x not a multiplication sign (refer to Guidelines under **Intergeneric Hybrid Flag** above).
3. The terms 'hybrid formula', 'Nothotaxa' and 'Cultivar-Group' are explained with examples in Annex1.

Example: sphyb “x”,

Species Qualifier

Transfer code: **spql**

Description: This qualifier permits the **Species Epithet** field to be used for normal species names, as well as names of aggregate (refer Guidelines 1, below) or segregate species.

Rules of Syntax:

1. If the **Species Epithet** field is *not* transferred, then this field *must not* be transferred.
2. If the **Interspecific Hybrid Flag** is transferred, then this field *must not* be transferred.

Otherwise:

3. The **Species Qualifier** consists of the characters in the table below, which refers to the following situations in **Species Epithet**:

<i>Content of spql</i>	<i>Nature of Name in sp</i>
agg.	An aggregate species
s. lat.	aggregate species (sensu lato)
s. str.	segregate species (sensu stricto)

Rules of Information:

1. If the entry is agg., then the plant has been identified to an aggregate species, and not to any of the segregate microspecies within the aggregate.
2. If this field is transferred, then **Infraspecific Rank Flag** and **Infraspecific Epithet** fields *must not* be transferred.

Guidelines:

1. An Aggregate species is a group of closely related species that are difficult to distinguish among themselves and is sometimes referred to as a whole by botanists as an aggregate species (usually with the Latin name followed by agg.); the constituent species are referred to as segregate species or microspecies. It is not possible to use the Aggregate concept at levels other than the species level.
2. The terms collective species or species groups are sometimes also used in plant names. They should be treated as for aggregate species.

Example: spql “agg”,

Species Epithet

Transfer code: **sp**

Description: The specific epithet of the name of the plant.

Rules of Syntax:

1. The specific epithet must be one word (except as in the cases of Rules of Information 1.1, 1.2, 3 and 4, below).
2. It must consist of lowercase letters (a-z), and may contain one or two hyphens.
3. The field should not be transferred if the species epithet is not known. (See Rules of Information 1.1 and Guidelines below).

Rules of Information:

1. If the **Infraspecific Hybrid Flag** is a space, this field must contain a validly published, non-hybrid specific epithet under the International Code for Botanical Nomenclature (ICBN), except in the following special cases:
 - 1.1 If the plant has not been identified to specific level, the field *must not* be transferred. (The abbreviation sp. should *not* be entered in these circumstances.)
 - 1.2 If the plant represents a new species which has not been formally described, sp. nov., sp. A, sp. 1 (or other acceptable codes) should be entered, if possible followed by a unique identifier, such as the collector's name and number or the locality.
2. If the **Infraspecific Hybrid Flag** is x, the entry in the field must be a Nothotaxon name for an Infraspecific hybrid, e.g. tellmaniana for *Lonicera x tellmaniana*.
3. If the **Infraspecific Hybrid Flag** is H, the entry in the field must be a Hybrid Formula, with the lowercase letter 'x' between the species epithets of the two parents, e.g. dichroanthum x griersonianum for *Rhododendron dichroanthum x griersonianum*.
If only one parent is known, then enter the specific epithet of that parent alone (without the lower case letter 'x').
4. If the **Infraspecific Hybrid Flag** is a +, then the entry in the field must be an Infraspecific Graft Chimaera (e.g. correlata for *Syringa + correlata*).
5. If the **Species Field Qualifier** is agg., then the entry in the field must be a validly published specific epithet under the International Code for Botanical Nomenclature (ICBN), used for the name of the group of species concerned. The word agg. should *not* be included in the entry of this field.

Guidelines: The abbreviation sp. is not used in the ITF standard if a plant has not been identified to the species level (Rule of Information 1.1 above). However, institutions may wish to store this information or to program their own internal systems so that the abbreviation sp. is printed in any paper reports of such records.

Example: sp “tellmaniana”,

Species Author

Transfer code: **spau**

Description: The author citation of the specific epithet (as given in **Species Epithet** field), in standard or standard abbreviated form¹ (alpha; any valid author abbreviation, initials and first letter of surname in uppercase, and other character as described below).

Rules of syntax:

1. The **Species Epithet** field should be filled with a valid name.
2. This field is omitted for the full name of a species aggregate.
3. Alphabetic symbols (A-Z, a-z), including fullstops, pairs of brackets, apostrophes, ampersands (&) and spaces are all valid entries for this field.
4. For the citation of joint authors, it is recommended that & is used between the last two names, *not* 'et' or 'and'. If more than two authors, then a comma , is used to separate all authors except for the last two.
5. Parenthetical author or authors in the recommended form enclosed in round brackets at the beginning of the field.

Guidelines: Names in other (non-English) alphabets may have to be transliterated into the roman alphabet for the receiving database. This field was omitted in ITF1 as it is mainly taxon based - if transferred, it applies to this accession's details only.

Example: spau "L.",

Infraspecific Rank/Hybrid Flag

Transfer code: **isprk**

Description: A field to indicate the rank or the nature of hybrid rank of the infraspecific name transferred in the **Infraspecific Epithet** field.

Rules of Syntax:

1. If the **Infraspecific Epithet** field is *not* transferred, then this field *must not* be transferred.
2. If the **Infraspecific Epithet** field is *transferred*, then this field *must* be one of the values in the table below or a combination of the codes separate by an 'x' to denote a hybrid (see examples):

<i>Content of isprk</i>	<i>Alternate isp code</i>	<i>Nature of Name in isp</i>
ss	subsp. s	Subspecies
va	var. v	Variety
sv	subvar.	Subvariety
fo	f. f	Form
sf	subf.	Subform
nss		Nothosubspecies
nva		Nothovariety
nfo		Nothoform

To allow precision where two similar ranks or two different ranks are involved in a hybrid, use the above two letter code separated by 'x'. See following examples.

<i>Content of isprk</i>	<i>Nature of Name in isp</i>
ssxss	Hybrid between 2 subspecies
ssxva	Hybrid between a subspecies and a variety
ssxfo	Hybrid between a subspecies and a form
vaxsf	Hybrid between a variety and a subform
... etc.	

Guidelines: ICBN suggests that a nothotaxon need not be indicated as such; for example *Polypodium vulgare* nothosubsp. *mantoniae* (Rothm.) Schidley could be written *Polypodium vulgare* subsp. *mantoniae*. (See ICBN Article H.3.4. Note 1), but because such a small modification was needed at this rank to retain this distinction, it was felt to be a pity not to keep the difference if required.

Unlike ITF1, Cultivar-Group epithets are no longer flagged in this field - (See **Cultivar-Group**).

Annex 1 explains the meaning of the various hybrid terms used above, in particular the difference between Hybrid Formulae Names, Nothotaxa and Cultivar-Group epithets.

Example: isprk "ss",

¹ Brummitt, R.K. & Powell, C.E. (1992) Authors of plant names (Royal Botanic Gardens: Kew) is one recommended standard of author abbreviations.

Infraspecific Epithet

Transfer code: **isp**

Description: The epithet of the *lowest* infraspecific rank of the name of the plant.

Rules of Syntax:

1. The entry must be one word (except as outline in Rules of Information, below).
2. It must only consist of lowercase letters (a-z), and may contain one or two hyphens. No other characters are allowed (except in the case of Rules of Information 1.1 & 2, below).
3. The field *may* be left unfilled to indicate that the plant is not identified below the species level. It *must not* be transferred if the species epithet is not known.

Rules of Information:

1. If the **Infraspecific Rank/Hybrid Flag** is subsp. var., subvar., f. or subf., then the entry must be an epithet in the rank denoted by that field, validly published under the International Code for Botanical Nomenclature (ICBN), except in the following special case:
 - 1.1 Where a new infraspecific taxon has not been formally described, subsp. nov., var. nov., subvar. nov., f. nov., or subf. nov. may be entered, if possible followed by a unique identifier, such as the collector's name and number or the locality.
2. If the **Infraspecific Rank/Hybrid Flag** value indicates a Hybrid Formula, the lowercase letter x *must* be included between the species epithets of the two parents. (Example 9 & 10 of Table 1)
If only one parent is known, then enter the infraspecific epithet of that parent alone, without the lower case letter x. (Example 7 of Table 1).

Guidelines:

1. Under the rules of the International Code for Botanical Nomenclature (ICBN), every trinomial below the level of species is unique. Hence, *Rhododendron arboreum* subsp. *delavayi* var. *peramoemum* can be known uniquely as *Rhododendron arboreum* var. *peramoemum*. Therefore the name can consist of the genus, the species and the *lowest* infraspecific taxon, qualified by its rank.
2. Annex I explains the meaning of the various hybrid terms used above, in particular the difference between Hybrid Formulae names and Nothotaxa.

Example: isp “delavayi”,

Infraspecific Author

Transfer code: **ispau**

Description: The author citation of the lowest infraspecific epithet, in standard abbreviated form.

Rules of Syntax: See under **Species Author** field, above.

Guidelines: See under **Species Author** field.

Example: ispau “Brown, J.S.”,

Second Infraspecific Rank Flag

Transfer code: **isp2rk**

Description: An additional field to indicate the rank of the *second lowest* infraspecific name (as given in isp2), which is at a higher level to that of the **Infraspecific Epithet** field. This is used when a full taxonomic name is required (refer Guidelines).

Rules of Syntax: See under **Infraspecific Rank/Hybrid Flag**, above. Note: these additional fields are for non-hybrid infraspecific taxa, *not* for hybrids, Collective names or cultivars.

Guidelines: This field is *not* part of the original ITF1 standard, but has been included for those institutions who wish to transfer and/or receive a complete taxonomic name in a form which is more easily inserted into a database than the **Full Name** field. When more than one infraspecific name is being transferred, the following fields refer to the *lowest* level infraspecific name: **Infraspecific Rank Flag**, **Infraspecific Epithet**, and **Infraspecific Author**; whereas, the **Second Infraspecific Rank Flag**, **Second Infraspecific Epithet**, and **Second Infraspecific Author** all refers to the *second lowest* level of infraspecific name (e.g. var. and subsp., respectively).

If institutions wish to transfer more than two levels of infraspecific names in this format, then the *third lowest* level has the number 3 included in the *Transfer Code* identifier (e.g. isp3rk, isp3, isp3au), and so on, as appropriate.

Example: isp2rk “var.”,

Second Intraspecific Epithet

Transfer code: **isp2**

Description: An additional field for the epithet of the *second lowest* infraspecific rank of the name of the plant, when a full taxonomic name is required (refer *Guidelines* under **Second Intraspecific Rank Flag** field, above).

Rules of Syntax: See under **Intraspecific Epithet** field, above. Note: these additional fields are for non-hybrid infraspecific taxa, *not* for hybrids, Collective names or cultivars.

Guidelines: This field is *not* part of the original ITF1 standard (refer *Guidelines* under **Second Intraspecific Rank Flag** field, above).

Example: isp2 “rodriguesii”,

Second Intraspecific Author

Transfer code: **isp2au**

Description: An additional field for the author citation of the *second lowest* infraspecific epithet, in standard abbreviated form.

Rules of Information: See under **Intraspecific Author** field, above. Note: these additional fields are for non-hybrid infraspecific taxa, *not* for hybrids, Collective names or cultivars.

Guidelines: This field is *not* part of the ITF standard (refer *Guidelines* under **Second Intraspecific Rank Flag** field, above).

Example: isp2au “Jones, J.W.”,

Vernacular Names

Transfer code: **vernam**

Description: A free text field to allow for the inclusion of vernacular (common) plant names.

Rules of Syntax: Vernacular name which is optionally followed by language and/or locality of each name in round parentheses ().

Guidelines: Because the same vernacular name can be used for unrelated taxa in different localities, it is recommended that the additional information in parentheses be entered, as it helps source the given vernacular name.

Example; vernam “Sweetpea (UK)”,

CULTIVATED PLANT NAMES

Rules for naming agricultural, forestry and horticultural plants have recently been revised in the *International Code of Nomenclature for Cultivated Plants* (ICNCP) (P. Trehane, ed, 1995, Quaterjack Publishing). ITF version 2 allows compatibility with this code by introducing two new fields, the *Cultivar-Group Epithet* and the *Trade Designation*, in addition to the *Cultivar Epithet* field which existed under ITF1. These three fields allow plants in cultivation to be named accurately in accordance with the rules of the ICNCP. For full details of the application of these rules, the reader should consult the reference given above. In practice, the only names that may be used in this code are the Cultivar epithet, the Cultivar-Group epithet, and the Trade Designation (or other similar trade name). Most plants arising in cultivation will not have epithets at all three ranks.

Signs to indicate hybrids (x) or graft chimera (+) must NOT be used in any of the following three fields - these should be flagged in the appropriate field. Authors' names are not required by the ICNCP, and should not be appended to the names given at any of the three ranks.

Examples:

1. *Brassica oleracea* Cauliflower Group
gen “Brassica”
sp “oleracea”
culgrp “Cauliflower”
cul “*”
trades “*”
2. *Dracaena fragrans* (Deremensis Group) 'Christianne'

gen "Dracaena"
sp "fragrans"
culgrp "Deremensis"
cul "Christianne"
trades ""*

* Blank entries would not be transferred

3. *Choisya ternata* 'Lich'
gen "Choisya"
sp "ternata"
culgrp ""*
cul "Lich"
Trade Designation = Sundance

Hybrids are not allowed for at any of the three ranks, but these can be tracked using the parentage fields.

Cultivar-Group

Transfer code: **culgrp**

Description: The Cultivar-Group epithet of a plant.

Rules of Syntax:

1. An entry in this field should consist solely of the Cultivar-Group epithet.
2. If the accession cannot be assigned to a Cultivar-Group, then the field should not be transferred.
3. A Cultivar-Group epithet must be a word or phrase of not more than three words, normally in a modern language. This epithet must not contain any punctuation other than apostrophe ('), comma (,), hyphen (-), or period/full stop (.).

Rules of Information:

1. The Cultivar-Group epithet must be established under the rules of the ICNCP. This field should NOT contain a cultivar epithet or trade designation.
2. The first letter of each word of Cultivar-Group epithet should be upper case, unless linguistic practice dictates otherwise (e.g. prepositions.).
3. The Cultivar-Group epithet should NOT be enclosed in parentheses (these can easily be appended to the information contained in this field in output programs if required).
4. If more than one Cultivar-Group has been designated for a particular cultivar, separate each of these Cultivar-Group epithets with a semicolon. For example, "xxxx; yyyy;"

Guidelines:

1. A Cultivar-Group is an assemblage of similar, named cultivars within a genus or species (including hybrid genera and species). For further details, see Article 4 of the ICNCP.
2. Cultivar-Group epithets are written as contained between round (parentheses) *or* square brackets when a cultivar epithet or trade designation is given; if no cultivar epithet or trade designation is given then these brackets are omitted. The word 'Group' always terminates the Cultivar-Group epithet: e.g. *Brassica oleracea* Cauliflower Group, *Dracaena fragrans* (Deremensis Group) 'Christianne' *or* *Dracaena fragrans* [Deremensis Group] 'Christianne'.
3. The word 'Group' should not be transferred. However institutions may wish to store the word internally and strip it out for transfer, or to program their own internal systems so that the word 'Group' is printed in any hardcopy reports of such records. (See Guidelines 2).

Example: culgrp "Deremensis",

Cultivar Epithet

Transfer code: **cul**

Description: The cultivar epithet of the plant.

Rules of Syntax: The entry should consist solely of the cultivar epithet. The abbreviation 'cv.' should not be used (except under Rules of Information 2), nor should the entry be enclosed in single quotes (these should be added in printed outputs only, not transferred by ITF).

Rules of Information:

1. The cultivar must be a valid name published under the International Code of Nomenclature for Cultivated Plants (see Article 17).
2. If the taxon is known to be a cultivar but does not yet have an epithet established or determined, the abbreviation 'cv.' should be entered in the field.

- The first character of each word in a cultivar epithet should be in upper case (capitals), unless linguistic practice dictates otherwise (e.g. prepositions).

Guidelines:

- A cultivar is part of the variation of cultivated plants being clearly distinguished by attributes that are distinct, uniform, stable and are retained when propagated by a suitable means. For further details, see Article 2 of the ICNCP.
- The cultivar epithet is written in outputs enclosed in single quotes, e.g. *Citrullus lanatus* 'Sugar Baby'. Double quotation marks or the abbreviation prefix 'cv. ' are NOT permitted under the ICNCP.

Example: cul "Sugar Baby",

Trade Designation

Transfer code: **trades**

Description: The marketing name of a taxon which is used in place of the accepted cultivar epithet.

Rules of Syntax:

- An entry in this field should consist solely of the trade designation, if applicable.
- If the accession does not bear a trade designation, this field should be left blank.

Rules of Information: The trade name must be a valid name published under the International Code of Nomenclature for Cultivated Plants and accepted by the International Registration Authority for the group concerned.

Guidelines: Trade designations are not acceptable epithets under the Rules of the International Code of Nomenclature for Cultivated Plants. They are coined solely for marketing purposes and are used in place of, or in addition to, a cultivar epithet.

Example: trades "Sundance",

Full Name

Transfer code: **fulnam**

Description: The full name of the plant, including full author citation, hybrid name, hybrid formula, collective name, cultivar name (as appropriate).

Rules of syntax: All previous rules, as described under the above name fields apply in this field. Free text field.

Guidelines: This field allow the full taxonomic name (including author citation), horticultural tradenames and patents, as well as quadrinomials or pentanomials. The reduction of a plant name to a trinomial (as in strict ITF1 format) results in the loss of much of the nomenclatural and associated information.

Example: fulnam "Rhododendron cinnabarinum subsp. cinnabarinum x subsp. xanthocodon",

Rank Qualified Flag

Transfer code: **rkql**

Description: The lowest name/epithet of the taxon qualified by the entry in field **Identification Qualifier** field (see below).

Rules of Syntax: If the **Identification Qualifier** field is transferred, then the entry in this field *must* be one of the values in the table below:

<i>Content of Field</i>	<i>Rank qualified</i>
B	Below Family
F	Family
G	Genus
S	Species
I	first Intraspecific Epithet
J	second Intraspecific Epithet (new for ITF2)
C	Cultivar

In each of these cases, the entry in the field that is qualified (e.g. Species, Cultivar) must be transferred.

If the **Identification Qualifier** Field is *not* transferred, then this field *must not* be transferred.

Example: rkql "G",

Identification Qualifier

Transfer code: **idql**

Description: A standard term to qualify the identification of the taxon when doubts have arisen while comparing the plant and the plant description; see introductory note (under C. Plant Name) and previous field.

Rules of Syntax: If the identification does not require qualification, then this field must not be transferred. If there is any doubt about the identification of the plant record, then this field must contain one of the following:

<i>Conventional Notation</i>	<i>Meaning</i>
aff.	Akin to or bordering
cf.	Compare with
Incorrect	Incorrect
forsan	Perhaps
near	Close to
?	Questionable

Most of above meanings are taken from Stearn, W.T. (1973). 'Botanical Latin' (David & Charles: Newton Abbot).

Guidelines:

1. The 'Incorrect' coding has been introduced into ITF2 to mark an identification where the name applied is definitely incorrect, but a new name has not yet been assigned.
2. At the generic level, the symbol '?' is normally the only identification qualifier used.
3. The symbol '?' is to be interpreted as 'possibly not' the correct name of the rank nominated in the Rank Qualified Flag (**rank**) field. The '?' clarifies which name or epithet is questioned (usually the lowest rank).
4. The '?' symbol is not to be used to express doubts concerning the lumping or splitting of certain taxa.

Example: idql "cf.",

Examples of Plant Names expressed in the ITF

1. A species

gen "Lilium",
sp "superbum",

2. An infraspecies

gen "Cypripedium",
sp "calceolus",
isprk "var.",
isp "pubescens",

3. A series

gen "Rhododendron",
subgen "ser.",
sp "madenii",

4. A Cultivar

gen "Pelargonium",
sp "zonale",
culnam "Pink Baby",

5. A Nothotaxon name for an Intraspecific Hybrid

gen "Rhododendron",
sphyb "x",
sp "praecox",

6. A Group Hybrid

gen "Brassica",
sp "oleracea",
culgrp "Acephala",
cul "Bornick"

7. Interspecific Hybrid Formula (with only one Parent known)

gen "Rhododendron",
sphyb "x",
sp "wardii",

8. A hybrid between 2 subspecies of the same species

gen "Asplenium",
sp "trichomanes",
isprk "ssxss",
isp "quadrivalens x trichomanes",

9. A hybrid between 2 infraspecific ranks of the same species that are different

gen "Cochlearia",
sp "officinalis",
isprk "ssxva",
isp "officinalis x alpina",

10. A hybrid between 2 subspecies of 2 different species

gen "Asplenium",
sphyb "H",
sp "adiantum-nigrum x trichomanes",
isprk "ssxss",
isp "onopteris x trichomanes",

Table 1

D. VERIFICATION DATA

This set of fields indicates the degree of confidence that can be placed in the identification of the plant's name. Clearly, in the course of its life in a particular botanic garden, an individual species may be identified several times, by different people, possibly with different results. The garden should send the information they regard as most accurate and relevant. Usually this field refers to the most recent identification, but individual gardens will rely on their own knowledge in such situations. The confidence in a plant name is also influenced by the quality of the references used for identification.

Verification Level

Transfer code: **vlev**

Description: The level to which the identification of the plant has been verified.

Rules of Syntax:

1. If transferred, the entry must be one of the values in the table below:

<i>Syntax</i>	<i>Meaning</i>
U	It is not known if the name of the plant has been checked by an authority.
0 (Zero)	The name of the plant has not been determined by any authority
1	The name of the plant has been determined by comparison with other named plants
2	The name of the plant has been determined by a taxonomist or other competent person using the facilities of a library and/or herbarium, or other documented living material
3	The name of the plant has been determined by a taxonomist who is currently or has been recently involved in a revision of the family or genus
4	The plant represents all or part of the type material on which the name was based, or the plant has been derived therefore by asexual propagation

Guidelines: Accessions may have multiple verifications; for transfer, please use the name currently accepted in the establishment holding the accession, verified to the highest level. The code 'U' has been introduced in ITF2 to make the distinction between a plant not determined ever, or not known to have been determined.

Example: vlev "U",

Verifier's Name

Transfer code: **vnam**

Description: The name of the person or persons followed by their institution who verified the identification of the plant, as qualified in the previous field.

Rules of Syntax: Alphabetic. If Verification Level field (**vlev**) is U or zero, then this field is not applicable and should not be transferred.

Guidelines:

1. The verifier's family name (surname - with initial letter uppercase) followed by comma and space (,) then initials of given names (in uppercase and each followed by a full stop, without spaces). Titles should be omitted.
2. If two names are needed, each name (as formatted in point 1 above) is separated by a comma and a space. If several names are needed, then the first name (as formatted in point 1 above) may be followed by 'et al.'
3. It is recommended that the verifier's institution also be cited (as acronym) in round parentheses.

Example: vname "Waldren, S. (TCD)

Verification Date

Transfer code: **vdat**

Description: The date on which the name of the plant was verified.

Rules of Syntax: Integer, year (4 digits) followed by month (2 digits) and the day (2 digits), without spaces between them. If Verification Level field (**vlev**) is U or zero, then this field is not applicable and should not be transferred.

1. In this notation, leading zeros must be included for months and days, i.e. March is coded as '03' not '3' and the 6th day is coded as '06' not '6'.

Example: 19741008 8 October 1974
 19120209 9 February 1912

2. If the day of the month is not known, the last two digits should be omitted.

- Example:* April 1881 would be transferred as 188104.
3. If the day and the month are not known, the last four digits should be omitted and just the 4 digits of the year information interchanged.
- Guidelines:* The ITF records the year as a full 4-digit number to facilitate the use of the system in the next century, as well as to track verifications from the previous century.
- Example:* vdate 19930212,

Verification Literature

Transfer code: **vlit**

Description: Citation of literature used for identification.

Rules of Syntax: Alphanumeric, free-text field; cite each journal or book title, followed by volume, year and pages (as relevant) - each component separated by comma and space.

Guidelines: Where multiple references are used, the most useful reference should be mentioned first, and each reference is separated by semi-colons ';'.
Example: vlit "Curtis Botanical Magazine Volume 19 Part 4 November 1996 page 192",

Verification History

Transfer code: **vhist**

Description: Annotation of previous identifications, stating plant name, verifier, date, and reference.

Rules of Syntax: Alphanumeric, free-text field.

Guidelines: This field combines the previous single entry fields of **Verification Level**, **Verifier's Name**, **Verification Date** and **Verification Literature** into one free text field, separated by a semicolon (;) for each unique verification, when the plant is re-inspected and re-verified. It should be noted that free text make 'databasing comparisons and selection' more difficult. An alternative suggestion is to keep these fields separate and call them **vlev2 vnam2 vdat2 vlit2** and **vpnam2**² for example, moving on to **vlev3, vnam3 vdat3 vlit3 vpnam3** etc. as re-verification makes the new fields necessary.

If this second option is used, then the new field names should be noted in the **New Field Option** section of the file header. There is no 'recommended' alternative as to which method is better - **Verification History** in ITF2 has been combined because in the majority of cases, institutions will view this field as of historical interest, and will not be working 'actively' on selecting and comparing this field

Example: vhist "1 Szwed, W 198303 THAISZIA vol 1, no.2 1992; next verification history",

E. SOURCE DATA

This set of fields records the source of the accession, i.e. how the botanic garden obtained the living plant. This is vitally important for conservation purposes, where plants of known wild source origin are far more valuable than plants whose origins are not known.

The first two fields provide a key to the types of sources for the accessions. It is important that these be completed as far as possible. The remaining, more extensive fields provide the actual data on the source of the plant, such as information on the collector(s) and about the location where the plant was obtained.

Provenance Type Flag

Transfer code: **prot**

Description: A code to indicate the provenance of the accession.

Rules of Syntax:

- If transferred, the entry must be one of the following values:

<i>Syntax</i>	<i>Meaning</i>
W	Accession of wild source
Z	Propagule(s) from a wild source plant in cultivation
G	Accession not of wild source
U	Insufficient data to determine which of the above categories apply

Rules of Information: The terms outlined above are defined as follows:

W Accessions which originate from material collected in the wild. The accession has not been propagated further, except in the case of plants that may have been grown on from the original stock. The accession may have come directly from the wild, or from a botanic garden or gene bank acting as a distribution centre. Recent accessions in this category should have accompanying

² **vpnam** - the verified plantname given at this verification/identification if different to the current plantname

collection data, but the category may also include older accessions which are known to be of direct wild origin but which do not have such additional data.

- Z Accessions derived by propagation directly from an original wild source plant. The method of propagation must be recorded in the Propagation History field. If the propagation is not directly from the original wild source plant, a *complete* history of the intermediate propagation steps *must* be known, otherwise the accession should be placed in the following category.
- G Accessions derived from cultivated plants where the immediate source plant does not have a propagation history that can be traced in detail to a wild plant. This category normally includes all cultivars.
- U Accessions where there is insufficient data or knowledge to know which of the three above categories applies.

Guidelines: It is recommended that gardens should always note the **Provenance Type Flag** of an accession, as plants of wild source are of particular interest for conservation purposes.

Example: prot "W",

Wild Provenance Status Flag

Transfer code: **wpst**

Description: A code to clarify the status of a recorded 'wild' provenance accession.

Rules of Syntax: The entry must be one of the four 'wild' provenance status flags as shown

<i>Syntax</i>	<i>Meaning</i>
Wild native	Endemic found within its indigenous range
Wild non-native	Plant found outside its indigenous range
Cultivated native	Endemic known to have been cultivated and re-introduced or translocated within its indigenous range.
Cultivated non-native	Plant known to be cultivated and found outside its indigenous range.

Guidelines: This field is trying to provide a means to record the status of an accession in its collection site that is compatible with the Plant Occurrence and Status Scheme (POSS) standard version 2.0 (Gillett *et al.* 1997). The main use of this scheme is to describe plant distributions in databases; the data therefore relates to taxa rather than accessions, and as such, is usually beyond the realm of botanic garden accession managers.

However this simpler field flags a plant accession as a 'native' or an 'exotic' as a part of its source data, which is useful for 'plant management' and may increasingly become of interest use to organisations storing plant distribution data, such as the World Conservation Monitoring Centre based in Cambridge, U.K.

Example: wpst "Wild native",

Propagation History Flag

Transfer code: **prohis**

Description: A code to indicate the nature of the production of the plant material being accessioned, for use in association with the previous field, **Provenance Type**.

Rules of Syntax: A single or two letter uppercase alphabetic letter, as designated below.

1. The entry must be one of the following values:

<i>Syntax</i>	<i>Meaning</i>
I	Individual wild plant(s)
S	Plant material arising from sexual reproduction (excluding apomixis)
SA	From open breeding
SB	From controlled breeding
SC	From plants that are isolated and definitely self-pollinated
V	Plant material derived asexually
VA	From vegetative reproduction
VB	From apomictic cloning (agamospermy)
U	Propagation history uncertain, or no information.

Guidelines:

1. The second character is optional to provide more detailed information to be recorded. It is recommended that both characters are used wherever possible.
2. The value 'I' refers to complete individuals (or rametes) that have been removed from the wild, or to accessions which are growing naturally within the area of the establishment to which the record system applies. For example, this allows for individuals or groups of individual growing naturally (i.e. not deliberately introduced) in reserve areas to receive full accession status.
3. Seed set by apomixis should be coded 'VB' rather than by any of the 'S' codes.

4. Most wild collected seed will be the result of open breeding, and even taxa which are fully self-compatible will normally show a small amount of outbreeding. Only if it is absolutely certain that wild-collected seed was set as the result of selfing (e.g. cleistogamy, controlled selfing *etc.*) should the entry be set to 'SC'. Occasionally wild-collected seed will be the result of controlled experimental pollinations, where the entry should be set to 'SB' (or 'SC' if selfed), but the majority of wild seed should be coded 'SA'.
 5. Where material has been derived from cuttings, divisions, or other vegetative propagules (including material for micropropagation) of wild plants, the entry should be set to 'VA', and *not* 'I'. Such vegetative propagules may *potentially* differ slightly from the wild individual by somatic variation.
 6. If the accession is of wild provenance (Provenance Type = W), Propagation History cannot be U.
 7. If Propagation History is 'I' (individual wild plants), Provenance Type must be 'W'.
 8. 'U' should be used if there is insufficient information.
- Example:* phist "I",

For Conservation purposes, accessions may be conveniently graded as 1, 2, or 3.

Grade 1 plants are of the greatest importance to the conservation of wild species. The plant material is a genetic sample of the wild population. Sexually produced material is to be preferred to clonal material when available as this is capable of expressing greater genetic variation, and because there is a slight chance of somaclonal variation occurring in clonal material; i.e.

W S	Plants grown from seed collected in the wild and germinated in the garden
W SA	
W SB	
W SC	
W V	Plants grown wild collected cuttings
W VA	
W VB	
Z V	Cuttings grown from a garden grown plant of known wild origin
Z VA	
Z VB	
W I	Individual growing <i>in-situ</i> , or individual removed from the wild.

Grade 2 plants. It is very difficult to recreate natural breeding conditions in cultivation and therefore plants derived from this source can deviate genetically from wild plants as they may have been affected by the artificial conditions of cultivation. For example, genetic modification can come about by inbreeding depression or by selection of plants that are fittest under cultural rather than wild conditions. However, in certain circumstances, Grade 2 plants can have great relevance to conservation: the controlled breeding of plants that do not reproduce in the wild would be one example; i.e.

Z SB	Seed sample set under controlled breeding of garden grown plants of known wild origin
Z SC	Seed produced by open breeding in a situation where a species is so isolated from close relatives that there is no chance of hybridization or where any hybrid would be so obvious that it would be immediately noticed (i.e. monotypic genera).

Although all Z S propagated material are counted as *grade 2 plants*, the above examples may sometimes be differentiated as 'being of greater conservation value' than a Z S or a Z SA propagated plant.

Grade 3 plants may include plants of great relevance to the conservation of cultivated plants, e.g. old crop varieties or when no grade 1 or 2 material is left; i.e.

G SA	Seed set by botanic garden plant of unknown origin by open breeding
G VA	Plant grown from cuttings of garden/cultivated plants; i.e. plants 'not of wild origin'.

Guidelines: It is unlikely that collectors' data would be available when the accession has a **Provenance Type Flag** 'G' or 'U'.

Accession Lineage

Transfer code: **acclin**

Description: The purpose of this field is to trace the lineage of an accession to either one or two immediate parent accession ids. Accession codes provided in this field identify both the accession AND the garden holding that accession.

Rules of Syntax:

1. It is obligatory that the accession id be preceded by the parent's garden code to avoid ambiguity, and allows accessions be traced as they are passed from one garden to another.
2. Where an accession has arisen by selfing or any method of asexual reproduction, the Accession parent should indicate the identifier of the source material, preceded by the garden code of the establishment holding the source accession.
3. Where an accession has been derived from a specific cross, the accession identifier of the male (pollen) parent should be given before the accession identifier of the female (seed) parent; in both cases the garden code should precede these identifiers. The two accession identifiers should be separated by commas.
4. If it is not known which is the pollen parent, the two accession identifiers should be separated by a forward slash (/)
5. The exact method of propagation (selfing, vegetative *etc.*) is defined by the Propagation History field, and does not need to be recorded in the Accession Parent field.

Examples

1. If the value for Accession Parent is **TCD19930026**, this indicates that the accession was derived from the specimen(s) assigned to the accession number 19930026 held at Trinity College Dublin. The accession may have been derived by selfing or by asexual propagation, this will be indicated by the value assigned to the Propagation History field.
2. If the value for the Accession Parent is **K19650056,NSW19741234**, this indicates that the accession is derived from a cross between the pollen parent 19650056 held at the Royal Botanic Gardens, Kew, UK and the seed parent 19741234 held at the Royal Botanic Gardens, Sydney, Australia.

Guidelines: Due to the complicated issues involved in lineage, it has been decided that it is beyond to scope for the ITF to be able to track lineage indefinitely. If an institution wishes to track lineage 'further back', then a separate ITF file or accession record can be sent which details the immediate parentage for each parent as separate ITF accession id. The onus is on the receiving garden to assemble the complete lineage for an accession, if required.

Example: acclin "K19650056",

Donor Type Flag

Transfer code: **dont**

Description: A code to indicate the type of immediate donor from which the accession was obtained. This may not be necessarily be the original collector of wild material.

Rules of Syntax: A single uppercase alphabetic letter, as designated below.

1. The entry must consist of one of the following characters:

<i>Syntax</i>	<i>Meaning</i>
E	Expedition
G	Gene bank
B	Botanic Garden or Arboretum
R	Other research, field or experimental station
S	Staff of the botanic garden to which record system applies
U	University Department
H	Horticultural Association or Garden Club
M	Municipal department
N	Nursery or other commercial establishment
I	Individual
O	Other
U	Unknown
2. If there is doubt as to which entry is correct, or if more than one entry applies (e.g. a plant collected by the botanic garden staff on an expedition) - a garden should be consistent in its use.

Guidelines: The purpose of this field is to allow the inclusion of information about the content of the **Donor** Field. If the value for **Donor Type Flag** is O, the **Donor** field description should be worded so as to indicate the type of donor. It should be noted that not all members of the ITF2 Review group viewed this data as important for transfer with an accession record. It was one of the original fields in ITF version 01.00 and as such is retained.

Example: dont "S",

Donor

Transfer code: **don**

Description: The person, institution or business from which the accession was obtained.

Rules of Syntax: Free text field.

Rules of Information: Plant material may come to a garden from many sources and in various ways. The information under these headings cannot be coded or fully standardised.

Guidelines:

1. Accessions obtained directly from the wild, are usually received from the collector. If the collectors' information is given, and this field is not sent because it has not been transferred, then it can be presumed that the collector was the donor. Alternatively, mark 'See Collector's information' or words to that effect.
2. Accessions obtained from other Botanic Gardens. Instead of the name, use the standard Institution Code e.g. K, CGG, AAH, MO.
3. Accessions obtained from private individuals. The minimum information should be the name (surname, comma, space, initials with full stops) and country. More detail, such as town and province, could be added if space permits.
4. Accessions obtained from horticultural or specialist plant societies. The name of the society (truncated as necessary) followed by the name of the country in which the society is based. Avoid abbreviations where the meaning is not clear.
5. Accessions obtained from gene banks, urban parks, garden centres or commercial suppliers. The name of institution (truncated as necessary) followed by the name of the country in which the institution is based.

Example: don "TCD",

Donor's Accession Identifier

Transfer code: **donacc**

Description: Used when an accession is transferred from one *garden or gene bank* (or other institution that maintains a record system) to another, this is the unique identifier from the *previous* garden or other institution's record system.

Rules of Syntax: Alphanumeric, the **Donor's Accession Identifier** may consist of any characters in the ASCII character subset as defined in Annex 2. It must be prefaced by the garden code of the donating botanic garden.

Rules of Information: If the plant was originally collected by or for the garden from the wild, or came from a source that did not have a record system, this field should be left blank.

Otherwise, the **Donor's Accession Identifier** should be a unique set of characters that identifies each accession in the donor's record system. Or in the case of multiple accessions of the same taxon from one collection site or multiple plants derived from a single seed sowing, a single value for the **Donor's Accession Identifier** field is permissible.

Guidelines: This field is *not* the Collector's number for the accession; that data are held under the **Collector's Identifier** field.

Example: donacc "TCD76-234"

F. PLACE OF ORIGIN

This group of fields deals with all the descriptive and coded information that describes the geographic position from which a plant was collected, including supporting data such as altitude, depth (for aquatic plants), and degree of precision in citing the locality details, together with the names of the collectors.

Where relevant, all of the standard ITF2 fields in this group refer to the original wild source collection information. That is, the information recorded in these fields (e.g. **Collection Date, Primary Collector's Name, Country of Origin, Habitat, Locality, Collection Notes, Primary Subdivision of Country of Origin, Secondary Subdivision of Country of Origin, Specific Geographical Unit**), all refer to the original wild source collection.

The geographical referencing data information of the 'Place of Origin' data are held in a hierarchy of 5 levels. These are:

1. Latitude and Longitude.
2.
 - a) Political country (written in full), strictly following the ISO system;
 - b) Political country (codified), according to the ISO system;
3. Basic Recording Unit of the World Geographical Scheme;
4. A defined subdivision of the ISO unit;
 - a) Primary subdivision of Country of Origin;
 - b) Secondary subdivision of Country of Origin;
5. The locality;
 - a) Specific Geographical Unit;
 - b) Locality in text format.

Because 'Biodiversity and Conservation' are such a priority today, and those issues alone make a good case for keeping records of plant origins, ITF 2.0 has created a separate field for conservation reserves (Specific Geographical Unit) rather than including it in Locality as in ITF 01.00.

The information relates to the place where the plant was collected, *not* to the full distributional range of the plant. The latter is not incorporated in the ITF because it should be supplied to garden record databases from taxonomic, conservation or geographic databases.

Annex 3 on "**An International Transfer Format for plant taxon information**" gives further information on the transfer of 'non accession based' or taxon data.

ITF records the original wild source collection information. However, if the current accession was taken from a secondary source (e.g. cultivated material, of known or unknown wild source), and the PLACE OF ORIGIN and COLLECTION fields were to be recorded for the secondary source, then it is suggested that the relevant field identifiers would all be prefaced by the word 'Subsequent' and the relevant Transfer Codes would be prefaced by a lowercase 's'.

That is, the field which contains the information about the collector's name of the current accession which was taken from cultivated material would be known as 'Subsequent Collector's Name' and the Transfer Code would be '**scnam**'. The same 'Rules of Syntax' apply as for the relevant 'primary' data fields.

If ITF files are transferred using these fields, it is recommended that the **Description of File Content and Other Comments** field advises file recipients of its use.

An example of the above might be when plant material is taken from a location where it is known 're-introduction' or translocation has taken place.

Latitude, Degrees

Transfer code: **latdeg**

Description: The degrees of latitude of the collection locality.

Rules of Syntax: Integer, any valid and geographically meaningful latitude in degrees.

Rules of Information: Degrees - within the range 0 - 90.

Guidelines:

1. Sensitive location information for rare and/or endangered plants can be omitted from the interchange record by not transferring the seconds from the latsec and lonsec fields for latitude and longitude, respectively
2. If the latitude is not known, then this and the following latitude fields should not be transferred.
3. If this field is transferred, then the last latitude field (**Latitude, Direction**) must consist of one of the letters 'N' or 'S' (for North or South).
4. The geographical referencing data information must be interchanged as latitude and longitude in degrees, minutes, seconds and direction. Decimal degrees must be converted to degrees, minutes and seconds before the data are interchanged..
5. Grid references should be converted to degrees, minutes, seconds and direction before data are interchanged.

Example: latdeg 22,

Latitude, Minutes

Transfer code: **latmin**

Description: The minutes of latitude of the collection locality.

Rules of Syntax: Integer, any valid and bio-geographically meaningful latitude in minutes.

Rules of Information: Minutes - within the range 0 - 59.

Guidelines:

1. If the latitude degrees (**Latitude, Degrees** field) is not known, then this and the following latitude fields should not be transferred.
2. If the latitude minutes (**Latitude, Minutes** field) is not known, then this and latitude seconds (**Latitude, Seconds** Field) should not be transferred.

Example: latmin 05,

Latitude, Seconds

Transfer code: **latsec**

Description: The seconds of latitude of the collection locality.

Rules of Syntax: Integer, any valid and bio-geographically meaningful latitude in seconds.

Rules of Information: Seconds - within the range 0 - 59.

Guidelines: If the value for this field is unknown, then this field should not be transferred. This field, although known, may also be deliberately omitted in order to keep sensitive locations imprecise.

Example: latsec 01,

Latitude, Direction

Transfer code: **latdir**

Description: The standard abbreviated direction of latitude of the collection locality.

Rules of Syntax: Alphabetic, N or S.

Guidelines: If **Latitude, Degrees** field is transferred, then this field (latdir) must consist of one of the letters 'N' or 'S' (for North or South).

Example: latdir "N",

Longitude, Degrees

Transfer code: **londeg**

Description: The degrees of longitude of the collection locality.

Rules of Syntax: Integer, any valid and bio-geographically meaningful longitude in degrees.

Rules of Information: Degrees - within the range 0 - 180.

Guidelines:

1. Exact location information for rare and/or endangered plants can be omitted from the transfer record by not transferring the seconds from the **latsec** and **lonsec** fields for latitude and longitude, respectively
2. If the longitude is not known, then this and the following longitude fields should not be transferred
3. If this field is transferred, then the last longitude field (**Longitude, Direction**) must consist of one of the letters 'E' or 'W' (for East or West)

4. The geographical referencing data information must be interchanged as latitude and longitude in degrees, minutes, seconds and direction. Decimal degrees must be converted to degrees, minutes and seconds before the data are transferred
5. Grid references should be converted to degrees, minutes, seconds and direction before data are transferred.

Example: londeg 103,

Longitude, Minutes

Transfer code: **lonmin**

Description: The minutes of longitude of the collection locality.

Rules of Syntax: Integer, any valid and bio-geographically meaningful longitude in minutes.

Rules of Information: Minutes within the range 0 - 59.

Guidelines:

1. If the longitude degrees (**Longitude, Degrees** field) are not known, then this and the following longitude fields should not be transferred
2. If the longitude minutes (**Longitude, Minutes** field) are not known, then this and longitude seconds (**Longitude, Seconds** field) should not be transferred.

Example: lonmin 05,

Longitude, Seconds

Transfer code: **lonsec**

Description: The seconds of longitude of the collection locality.

Rules of Syntax: Integer, any valid and bio-geographically meaningful longitude in seconds.

Rules of Information: Seconds within the range 0 - 59.

Guidelines: If the value for this field is unknown, then this field should not be transferred. This field, although known, may also be deliberately omitted in order to keep sensitive locations imprecise.

Example: lonsec 01,

Longitude, Direction

Transfer code: **londir**

Description: The standard abbreviated direction of longitude of the collection locality.

Rules of Syntax: Alphabetic, E or W.

Guidelines: If **Longitude, Degrees** field is transferred, then this field must consist of one of the letters 'E' or 'W' (for East or West).

Example: londir "E",

Accuracy of Geographical Referencing Data

Transfer code: **geoacy**

Description: The accuracy of distance of the collection.

Rules of Syntax: Integer, in metres;

Guidelines: The area of possible location is a circle of radius from the accession's recorded latitude and longitude position equal to the stated distance in kilometres. If the latitude and longitude are not known, or the accuracy is in doubt, then this field should not be transferred. It should be noted that the 'accuracy' of latitude and especially longitude positions will vary depending on global location - accurate **Locality** notes are very necessary to help relocating plant material.

Example: geoacy 100,

Editorial Note: There have been many discussions as to how to portray the accuracy of geocode, especially with the inherent inaccuracy in the higher latitudes. ITF2 has opted to keep the option simple, all GIS recording units convert into Latitude and Longitude and can be reconverted back again if required.

Country of Origin

Transfer code: **cou**

Description: The country of origin of the plant, entered in full.

Rules of Syntax: Alphabetic, Standard full political country name.

Rules of Information: If the name of the country where the plant was collected is unknown, then this field may contain the value UNKNOWN (in uppercase). In this case, the following **ISO code for Country of Origin** field must have the entry 'XX' or 'XY'. All remaining 'place of origin' fields should not be transferred.

Guidelines: It is recommended that the spelling of the country should be as recognised by the International Standards Organization (ISO) based in Geneva, Switzerland.

Example: cou "Vietnam",

ISO code for Country of Origin

Transfer code: **iso**

Description: The 2 letter code for the representation of the name of the country from where the plant was collected, using the codes assigned by the International Standards Organization (ISO).

Rules of Syntax: The code must consist of 2 uppercase letters (A-Z).

Rules of Information: The entry in the field must be a valid entry as defined by the International Standards Organization (ISO Standard 3166).

Guidelines: The ISO area codes are assigned by the International Standards Organization (ISO) based in Geneva, Switzerland and are available from national standards organisations in member states. BGC I can provide copies if need be. The ISO standard declares that 'The series AA, QM-QZ, XA-XZ, and ZZ are available for individual use'. Users should be careful not to use such codes in the ITF.

Example: iso "VN",

World Geographical Scheme

Transfer code: **wgs**

Plant Taxonomic Database Standards No. 2

Description: World Geographical Scheme for Recording Plant Distributions by S. Hollis and R.K. Brummitt. - Plant Taxonomic Database Standards No. 2, Version 1.0 (1992).

Rules of Syntax: The entry in the field must be a valid entry from the above publication.

Rules of Information:

1. This code contains up to 5 characters when taken to the complete Level 4 of the World Geographical Scheme.
2. Every code is unique, so that the Level 1, 2 and 3 codes must also be recognised if given in lieu of the complete Level 4 code.

Guidelines: World Geographical Scheme for Recording Plant Distributions by S. Hollis and R.K. Brummitt. This standard was published for the International Working Group on Taxonomic Databases for Plant Sciences (TDWG) by the Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, USA.

Example: wgs "VIE-OO",

Primary Subdivision of Country of Origin

Transfer code: **pru**

Description: The primary recording unit which is the highest order subdivision recognised by the **Country of Origin**.

Rules of Syntax: Alphabetic, accepted by or agreeing with the Hollis & Brummitt standard full Complete 4-level Geographical area, written in full (not coded).

Rules of Information:

1. The entry in the field must be a valid entry as defined by Table (Hollis & Brummitt 1992).
2. If the entry is not part of the Hollis & Brummitt standard, then it must be equivalent to the entries in this latter standard. For example, this field is expected to contain State, Province, and other comparable geographical regions.

Guidelines: Complete 4-level Geographical scheme (see Table 4 in Hollis & Brummitt). Only one of the above codes need be recorded in the institution's internal database, but it was felt necessary to separate the

codes for institutions that are using the World Geographical Scheme - Plant Taxonomic Database Standard No. 2 as their primary recording unit.

Example: pru "North West Vietnam",

Secondary Subdivision of Country of Origin

Transfer code: **sru**

Description: The secondary recording unit which is the second highest-order subdivision of **Country of Origin** field.

Rules of Syntax: Alphabetic, written in full or any valid regional code or abbreviation.

Rules of Information: This field contains the district or region from which the specimen was collected, usually a subdivision of State or Province.

Example: sru "Hoang Lien Son",

Specific Geographic Unit

Transfer code: **sgu**

Description: The specific geographic recording unit describes specific conservation areas and other nature reserves/protected areas of **Country of Origin** field.

Rules of Syntax: Alphanumeric, written in full.

Rules of Information: The field consists of the name of a defined conservation area, such as national or state parks, forest reserves, nature reserves, conservation or heritage parks.

Example: "Sapa",

Locality

Transfer code: **loc**

Description: The locality where the plant was collected within the country and country units assigned in the previous two fields.

Rules of Syntax: Alphanumeric, written in full.

Guidelines: The field is an area of free text. One useful way to record **Locality** is to note distance and direction from a nearest named location on a map - always give details on the map used, especially if grid references are included. Precise **Locality** notes should be made to help relocation of the plant material.

Example: loc "Left of the noticeable very large rock half way up the West Path"

Altitude

Transfer code: **alt**

Description: The altitude of the collection locality or if the collection is from an altitudinal range, then the minimum altitude of the collection locality, in metres above or below sea level.

Rules of Syntax: Integer, any geographically reasonable altitude in metres between the range of -400 (Dead Sea) to 8393 (Mt. Everest)

Guidelines: Altitudes in feet should be converted to metres before interchange. Negative values indicate terrestrial altitudes below sea level (depressions), not aquatic environments:

<i>Examples:</i>	<i>ITF2 id & value</i>	<i>Meaning</i>
	alt 200,	200 metres above sea level
	alt -200,	minus 200 feet below sea level in a terrestrial setting.

Aquatic environments are given, by noting the altitude at the surface of the water; and then giving a value in the **Depth** field of metres below the water surface; e.g.:

<i>ITF2 id & value</i>	<i>Meaning</i>
loc "..... etc",	Aquatic setting (lake) at an altitude of 1025 metres exactly,
alt 1025,	accession found at a depth of 5 meters in the locality
altacy 0,	described.
dep 5,	

Accuracy of Altitude

Transfer code: **altacy**

Description: The accuracy of the altitude estimation, or when a range of altitudes given, then the accuracy of the minimum altitude estimation, in metres.

Rules of Syntax: Integer, in metres. If degree of accuracy is unknown, then this field should not be transferred.

Guidelines: Refer to examples in 'Guidelines:' of the **Altitude** field and **Accuracy of Maximum Altitude** field. If the **Accuracy of Altitude** field is omitted, then it should be assumed that the level of accuracy is not known.

Maximum Altitude

Transfer code: **altx**

Description: The maximum altitude when the collection is cited as being taken from within an altitudinal range, in metres above or below sea level (cf. depth).

Rules of Syntax: Integer, any geographically reasonable altitude in metres.

Guidelines: Altitudes in feet should be converted to metres before interchange. Negative values indicate terrestrial altitudes below sea level (depressions), not aquatic environments. See examples in **Accuracy of Maximum Altitude** field.

Accuracy of Maximum Altitude

Transfer code: **altacyx**

Description: The accuracy of the maximum altitude estimation when the collection is cited as being taken from within an altitudinal range, in metres.

Rules of Syntax: Integer, in metres. If degree of accuracy is unknown, then this field should not be transferred.

Guidelines: Refer to 'Guidelines:' of the **Altitude** field.

The two fields **Accuracy of Altitude** and **Accuracy of Maximum Altitude** are given to record the accuracy of the altitude when a collection is made over an altitudinal range. The **Accuracy of Altitude** field refers to the accuracy of the value recorded for the lower **Altitude** field, and **Accuracy of Maximum Altitude** applies to the value in **Altitude** field. If the collection altitude only refers to one value, then only **Altitude** field and the **Accuracy of Altitude** should be transferred.

Examples: If a collector harvests seed from a number of bushes growing on a mountain side, then **Altitude** field refers to the lowest altitude, and **Maximum Altitude** field to the highest altitude. The collector may have a very accurate altitude reading for the lowest position, but only an approximation for the upper range. Therefore the accuracy of value in the **Accuracy of Altitude** field would be different to that recorded in the **Accuracy of Maximum Altitude** field. By filling out the two Altitude fields, the data receiver knows that seed has been collect over a range of plant material; i.e.:

<i>ITF2 id & value</i>	<i>Meaning</i>
alt 100,	Seed collected over a range of plant material, with an
altacy 5,	accurate lower altitudinal reading, but with the upper
altx 250,	altitudinal limit anywhere between 225 and 275 meters.
altacyx 25,	

Another example is when a collector harvests seed from only one plant source, for which he has an inaccurate altitude reading; i.e.:

<i>ITF2 id & value</i>	<i>Meaning</i>
alt 1000,	This plant was collected at an altitude anywhere between
altacy 100,	900 and 1100 meters.

Note: if either 'Altitude Accuracy' fields are omitted, then it should be assumed that the level of accuracy is not known, as opposed to an exact reading. A reading of zero in either field refers to an exact reading.

Depth

Transfer code: **dep**

Description: The depth of the collection locality beneath the water surface in metres.

Rules of Syntax: Integer, any reasonable depth in metres.

Guidelines: Depth in feet and fathoms should be converted to metres before transfer. (Only complete metres are to be recorded, due to cultural differences between a decimal point or coma which could lead to confusion when receiving the transfer). Depth accuracy is not recorded, as it is presumed a measured stick

or a depth gauge would be used which is sensitive to pressure; tidal conditions should also be taken into account and the conditions noted in **Locality** field.

Depth below ground surface ie from within a terrestrial cave; should be accurately described in **Locality** field, and not in this field, which refers to aquatic plants.

For accurate information on Depth, latitude fields (**latdeg latmin latsec latdir**) longitude fields (**londeg lonmin lonsec londir**) and especially **Locality** field should be carefully transferred. The locality field should also include details on collection method and water conditions at the time of collection:

Example:

<i>ITF2 id & value</i>	<i>Meaning</i>
alt 1000, dep 5,	Plant taken from an aquatic setting (i.e. lake) at an altitude of 1000 metres with the Accuracy of Altitude not known at a depth of 5 metres.
loc "A compass bearing of 83 degrees from 2 nd buoy marking water channel, 210 degrees from large rock from shore and 300 degrees from car park sign was noted to mark the exact location of the boat's position when diving at that time. It should be noted that the time was mid-tide.",	

Habitat

Transfer code: **hab**

Description: Information on the Habitat of the accession including its directional aspect, the habitat geology and soil type as well as the associated species of the community from which this accession was collected.

Rules of Syntax: Free text.

Guidelines: This information is usually provided by the original collector.

Example: hab "Accession found on the north westerly slope on the Pirates Lookouts with a heavy clay based soil type",

Conservation Status (Threat)

Transfer code: **consta**

Description: An outline of any perceived threats (potential or real) in the above habitat.

Rules of Syntax: Free text.

Guidelines: This information is usually provided by the original collector.

Example: constat "Plant is found close to a tourist wilderness trail, which is becoming more used, and therefore subject to some erosion.",

Primary Collector's Name

Transfer code: **cnam**

Description: The name of the person(s) who collected the plant from the wild and whose collection number is cited in the next field (refer **Collector's Identifier**).

Rules of Syntax: Alphabetic, any valid collector's name, primary collector's family name (surname) followed by comma and space (,) then initials (all in uppercase and each separated by fullstops). All initials and first letter of the collector's family name in uppercase. For example, Wilson, B.K.

Rules of Information: The collection number of the record (refer **Collector's Identifier**) is regarded as being assigned by the primary collector of the material (as cited in this field).

If more than one collector is associated with the collection number, then the names of these collectors should be cited in this field, with the comma and space used to separate these multiple collectors. For example, Tan, F., Jeffreys, R.S.

If only one person collected the material from the wild, as represented by this record, then the person's name *must* be entered only into this field.

Guidelines: Titles should be omitted.

Collector's Identifier

Transfer code: **cid**

Description: The number of the collection as assigned to it by the primary collector(s) (previous field).

Rules of Syntax: Alphanumeric

1. If the **Primary Collector's Name** is unknown, then this field would normally not be transferred.

Rules of Information: The **Collector's Identifier** should be the number assigned by the collector(s) at the time of collection. The number should not be reused for other collections by the same collector.

Guidelines: Very often a collector's name and number is the key to locality data of great value to the conservation of wild plants.

Example: "12/12/89-123",

Additional Collectors' Name

Transfer code: **cnam2**

Description: The name of the person(s) who collected the plant (from the wild) together with the primary collector.

Rules of Syntax: Alphabetic, any valid collector's name, the additional collector's family name (surname) followed by comma and space (,) then initials (all in uppercase and each separated by full stops). Refer to **Primary Collector's Name** field for further details.

Rules of Information: Remember that the collection number of the record (refer **Collector's Identifier**) is regarded as being assigned by the primary collector of the material, *not* by the additional collector(s). In the following example of multiple collectors: Peng, C-I. 1356 and Cooper, R.S. ; 'Peng' is regarded as the primary collector, with the collection number belonging to his collection series, whereas 'Cooper' is regarded as the additional collector because the collection number does not belong to his/her collection series. In this example, 'Peng, C-I.' would be transferred in the refer **Primary Collector's Name** field, whereas 'Cooper' would be transferred in this field (**Additional Collectors' Name**).

If there are multiple additional collectors, then the names of these collectors should be cited in this field, with the comma and space used to separate these multiple collectors. For example, Campbell, E.D., Lindley, S.A.

Titles should be omitted.

Collection Date

Transfer code: **cdat**

Description: The dominant date on which the material was collected, as represented by this record.

Rules of Syntax: Integer, year (4 digits) followed by month (2 digits) and then day (2 digits), without spaces between each unit of information.

1. In this notation, leading zeros must be included for months and days, i.e. January is coded as '01' not '1' and the 4th day is coded as '04' not '4'.

Example: cdat 19851109, 9 November 1985
cdate 19510203, 3 February 1951

2. If the day of the month is not known, then the last two digits should be omitted.

Example: March 1901 would preferably be transferred as 190103.

3. If the day and month are not known, the last four digits should be omitted and just the 4 digit year information interchanged.

Guidelines: The ITF records the year as a full 4-digit number to facilitate the use of the system in the next century, as well as to track collections from the previous century. If plant material was collected over a range of dates - without any clearly identified dominant date, then a year should be entered in this field, and the collection dates entered as free text along with any relevant details in the **Collection Notes** field. It is important to have a clearly defined date as to when an accession was collected because if subsequently, it is never relocated, perhaps presumed extinct - the date recorded is when the species was last seen in that locality.

Collection Notes

Transfer code: **cnot**

Description: This field describes information about this plant record, including habit, shape and colour of vegetative and reproductive parts of the plant. If the record has no dominant collection date, then a year can be entered in the **Collection Date** field and a range of collection dates can be added in this field along with 'date stamped' notes.

Rules of Syntax: Free text.

Guidelines: This information is usually provided by the collector.

Example: cnot "Accession source is in bad condition, therefore suitable cuttings were difficult to find",

G. ADDITIONAL DATA

ITF1 did not allow any means to transfer cultivation or miscellaneous details that may be relevant to individual accessions. The majority of these fields allow for free text, but more sophisticated fields could be exchanged using the **New Fields Option** technique between individual institutions.

Cultivation Information

Transfer code: **culinf**

Description: Allows for cultivation information to be passed as free text in order to help the receiving garden care for the transferred accession.

Rules of Syntax: Free text.

Guidelines: Use the **New Field Option** if further field division is required for cultivation information.

Example: culinf "Spraying with insecticide early summer to reduce infestation of red spider mite is recommended",

Propagation Information

Transfer code: **proinf**

Description: Allows for information about any propagation requirements to be passed as free text in order to help the receiving garden propagate the transferred accession.

Rules of Syntax: Free text.

Guidelines: Use the **New Field Option** if further field division is required for propagation information.

Example: proinf "Cuttings of plant may be taken throughout the summer, when it roots more successfully",

Perennation Flag

Transfer code: **per**

Description: A code to indicate the means of perennation, providing a means of noting living plant accessions that require regular curatorial monitoring.

Rules of Syntax: The entry must consist of one of the values in the table below:

<i>Syntax</i>	<i>Meaning</i>
M	Monocarpic plants
MA	Annuals
MB	Biennials and short-lived perennials
ML	Long-lived monocarpic plants
P	Polycarpic plants
PD	Deciduous polycarpic plants
PE	Evergreen polycarpic plants
U	Uncertain which of the above applies.

Rules of Information:

1. The second character is optional to provide more detailed information to be recorded. It is recommended that both characters are used wherever possible.
2. Polycarpic plants are individuals which are capable of flowering/fruitletting over several seasons. They should be coded 'PD' if known to be deciduous, or 'PE' if known to be evergreen.
3. Monocarpic plants are here defined as those which can be expected to die after flowering or fruiting. Their life cycle may last from several months to many tens of years, possibly centuries. Curatorial action will be needed to ensure that genetic material from these plants is not lost when the mother plant dies. Living plant accessions that contain 'M' in this field require regular examination by garden staff, particularly accessions of conservation value.
4. Long-lived monocarpic plants which grow for several years and then die after flowering are here defined as those in which the life cycle can usually be expected to last more than three years; they should be coded 'ML'. Where the life cycle is known to be of short but uncertain duration, the accession would be better coded as 'MB', indicating closer curatorial attention be paid than would be necessary with accessions that are definitely long lived.
5. Short lived monocarpic and biennial plants are here defined as those which complete their life cycle in a duration between one and three years; they should be coded 'MB'.
6. Annual plants are here defined as plants which normally complete their life cycle in 12 months or less; they should be coded 'MA'.

- Certain long-lived plants which may have monocarpic rosettes (e.g. various *Agave* spp.) may produce offsets; if offset production is regular and certain, the field should be coded 'PB'. Where there is any doubt as to whether such offsets are produced, or if they are produced only occasionally, the field should be coded 'ML' to flag curatorial staff that more immediate action is needed in order to maintain the accession.

Guidelines:

- The purpose of this field is to provide brief information about the life history of the accession which is relevant to horticultural practices. This can act as a flag for curatorial action where monocarpic accessions may be lost. It is *not* intended to accurately describe the life form of the accession, but to provide a method of identifying certain accessions that need to be frequently regenerated, such as annuals.
- Flagging deciduous polycarpic accessions may prevent against accidental loss.

Example: per "P",

Breeding System

Transfer code: **brs**

Description: A code to indicate the breeding system of the accession.

Rules of Syntax: Alphanumeric.

- The entry must be one of the values in the Table below:

<i>Syntax</i>	<i>Meaning</i>
M	'Male', defined as plants that do not produce functional female flowers
F	'Female', defined as plants that do not produce functional male flowers
B	The accession includes both 'male' and 'female' individuals as described above
Q	Dioecious plant of unknown sex
H	The accession reproduces sexually, and possesses hermaphrodite flowers or is monoecious
H1	The accession reproduces sexually, and possesses hermaphrodite flowers or is monoecious, but is known to be self-incompatible.
A	The accession reproduces by agamospermy
U	Insufficient information to determine breeding system.

- The field should be coded M, F, B or Q only if accessions are known to be dioecious. B should be used where an accession contains several individuals, some of which are functionally male and others female. The field should be set to Q if the accession is thought or known to be dioecious, but the sex has not been determined.
- Most plants are hermaphrodite or bisexual, i.e. their flowers have both male and female parts. For these and monoecious taxa, where separate male and female flowers are borne on the same individual, the field should be coded H. For such taxa where self incompatibility is known, the field should be coded H1.
- For accessions which are known to reproduce by agamospermy, that is seed is set without sexual fusion, the field should be set to A.
- Exceptionally*, where it is not possible to decide which of the above codes apply, for example a new or unknown taxon or tissue culture sample, the field should be coded U.

Guidelines: Flagging accessions which are known to be self-incompatible may help propagation of the taxon, but care should be taken to ensure the taxon has been demonstrated to be self-incompatible. Failure to set seed does not in itself demonstrate self-incompatibility.

This field records the sexuality and breeding system of accessions. The main purpose of this is to highlight accessions which require outcrossing for sexual reproduction (dioecious and self-incompatible taxa), so that appropriate procedures can be used in propagating such accessions. The field does not therefore attempt to fully describe the breeding biology of an accession. It expands the information provided by the field 'Sex' in ITF version 01.00.

Example: brs "A",

Accession Uses

Transfer code: **accuse**

Description: The description of the (economic) uses of this accession. The term 'economic uses' is used in a very wide sense and incorporates medicinal uses.

Rules of Syntax: Free text.

Guidelines: An ITF record is accession-based and the information transferred refers uniquely to the economic use of the plant accession record being interchanged. For further information on the transfer of taxon-based information, including conservation categories and economic uses, please refer to the Annex 3.

One relevant standard is Cook, F.E.M. and Hastings, L.H. (1995). 'Economic Botany Data Collection Standard' (Royal Botanic Gardens: Kew). This standard was prepared for the International Working Group on Taxonomic Databases for Plant Sciences (TDWG).

Example: accuse “Any free text is allowed, but note that it filled it differentiates this accession from the uses that are generally applies to the taxon in general, which would be noted under Taxon Uses (taxuses) See Annex 2?”,

Miscellaneous Notes

Transfer code: **misc**

Description: Any additional information to be transferred pertaining to the accession, but not catered for in the preceding fields.

Rules of Syntax: Free text.

Guidelines: This field is to include any information; such as the state of health of a specimen when sent is very important to a receiving garden, but because it is a transient element of data which is attached to a 'moment in time', it would be wise to include it here rather than give it 'field' status.

Example: misc “Accession’s health in garden is not in good condition, and therefore cuttings are being transferred to Micropropagation Unit.”,

End of ITF Version 2.0 Record

Transfer code: **}**

Description: The single character **}** indicating the end of an ITF Version 2.0 Record.

Rules of Syntax: Must contain the symbol **}** only.

Guidelines: To be found at the end of an ITF2 record indicating the end of the data of each record, prior to beginning the next record or the **endfile** identifier if it is the last record in the transfer file.

Example: **}**

End of File

Transfer code: **endfile**

Description: The end of the transfer file has the file identifier 'endfile' only.

Rules of Syntax: Only one entry permissible - the word 'endfile'. Must always be found at the very end of an ITF2 file.

Guidelines: To be found at the very end of an ITF2 file indicating the end of file.

Glossary

- ASN.1 Information technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1). International Standard ISO/IEC 8824, 2nd ed. (1990)(ISO/IEC: Genève).
- HISPID Herbarium Information Standards and Protocols for Interchange of Data -Version 3 (B.J. Conn, 1996)
- ICBN International Code of Botanical Nomenclature (the "Tokyo Code") (Greuter *et al.*, 1993)
- ICBCP International Code of Nomenclature for Cultivated Plants (the "Cultivated Code") (Trehane *et al.*, 1995)
- ITF1 International Transfer Format for Botanic Garden Plant Records - version 01.00 (Plant Taxonomic Database Standard No. 1, Botanic Gardens Conservation Secretariat - Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, 1987)
- ITF2 International Transfer Format for Botanic Garden Plant Records - version 2

Acronyms

- BGCI Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond Surrey, TW9 3BW, UK. Tel +44 181 332 5953/4/5 Fax +44 181 332 5956 email: bgci@rbgkew.org.uk
- IUCN The World Conservation Union, Rue Mauverney 28, CH-1196 Gland, Switzerland. Tel: +41229990001, Fax: +4422-999 00 02 , e-mail mail@hq.iucn.ch
- WCMC World Conservation Monitoring Centre, 219 Huntington Road, Cambridge CB3 0DL. UK. Tel +44 1223 277314 Fax: +44 1223 277136 e-mail wcmc@wcmc.org.uk

Annex 1

Hybrid Names

Hybrids are by the far the most difficult type of plants to cover in any computer record system. They cause great problems for any computerized system as in many cases they require a doubling of name-fields. The ITF provides the ability to cover most but not all situations that could be encountered in a garden record database. The text below provides the botanical background to the coverage of hybrids in the formal definitions above.

1. *Sexual Hybrids*

Hybrids produced by sexual crossing can be named in one of three ways (A, B and C below); A and B are governed by the Tokyo Code, C by the Cultivated Code.

1.A *Hybrid Formulae*

In this method, the names of the parent taxa connected by the multiplication sign (x) (interpreted on typewriters and word-processors as the lower case letter 'x').

Where the female parent is known, it is usual to list this first. Alternatively, the sexes can be indicated by the characters (M) and (F) after the names, or by the conventional signs used in science for male (♂) and female (♀). For many garden plants, however, the direction of the cross is not known and so these refinements are not covered by the ITF. Similarly the abbreviations 'M' and 'F' should not be added to names in the ITF.

Examples:

Acer davidii x *rufinerve*

Polypodium vulgare subsp. *prionodes* x subsp. *vulgare*

Rhododendron cinnabarinum subsp. *cinnabarinum* x subsp. *xanthocodon*

Magnolia campbellii subsp. *mollicomata* x *Magnolia sprengeri* var. *elongata*

As the above examples show, formulated hybrids can be very complex and it is difficult to plan for all permutations. ITF2 allows the option to transfer more than a trinomial botanical name (unlike ITF1) but it is accepted that it may not be able to cope successfully with all hybrid formulae. The additional free text field **Full Name** gives the sender the option to divide the plant name into its ITF fields, and also send it as a complete text field to iron out any discrepancies.

1.B *Nothotaxa (Hybrid Names)*

Here the hybrid has been given a botanical name of its own, which is preceded by a multiplication sign (without a space in between). On a typewriter, however, normally a capital or lower case ex ('X' or 'x') is used, separated on both sides by a space.

Nothotaxa (Hybrid names) are the commonest method of referring to hybrids. Nothotaxa covers all progeny of any particular hybrid combination, rather than the progeny of a single specific cross between those parents.

Examples:

- | | |
|--------------------------------|---|
| <i>x Cupressocyparis</i> | (refers to all crosses between species of <i>Cupressus</i> and <i>Chamaecyparis</i>) |
| <i>Lonicera x tellmanniana</i> | (refers to all crosses between <i>L. sempervirens</i> and <i>L. tragophylla</i>) |

1.C. Cultivar-Group Epithets

These are collective epithets used only in relation to cultivated plants. A Cultivar-Group may consist variously of:

- a) two or more similar named cultivars;
- b) all the plants formerly placed in a botanical taxon which is no longer recognised as such, but which it is still useful to recognise in cultivation;
e.g. *Rhododendron boothii* Mishmiense Group (*R. michmiense*)
- c) all the progeny of a known parental combination which share one or more characters and which it is useful to recognise as a unit.
e.g. *Lilium* Celica Group (*L. 'Pumpkin Sweet' x L. 'Unique'*)

Cultivar-Group epithets must consist of no more than three words in a modern language, unless based on an accepted cultivar epithet or other accepted Latin epithet to which the word Group is appended. When required Group may be shorted to Grp. Cultivar-Group names should not include the words: cross, form, grex, group (except as the final word), hybrid, mutant, seedling, selection, sport, strain, variety, the plural of these words, or the words 'improved' and 'transformed'.

If a cultivar-group epithet is used in conjunction with a cultivar epithet the group epithet must be placed in either round or square brackets, and placed either immediately before or immediately after the cultivar epithet.

- e.g. *Hydrangea macrophylla* (Hortensia Group) 'Ami Pasquier'
or *Hydrangea macrophylla* 'Ami Pasquier' [Hortensia Group]

When used without reference to a cultivar, the cultivar-group epithet should not be placed in brackets.

- e.g. *Hydrangea macrophylla* Hortensia Group.

It should be noted that the cultivar-group epithet may at the same time be used in a cultivar sense, e.g. *Rhododendron* (Fabia Group); 'Fabia' represents the RHS awarded clone of this cultivar-group.

The term grex is now restricted for use in orchids alone. Orchid grex epithets do not incorporate the word group or grex and are not placed in brackets when used in conjunction with a cultivar epithet. A grex epithet applies to all the progeny of two parent plants which bear the same pair of specific names and/or grex names. This applies to each and every crossing of the parents and is irrespective of the cultivars used and the direction of the cross.

- e.g. Any plant of the grex *Odontoglossum* Opheon crossed with any plant of the species *Odontoglossum crispum* will fall within the grex *Odontoglossum* Royal Ballet.

2. Graft-chimaeras

Graft chimaeras are composed of tissues from two or more different plants which originate by grafting and are not hybrids. When the component taxa of a graft-chimaera are different genera, a new name in Latin form may be formed by combining the generic names of the component genera, preceded by the addition sign. This generic name must not be the same as the nothogenus of the same genera.

A graft-chimaera cultivar epithet is formed as for any other cultivar. Distinct graft-chimaeras arising from the same component taxa are treated as separate cultivars and named accordingly

- e.g. +*Crataegomespilus* 'Dardarii' and +*Crataegomespillus* 'Jules d'Asnières'

Annex 2

An International Transfer Format for plant taxon information

based on the 'International Transfer Format for Botanic Garden Plant Records - version 2'.

DEFINITIONS:

Taxonomy: The science of classification as applied to living organisms; (Webster Dictionary)
Taxon: A single unique element to which the 'science of classification' has been applied.
Accession: Under the rules of the ITF - this applies to a plant or group of plants in an institution that has been acquired as a separate addition or element of its collection. There may be many accessions or examples of a single taxon in an institution, but a single accession cannot represent more than one taxon.

GENERAL RULE OF INFORMATION OF AN ITF RECORD

1. Each record must refer to an accession in an institution. One record is applies to a single accession. However, any single accession may cover more than one *individual* specimen, for example if the accession is in the form of seed or of plants that have been raised from seed, or if several individuals have been collected from one site at one time. It *must not*, however, cover individuals of the same taxon collected from different places in successive years.

Accession information and Taxon information in the same record transfer - what are the problems?

The International Transfer Format for botanic garden plant records - version 1 (ITF1) publication deals with individual plant accession information only, the exception being the IUCN Conservation Category codes which refers to the plant taxon in general.

The notes for the taxon based field (IUCNCAT) in ITF1 explained its inclusion:

QUOTE 'This field is included so that the IUCN Threatened Plants Unit can fill in the categories for species on ITF databases sent to them from gardens, for inclusion in the gardens' own database. This should *not* be used for the gardens' own assessments of the status of plants; these should be sent separately to the IUCN Threatened Plants Unit'. END QUOTE

Problems arise when a receiving garden tries to process an International Transfer Format, and extract IUCN Category Code only. The file transferred would include many 'flat file' records of accession based information.

Was each category to be received into each accession record, and if the IUCN category field was updated, how would the garden change all the individual accession IUCN conservation category fields?

Or

If the receiving garden had a relational type database in which taxon information was held at the plantname level, with accession information being held relationally attached to each plantname - did they want to have to process each received ITF record on an accession basis, ignoring each of the 31 fields preceding the IUCN conservation category just to extract this one field.

The next accession record may also be transferring the same IUCN Category code for the same plantname, and the date and time stamp would be later than when the IUCN category was first updated, so would it be overwritten many times by each accession record, or should the receiving garden ignore all subsequent records for the same plantname accession.

In reality, many gardens preferred 'printed hard copy' as opposed to electronic file transfer format so that these decisions could be made manually, and not on computer software coding.

When the ITF version 2 working group first met, and were asked 'What additional information would botanic gardens like to transfer electronically?', it was found that many of the additional fields that botanic gardens found missing from the ITF1 and would like to include are taxon based.

In practice this could mean that the same information will be duplicated in a file transfer, especially when a garden has multiple accessions of a same plantname. Again, this will pose a problem to the receiving garden especially if they use a relational databases, which is increasingly common.

ITF1 was divided into 8 sub sections:-

A	File identification data
B	Accession data
C	Plant name
D	Verification data
E	Sexuality
F	Source data
G	Place of origin
H	IUCN Conservation Category

These majority of these sub sections are still relevant to ITF2 with the exception of subsection H which refers to the plantname taxon only and subsection E, which has been incorporated into Additional Information at the end of the file transfer.

Other non accession fields that excluded from the ITF1 were Authorities, Geographical Range and Economic Uses:

Authorities were excluded because 'the citation and spelling of authorities vary greatly', even in the same database. In the section on 'Place for Origin' - the full distributional range of plant on the plant was noted as not being included because this information can be supplied from taxonomic databases. This same comment could be applied to the economic uses of a taxon.

Solution to the data processing of Accession and Taxon based information.

The ITF version 2 working group agreed with the notes and reasons given for the original ITF1 'taxon information' exclusion, but acknowledged that for a variety of reasons, taxon based information must be allowed to be electronically transferred. *The solution is to clearly identify information that the sender knows to be attributed to the individual accession records only, as opposed to more general information that can be ascribed to the plantname or taxon.* It is then clear where the data should be entered in the receiving database.

All International Transfer Records for botanic garden plant records (ITFs of any version, current or future) refer only to plant accession fields. Each field transferred describes information that is unique to that accession or record identifier only.

Nevertheless, the same principles that apply to the sending or receiving of an ITF2 record, can be used to deal with Taxon or plant name information. The only difference is that the receiving garden knows that this information refers to the plant name or taxon in general - i.e. authorities, geographical range, synonyms, economic uses, propagation information or any other fields required for transfer.

The receiving garden can now clearly identify whether the information is accession or taxon based, and should be able to program the receiving software computer code accordingly. In reality (in the case of a relational database), many for the fields will be duplicated in the taxon and accession files, although the accession duplicate fields would be likely to be empty, unless the information is unique to that accession record only.

This practice of having duplicate fields in the different file of a relational databases no longer implies that this will automatically lead to data updating difficulties, problems with data storage and disks being overloaded due to information technology improvements in the last decade. These problems occurred when duplicate material was re-entered in 'flat file' fixed length type databases.

For example - the economic uses of a taxon would usually be held at the plantname level, - if it was also entered for further use at the accession level, - then the botanic garden recognises that this particular accession has properties that makes it unique from the other accessions of the same taxon and would know to undertake further research.

Following this reasoning, it no longer made sense to maintain the IUCN conservation category at an accession file level, but to transfer it at a plant name or taxon file rank.

The IUCN conservation categories are maintained by the World Conservation Monitoring Centre (WCMC) in Cambridge.³ Botanic Gardens Conservation International (BGCI) holds a subset of the IUCN conservation categories which is updated regularly from WCMC. These organisations have agreed that they will transfer the data back to gardens in the an identical format.

The format will follow the field descriptors and the transfer methodology specified in the ITF version 2 format, and so will not be reproduced in this section. Only the additional field names used will be described below. The following is an example of a proposed IUCN Conservation Category transfer file:

```

startfile
numrec          number of records in this file
institute       full name of institution supplying information
datefile        date to which the file refers
contact         contact name
address         postal address
phone          telephone number
fax            fax number
email          email address
content         description of contents of the file and other comments
newfields       optional field to describe any new fields added to the ITF2.
{
fam            Sent if required by receiving institution
supgen         if applicable
genhyb         if applicable
gen            Genus - Always sent
subgen         If applicable
sphyb          If applicable
spql           If applicable
sp             Species - Always sent
spau           Sent if required by receiving institution
isprk          Intraspecific Rank - sent if applicable
isp            Intraspecific Species - sent if applicable
ispau          Authority of Intraspecific epithet, sent if required by receiving institution
isp2rk         If applicable
isp2           If applicable
isp2au         If applicable and requested
iucn1          Always sent
iucn2          Sent if updated
iucn2not       Explanation of IUCN2 reasoning - sent if required by receiving institution
wgs            BRU from Brummitt. Sent if required by receiving institution
georan         Geographical Range in full text. Sent if required by receiving institution.
taxuses        Taxon Economic Uses. Sent if required by receiving institution.
}
{
}
}
endfile

```

IUCN Category (version 1)
iucn1

Transfer code:

Description: The IUCN Conservation (Red Data Book) category to denote the degree to threat to the taxon in the wild on a world scale.

IUCN Category (Version 2)

Transfer code **iucn2**

³ The World Conservation Monitoring Centre, 219 Huntington Road, Cambridge, CB3 0DL. Tel: +44 1223 277314
Fax: +44 1223 277136 e-mail: wcmc@wcmc.org.uk

Description: IUCN Red List Categories - as approved by the 40th Meeting of the IUCN Council, Gland, Switzerland dated 30 November 1994

Editorial Note: This section is trying to deal with the complexities of different character sets and keeping the integrity of a data when transferring internationally. Ken Bailey of the computer department of RBG Kew wrote this section, but would welcome feedback/contributions covering this complex issue.

ANNEX 3:

BEYOND ASCII

INTRODUCTION

Anybody working with computers in an international context cannot avoid encountering problems when trying to work with accented characters, diacritic marks, foreign language scripts or other symbols used in science, mathematics etc.

These are exacerbated when trying to transfer data between different software or hardware platforms. This paper examines these issues and traces some of the more recent developments that are attempting to overcome these problems.

HISTORICAL PERSPECTIVE

As recently as the mid 1980's it was not unusual to find hard-copy printing terminals as a main display output device of computers. The character encoding standards developed at that time were developed in, and designed for, that environment.

Communication with these devices was often unreliable and a 7 bit protocol was used, reserving the 8th bit for parity checking to ensure accuracy of transmission. With the majority of computer manufacturers being based in the United States the most widely adopted standards adopted were ANSI US ASCII and its equivalent, ISO 664. These assigned a standard code for each number from 0 to 127 available within a 7 bit range. The first 32 codes were mostly for mechanical device control, the remainder being assigned the letters, digits, punctuation marks and symbols in common use in an English language commercial environment.

As the necessity for 7 bit communication declined the 8th bit could be used to increase the character sequence to 255 values and hence include other symbols and characters from other alphabets. The control characters were often re-utilised by programmers to provide clever features within software or to produce effects on display terminals which had not been possible with early hard-copy devices. These developments were frequently proprietary, requiring a supported combination of computing hardware, display device, operating-system and application software to fully exploit the extended facilities.

The exchange of data between differing computer architectures was therefore more or less restricted to 7 bit ASCII and sometimes further restricted to the range of printable characters due to the sometimes unpredictable effects of the control characters. Anything more elaborate required the collaborating institutions to agree a strict transfer format. This would often require bespoke software to facilitate. This inhibited the exchange of digital data on an ad-hoc basis or between those lacking such technical or financial resources. It was often easier and more prudent not to develop systems which relied on such proprietary extensions.

8 BIT STANDARDISED CHARACTER SETS

The need for a standard definition of extended character sets led to the ISO 8859 series which defines several 8-bit character sets as follows:

- 8859-1 Western Europe, Latin America (supporting: Afrikaans, Basque, Catalan, Danish, Dutch, English, Faeroese, Finnish, French, Galician, German, Icelandic, Irish, Italian, Norwegian, Portuguese, Spanish and Swedish)
- 8859-2 Eastern Europe

- 8859-3 SE Europe/miscellaneous (Esperanto, Maltese, etc.)
- 8859-4 Scandinavia/Baltic (mostly covered by 8859-1 also)
- 8859-5 Cyrillic
- 8859-6 Arabic
- 8859-7 Greek
- 8859-8 Hebrew
- 8859-9 Latin5, (the same as 8859-1 except for Turkish instead of Icelandic)
- 8859-10 Latin6, (Lappish, Nordic, and Eskimo languages)

These are all supersets of ISO 646, they each have the standard ASCII values for 0 - 127. They also deliberately ignore the first 32 positions of the extended range 128-160 in case these are misinterpreted as control characters if the eighth bit is accidentally stripped.

ESCAPE SEQUENCES

Even where an 8 bit standard is agreed, problems still remain if the 8 bit data needs to be stored in or transmitted via systems which can only reliably support a 7 bit format.

The classic response to the restriction of representing non-ASCII characters using the ASCII "palette" is to define an "escape sequence"; a combination of a specially nominated constant character combined with one or more variable characters that act as pointers to a substitution table of alternative symbols. Provided a common standard is agreed, there is no limitation on the range of information that may be represented in this way. Two commonly encountered examples are Rich Text Format (RTF) and the Hypertext Mark-up Language (HT) used on the Internet's World Wide Web.

Although RTF does not prohibit the utilisation of codes outside the printable ASCII sequence it is usually restricted to it. It uses the backslash; "\", as the escape character. A literal backslash is represented by a double backslash. The standard defines a series of control letters and words, or tags, which can express not only character entities beyond the printable ASCII range but also formatting, font, colour, tabular and other information..

In HT the "&" character is nominated as the escape character. Sequences are terminated by a semi-colon. Character entity names are based on those defined using ISO 8879 (The Standard Generalised Markup Language; SG, of which HT is an application). A literal ampersand can be represented as "&";. A substitution table exists for a range of characters. A second escape mechanism is also employed using paired angle brackets to define tags which convey document structure, context and hypertext link information.

The disadvantages of this general technique are that a comprehensive standard needs to be agreed to cover all eventualities, it renders the data less human-readable and, especially if the data set comprises characters primarily from the substitution table, the size of data files may increase two or more times.

7 BIT ENCODING OF 8 BIT DATA

Other encoding schemes exist which have developed mainly to enable the transmission of 8 bit data as electronic mail via intermediate 7 bit systems.

The Multi-purpose Internet Mail Extensions (MIME, RFC 1521) defines 'quoted printable' encoding which consists of converting each character to the '=' symbol followed by its 8 bit numeric code expressed in hexadecimal. Thus the encoded text will consist of just the characters: "=0123456789ABCDEF" but at the expense of almost tripling the text size.

Perhaps the most widely used and best known encoding mechanism is "uuencoding". This works by converting adjacent groups of 3 x 8 bit characters (24 bits) into 4 x 6 bit characters then increasing the value of each character by 32. This brings the whole 6 bit set within the printable ASCII range. Uuencoding also includes file start and end markers and simple line oriented checksums. Although developed on the Unix platform, the source code is freely available and versions exist for most computer architectures. Unfortunately several variants of uuencode exist and some of the characters in the encoded message have special meaning to particular mail relays with resulting message corruption.

To overcome these drawbacks MIME encourages the use of 'base 64' encoding, first defined in RFC 1421. Like uuencoding it converts 24 bit sequences into 4 x 6 bit indexes. Instead of translating directly to a continuous ASCII sequence, these indexes are converted into the 64 character sequence; "A" to "Z", "a" to "z", "0" to "9", "+" and "/".

SET SWITCHING

Although acceptance of an 8 bit standard improves the range of valid characters for data expression, a mechanism is still required to declare both default and alternate sets when characters from other sets need to be expressed. Again, an escape sequence mechanism can be used to provide a "code switching" signal combined with a declaration of the new character set.

MIME achieves this by defining a list of content-type declarations where the content type of "text" has an optional "charset" qualifier. This defaults to ISO-8859-1. MIME also defines a "boundary separator" mechanism which defines an arbitrary string as the separator which can then be followed by a different content-type declaration.

Problems may arise if the recipient cannot support a requested change. Software may therefore need to define an appropriate response such as printing substitute characters or build in a negotiation mechanism before a transaction.

UNICODE

By increasing from single byte (8 bit) characters (SBC) to dual byte (16 bits) characters (DBC) or more, the number of characters that can be coded increases dramatically. These so-called "wide characters" form other ISO character sets (e.g. ISO-2022-jp) which provide standardised support for most of the worlds other languages (Japanese, Korean, Chinese, etc.)

ISO 10646 was originally conceived as a 32 bit coded character set to unite the ISO-8859 character sets with the wide characters by effectively laying the sequences end-to-end in a standardised order and incorporating techniques for switching between 8 or 16-bit subsets of the range. This canonical form of the Universal Character Set (UCS2), defines over 34,000 characters from 23 different modern language scripts

Unfortunately this approach builds-in a degree of repetition of characters which may be common to several subsets and the full set is unwieldy for many low-level programming functions. The approach was opposed by many computer manufacturers who united to form the "Unicode consortium". They proposed a more compact 16 bit standard comprising a single instance of each unique character.

ISO compromised by standardising both formats and the terms Unicode and ISO 10646 are more or less synonymous. Unicode is still developing, and more scripts and characters await acceptance in the next version of the standard.

Using a 32 bit code may be a convenient internal mechanism for today's 32 or 64 bit processor architectures but would simply quadruple the size of most external operations such as data storage and transfer. To address this, the Unicode standard also defines 8 and 7 bit encoding schemes.

The proposed third version of HT declares Unicode as the underlying standard then define an appropriate subset, such as ISO-8859-1, as the default encoding. Symbols outside this range may be referenced by using an escape character combined with a hexadecimal numeric pointer to the canonical Unicode character.

RFC 1461 and 1462 define a mechanism for using Unicode with MIME and encoding Unicode in a 7 bit, "mail safe" manner (UTF-7). Earlier encoding techniques referred to above are only defined for 8 bit data. UTF-7 combines the ability to leave most printable ASCII 'intact' and, by using a modified version of base64 encoding, enables the transmission of any combination of Unicode characters.

PRACTICAL CONSIDERATIONS

Apart from questions of storage and transfer, issues of input and output need to be considered. Standard keyboards have developed to cater primarily for the requirements of the first language in the country of sale. Generating characters beyond this range may not be straightforward. Similarly, even if the target character is input and stored accurately, the output device; printer or terminal, still needs to be able to select an appropriate font to render that character as accurately as possible. Sometimes a system of character mapping rules needs to be employed to overcome shortcomings in both input and output stages.

DOS systems use a series of numbered "code page" 8 bit character sets. The default set, 437, has a small repertoire of international characters. The multinational code page, 850, contains most of the characters of

ISO-8859-1 but in a different sequence. Programs importing or exporting data with ISO-8859-1 would therefore need to undergo an appropriate substitution. Changing the default code page may well have undesirable or unpredictable consequences on other programs in use on the system. Code page 1252, the equivalent of ISO-8859-1, may not be readily available for some older systems.

Text mode OS/2 programs suffer the same restrictions as DOS but Presentation Manager programs can display ISO-8859-1 characters provided the correct font is used.

Microsoft Windows uses code page 1252, ISO-8859-1 as the English language default.

Apple Mac has good support for international characters but its non-standard programming interface sometimes discourages the development of portable programs using anything more than ASCII.

SVR4 Unix systems have programming support for wide characters but true Unicode support is only beginning to appear in the X window system and the level of support varies between implementations.

It is, not surprisingly, only the more recently developed operating systems that use Unicode internally; e.g. Microsoft's NT or AT&T's Plan9.

CONCLUSION

The growth of the Internet as a means of international communication is driving the development of internationalised software and the underlying standards on which it must be based. It will take time for the development of application software that can take advantage of this underlying support in these environments or provide support using the standards in older environments. Even before such support develops however, the existence of these standards may be sufficient justification for revising existing data sets and incorporating multilingual textual components in line with the standards.

ITF2 Recommended Field Lengths

text = Text field
N/A = Not applicable

Field full name	Recommended Length	Field full name	Recommended Length
Start of File	N/A	Verification Date*	8
End of File	N/A	Verification Literature	text
Start of Record	N/A	Verification History	text
End of Record	N/A	Provenance Type*	1
ITF Version*	10	Wild Provenance Status Flag	13
Number of Records in file*	14	Propagation History Flag*	2
Date of file*	8	Accession Lineage	40
Name of sending Institution*	30	Donor type Flag*	1
Name of sending Contact	20	Donor*	20
Sending Institution's address	text	Donor Accession Identifier*	12
Telephone number of Institution	20	Latitude degrees*	3
Facsimile number of Institution	20	Latitude minutes*	2
E-mail address of Institution	30	Latitude seconds*	2
New Field Option	text	Latitude direction*	1
File Action Flag*	1	Longitude degrees*	3
Page Code Descriptor	3	Longitude minutes*	2
Description of File Contents & other Comments*	text	Longitude seconds*	2
Garden code/Institutions id*	5	Longitude direction*	1
Accession identifier*	12	Accuracy of Geocode	6
Accession specimen numbers	5	Country of Origin (full text)	40
Accession status*	1	ISO Code of Country of Origin*	2
Accession material type	1	World Geographic Scheme	5
Suprafamilial Group Name	22	Primary Subdivision of Country of Origin*	100
Family	22	Secondary Subdivision of Country of Origin	100
Suprageneric Rank	15	Specific Geographical Unit	100
Suprageneric Name	22	Locality*	text
Intergeneric Hybrid Flag*	1	Altitude*	5
Genus Name*	22	Accuracy of Altitude	4
Subgeneric Rank	15	Maximum Altitude	4
Subgeneric Name	22	Accuracy of Maximum Altitude	4
Interspecific Hybrid Flag*	1	Depth	5
Species Qualifier*	6	Habitat	text
Species Epithet*	40	Conservation Status (Threat)	text
Species Author	text	Primary Collector's Name*	20
Infraspecific Rank/Hybrid Flag*	7	Collector's identifier*	12
Infraspecific Epithet*	40	Additional Collectors' Name	
Infraspecific Authors	text	Collection date*	8
Second Infraspecific Rank Flag	7	Collection Notes	text
Second Infraspecific Epithet	40	Cultivation Information	text
Second Infraspecific Authors	text	Propagation Information	text
Vernacular Names	text	Perennation Flag	2
Cultivar-Group	40	Breeding System*	2
Cultivar name*	40	Accession Uses	text
Trade Designation Name	40	Miscellaneous Notes	text
Full name in a Text form to allow for horticultural type information	text		
Rank Qualified Flag*	1		
Identification Qualifier*	9		
Verification Level*	1		
Verifier's Name*	20		

* Based on the original ITF version 01.00 field

*Indicates an ITF1 field

*Accession Id:
*Institutional Id:
*Accession Status:
Location:
Iucn Cat:

Accession Record Form:

Suprafamilial Name:

*Intergeneric Hybrid:

Family:

*Genus:

Suprageneric Rank:

*Infraspecific Hybrid:

Suprageneric Name:

*Species Qualifier:

Subgeneric Rank

*Species:

Subgeneric Name:

*Infraspecific Rank/Hybrid:

Vernacular Names:

*Infraspecific Epithet:

Species Authors:

Infraspecific Authors:

Cultivar Group:

*Cultivar Name:

Trade Designation:

Full Name:

*Rank Qualified Flag:

*Identification Qualifier:

Verification Details:

*Level (U, 0 - 4)

*Name:

*Date:

Literature:

History:

Source Details:

*Latitude:

*Longitude:

*Altitude

*Country:

World Geographical Scheme:

*Primary Division:

Secondary Division:

Specific Geographical Area:

*Locality:

Depth:

Habitat:

Additional Altitude Info:

Threats:

*Provenance: (W G Z U)

Wild Provenance Status Flag:

Additional Information:

*Donated by:

*Donor Description:

*Donor id:

*Propagation History Flag:

Accession Lineage:

Propagation Info:

Cultivation Info:

Perennation Flag:

*Breeding System:

Accession Uses:

Miscellaneous Notes:

*Indicates an ITF1 field

*Accession Id:
*Institutional Id:

Collectors Record Form:

Primary Collector:

Collector's id:

Date:

Additional Collectors' Names:

Collection Notes:

*Country:

World Geographical Scheme:

*Primary Division:

Suprafamilial Name:

*Intergeneric Hybrid:

Family:

*Genus:

Suprageneric Rank:

*Infraspecific Hybrid:

Suprageneric Name:

*Species Qualifier:

Subgeneric Rank

*Species:

Subgeneric Name:

*Infraspecific Rank/Hybrid:

Vernacular Names:

*Infraspecific Epithet:

Species Authors:

Infraspecific Authors:

Cultivar Group:

*Cultivar Name:

Trade Designation:

Full Name:

*Rank Qualified Flag:

*Identification Qualifier:

Source Details:

Geocode:

Accuracy:

*Latitude:

*Longitude:

*Altitude

Secondary Division:

Max:

Accuracy:

Specific Geographical Area:

Min:

Accuracy:

*Locality:

Depth:

Habitat Description:

Threats Description:

Wild Provenance Status Flag:

- Wild Native
- Wild non-native
- Cultivated native
- Cultivated non-native

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