

## **TROPIS: Tree Growth and Permanent Plot Information System**

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### **Abstract**

TROPIS, the Tree Growth and Permanent Plot Information System, contains five elements: (1) a network of people willing to share permanent plot data and tree growth information, serviced by newsletters and information sources hosted at <http://www.cgnet.org/cifor/research/tropis.html> (or available from CIFOR), (2) an index of people and institutions holding permanent plot data, (3) a database management system to assist more efficient data management, (4) a system to facilitate site-matching by identifying comparable sites and allowing foreign data to be used when no local growth information exists, and (5) an inference system to allow growth estimates to be made in the absence of empirical data. The index or metadatabase contains references to 10,000 plots with 2000 species provided by 100 contributors, and is growing at about 1000 plots per month. Searches of the database are welcomed, and may be directed to the author.

### **Introduction**

**TROPIS** is the acronym for the Tree Growth and Permanent Plot Information System sponsored by CIFOR, the Center for International Forestry Research, to promote more effective use of existing data and knowledge about tree growth. Several recent reviews report a paucity of long-term studies in terrestrial ecology (e.g., Strayer *et al.*, 1986; Tilman, 1989); this presumably relates more to the availability of data from long term permanent plots, rather than the existence of such studies. TROPIS attempts to redress this situation by drawing attention to existing studies. TROPIS is concerned primarily with information about permanent plots and tree growth in both planted and natural forests throughout the world. It has five components:

1. a network of people willing to share permanent plot data and tree growth information;
2. an index (metadatabase) of people and institutions with permanent plots;
3. a database management system to promote more efficient handling of data;
4. site-matching software to facilitate use of supplementary data from comparable sites; and
5. an inference system to allow growth estimates to be made in the absence of empirical data.

### **The network**

TROPIS is about people, and about information. So unless they request otherwise, all contributors and clients of TROPIS are placed on the mailing list of *TROPIS-Update*, a twice-a-year information sheet informing of recent developments and progress. At present, *TROPIS-Update* goes to about 200 people by email, and to a further 200 by regular mail. Others are also welcome to subscribe, and may do so by sending an email to [listserv@cgnet.com](mailto:listserv@cgnet.com) with the message "subscribe tropis" or by contacting the author. Back issues of *TROPIS-Update* are archived at <http://www.cgiar.org/cifor/research/tropis.html>.

TROPIS also provides information via the internet, at <http://www.cgiar.org/cifor/research/tropis.html>. In addition to the latest information on TROPIS, this site offers advice on how to contribute and how to search TROPIS, and offers hypertext links to other sources of long-term permanent plot data. Although these other sources may serve different objectives and have different scales, they are consistent with the TROPIS objective to make better use of existing data. If you are aware of monitoring efforts not documented in the TROPIS internet pages, please bring them to the attention of the author.

### **The index**

The core of TROPIS is the index (or metadatabase) of people and their plots, maintained in a relational database. The database is designed to fulfill two primary needs:

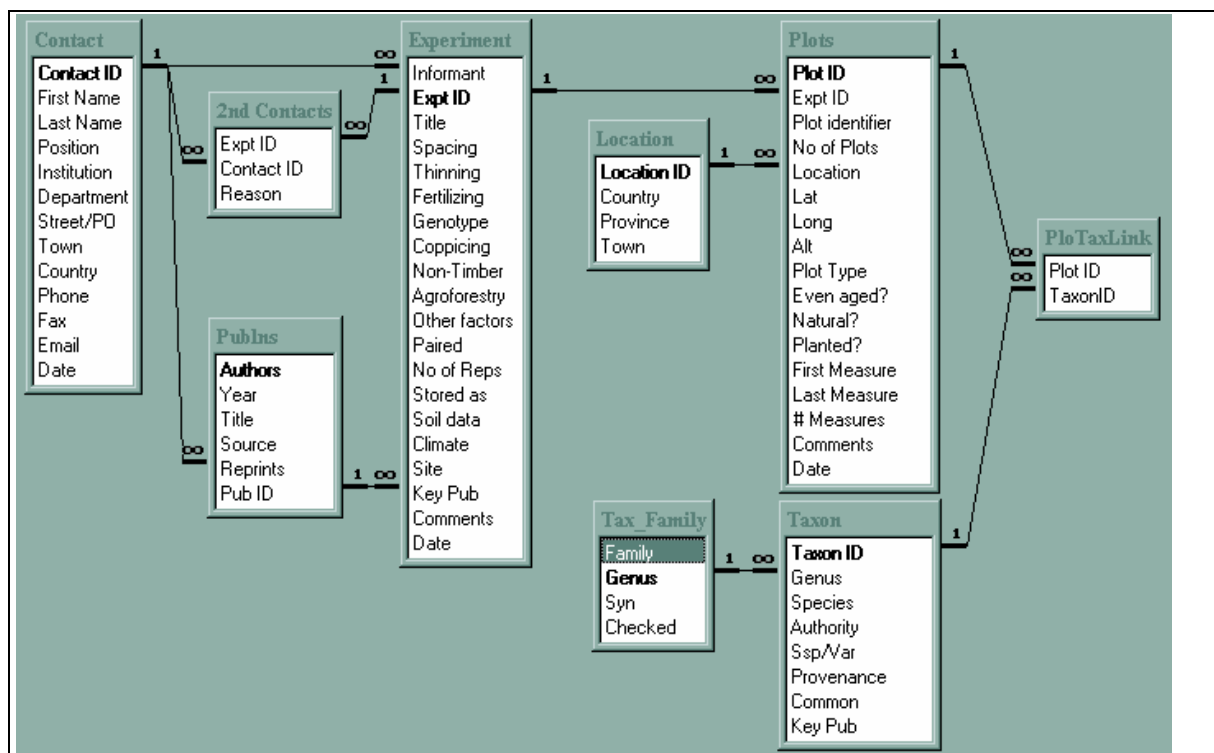


Figure 1. Simplified representation of the TROPIS metadata database.

1. to provide for efficient cross-checking, error-checking and updating,
2. to facilitate searches for plots matching a wide range of specified criteria, including, but not limited to location, forest type, taxa, plot area, measurement history, etc.

The database structure is outlined in Figure 1, and in the data entry form in the appendix. The database is essentially hierarchical: the key element of the database is the informant. Each informant may contribute information on many plot series, each of which has consistent objectives. In turn, each series may comprise many plots, each of which may have a different location, a different size, etc. And each plot may contain many species. A series may be a thinning or spacing experiment, some species or provenance trials, a continuous forest inventory system, or any other aggregation of plots convenient to the informant. Plots need not be current, and discontinued or abandoned plots may be included provided that the location is known and the plot data remain accessible. In addition to details of the informant, we try to record details of additional contact people associated with plots, to maintain continuity when people transfer, retire or otherwise cease their involvement with the plots. Thus the relational structure revealed in Figure 1 may appear complex, but ensures data integrity.

TROPIS currently contains references to over 10,000 plots with over 2,000 species in all parts of the world. When first proposed, the original emphasis of TROPIS was on tropical plantations, but workers dealing with natural forests have been particularly enthusiastic in their support for this initiative, contributing over 60% of all entries and diversifying the content of the index. Tables 1 and 2 give an indication of the present scope of TROPIS.

At present, searches are possible only via mail, fax or email requests to the TROPIS-coordinator at CIFOR, but it is anticipated that self-service on-line searching will be made available soon (assisted searches will continue to be available for those without Internet access). Clients may search for plots with specified taxa, locations (latitude/longitude or place name), silvicultural treatment, or other specified criteria and combinations. Some requests previously fulfilled include searches for

- plots with particular species and/or locations (regions, latitudes, elevations, etc.);
- plots planted with two species and a range of spacing and thinning treatments; and
- plots in logged natural forest with several remeasures spanning at least 40 years.

No of Plots	Species
953	<i>Acacia mangium</i>
891	<i>Pinus caribaea</i> var <i>hondurensis</i>
798	<i>Eucalyptus camaldulensis</i>
669	<i>Pinus caribaea</i>
341	<i>Gmelina arborea</i>
268	<i>Acacia auriculiformis</i>
253	<i>Cassia siamea</i>
223	<i>Inga alba</i>
216	<i>Pinus oocarpa</i>
206	<i>Pinus patula</i>

**Table 1.** Top ten species in the TROPIS index.

Country	No of Plots
Indonesia	2937
Fiji	833
Brazil	830
Kenya	762
Uganda	634
Malaysia	518
Thailand	434
Australia	389
Bangladesh	336
Honduras	296

**Table 2.** Top ten countries in TROPIS.

The main outcome of such searches is a list of people to contact, with details of the nature and amount of relevant data held. A catalogue of past searches is also maintained, so that clients with similar requests can be advised of their common interests.

### **Database management**

Several sources, including some contributors to TROPIS, indicate that many researchers have some difficulty in compiling field data into an efficient database. Informal surveys of contributors who store data as paper or word-processor files revealed difficulties with basic technical aspects of database design, often rather similar in nature. TROPIS attempts to eliminate some of this unnecessary duplication by providing a standard database system free to any contributor who requests it. Such standard database systems have been proposed before, often with limited success, but one such system, MIRA (Ugalde, 1988, 1989), has been used extensively in Latin America for several years, and appears to meet the basic requirements of many TROPIS participants. Thus CIFOR has sponsored the development of a new version of MIRA, based on a standard platform (MicroSoft-Foxpro) and made multi-lingual (English, Spanish, and French, plus the ability to customize to a fourth language). The prototype is now being tested, and will be available shortly.

### **Comparable sites**

Researchers studying tree growth are often handicapped by the paucity of data, or by the absence of independent data to corroborate their findings. Tree ring analyses are not always possible, so growth data often must be obtained from direct measurement. Reliable growth estimates require permanent plots that have been remeasured regularly over long periods, and these are not always available. However, there are many plots world-wide, and some of these may be used if an objective basis such as homoclimate analysis can be used to select comparable growing conditions. Such analyses are commonly undertaken to assist species and provenance selection (e.g., Booth, 1990a, 1991), but the issue of identifying comparable plots is analogous. Thus TROPIS will include a new version of WORLD (Booth, 1990b) to enable such comparisons to be completed efficiently. This work is still in progress, but will be accessible by mail, fax, email and on-line when completed.

### **Objective inferences**

Homoclimate analyses are useful when data are available from comparable sites elsewhere, but this is not always the case. In some cases, despite judicious searches, no comparable data can be located, and yet it may still necessary to make some forecast about the suitability of a species on a given site. Despite this difficult situation, it may still be possible to provide a reasonable estimate, by making expert inferences from existing knowledge about the site and about the species under consideration. The PLANTGRO system (Hackett, 1991; Hackett and Vanclay, 1998) has been used with some success for agricultural crops, and is being enhanced so that inferences about tree growth can be made in the absence of empirical data. A preliminary version of PLANTGRO for trees is currently being tested, and will soon be available.

PLANTGRO can only make growth predictions on the basis of information contained in specific files, and the construction of these files requires some specialist knowledge and empirical testing. Files for

several important tree species are available at <http://www.cgiar.org/cifor/research/tropis.html>, but users may need to construct additional files for new species. Thus an expert system, INFER, was developed to help users compile plant-files suitable for use with PLANTGRO. INFER presently exists as a paper-based expert system, but is being implemented as a Windows-based package and should soon be available on-line as well as a stand-alone package.

### **How to participate**

The objective of TROPIS is to help people learn more about trees and forests, and to help them manage these resources better. Anyone may contribute information on their permanent plots to the TROPIS system, provided that they agree in principle to share their data with others, subject of course, to a mutually satisfactory agreement between the data owner and the intending user. Conversely, anyone may use any of the five components of the system, provided that they respect the rights of contributors.

Subscriptions to *TROPIS-Update* may be emailed directly to the listserver, or directed to the author, and anyone with internet access may browse the TROPIS internet pages. Information about permanent plots is welcomed from anyone with the appropriate authority, and may be submitted to the author using the form in the appendix, or using the form found in the TROPIS internet pages. At present, searches of the index must be directed via the author, but on-line searching should become available soon. The other components, MIRA, WORLD and PLANTGRO, will soon be available for general use. Their availability will be announced in *TROPIS-Update*.

### **Acknowledgements**

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# TROPIS: An index to permanent plots in the tropics.

Please complete this form for all plots you know about: Copy as necessary. If you need more space, add an extra page.

If you would prefer to create an ASCII or dbase file directly, please contact Jerry Vanclay for more details.

## About yourself

Your name: \_\_\_\_\_ Position: \_\_\_\_\_

Institute: \_\_\_\_\_

Street or PO Box: \_\_\_\_\_

Town: \_\_\_\_\_ Country: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

Other people associated with these plots: \_\_\_\_\_

Are they the: owner / initiator / collaborator / DB manager / user? (circle one)

## About the Experiment or Plot Series

Experiment Identifier: \_\_\_\_\_

Title: \_\_\_\_\_

Tick if it examines: Spacing  Thinning / logging / treatment  Fertilizing  Genotype   
Non-timber products  Agroforestry  Coppice  Other (State) \_\_\_\_\_

Are there paired treatment - control plots? Yes / No How many replications?

How are data stored? Paper / ASCII file / Spreadsheet / Database

Details recorded: **Soil:** None/Some/Detailed; **Climate:** None/Some/Detailed; **Site:** None/Some/Detailed

Key Reference (Full citation: author, date, title, source): \_\_\_\_\_

Comments: \_\_\_\_\_

## Plot Details (N.B. Each experiment/series may have many plot records)

Identifier for this record:  Number of plots:

Location: Country: \_\_\_\_\_ Province: \_\_\_\_\_ Nearest Town: \_\_\_\_\_

Latitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"N/S Longitude: \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_"E/W Elevation: \_\_\_\_\_(m ASL)

Plot Area: \_\_\_\_\_(ha) Minimum DBH: \_\_\_\_\_(cm) Stem maps or X-Y coords? Y / N

Tick if all tree species are measured  If all stems above min DBH are measured

List of Plot Identifiers : \_\_\_\_\_

Tick if plot is even-aged  is natural forest

Year planted  First measured  Last measured

Number of measures : \_\_\_\_\_

List main species present on plot: \_\_\_\_\_

Comments: \_\_\_\_\_

Please return to Jerry Vanclay, CIFOR, P.O. Box 6596 JKPWB, Jakarta 10065, Indonesia

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