CIAT Data Documentation

Justine Klass

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CGIAR Consultative Group on International Agricultural Research

The Datasets

CIAT Digital Database

The digital data at CIAT has been moved to a central location (/raid3/geodata) where the data is accessible to all users but cannot be edited because it is read only. The data created using ESRI's Arc/INFO software are catalogued by data type (ie. Vector (data_esri) or raster (data_grids)). Within each of these directories the data has been further subdivided by continent (ie. Africa, Asia, Latin America and the Caribbean, Europe and North America) (refer to Figure 1).

In 1997 CIAT's spatial data was mis-managed and located on 50 different disks with little to no documentation on how the data was created, errors associated with each data set and what the feature attributes represented. Over the last 2 years, through the co-ordination of team-efforts, strategic data sets were identified and documented. This has lead to the documentation of 3000+ Arc data sets of which approximately 400 have been identified as key data sets. These include environmental and socio-economic data gathered through various projects and from a variety of data sources within the last 5 years. For the 400 data sets, further documentation was created using the IGDN software, MetaLite, to create standardized metadata.

Metadata for each of the datasets is available and is currently being checked (see S Castano for more details). The metadata file can be accessed using MetaLite on gisserver2 or by opening the *metadata.pdf* file on unix (raid2/geodata/data_info/).

For further information on how specific datasets were created refer to the documents contained in the */raid2/geodata/data_info/* directory on UNIX as well as the *jkdata.pdf* file. This contains a detailed summary of various datasets including DCW, USGS, P Jones climate surfaces, administrative boundary information and so forth. Additionally the *oracledata.pdf* file contains a list of the databases stored in Oracle with a brief description for each table (further information see J H Trejos).

While re-organising CIAT's digital data a set of standards were devised to enable users to access, update and store new data with ease and efficiency. These include:

(1) Common projection: All the data sets have been converted to a common projection, lat/long (Datum: wgs84, Spheroid: wgs84). This was selected because it is easy to convert a dataset from lat/long into any other type of projection.

(2) Naming conventions for coverages: Datasets will be no longer than 8 characters. This is to ensure ease of transfer between different platforms (ie unix and the pc)

- Metadata will accompany each coverage and will be the given the same name as the coverage
- In astorm, coverages representing the same information will be given the same name but will have the region extension included.

For example:

Africa	cov_af
Asia	cov_as
Australia	cov_au
Europe	cov_eu
North America	cov_na
South Armerica	cov_sa
Central America	cov_ca
Caribbean	cov_cr

(3) Basic items to be included in all coverages: This is to ensure (1) when coverages are edited basic information is maintained with the cover (ie modification dates and distribution limitations), (2) items have a standard definition and are in the same order for ease of merging and joining different datasets.

Polygon coverages:

Attribute	Arc/Info Item	Item definition	Attribute Domain	Definition
Feature	Feature	25 25 C	Alphanumeric	Name of the feature
Feature ID	Feature_ID	10 10 I	Integer	Unique permanent feature ID to be linked to a symbol set
Feature type	Feature_type	13 13 C	River	1 = Single river, 2 = double river, 3 = stream, etc
Source	Source	40 40 C	Alphanumeric	Source data from which the feature was captured
Source date	Source_date	6 6 I	6 digit number (day/month/year)	Date of the source data
Editor/creator	Editor	20 20 C	Alphanumeric	Who captured the data and later edits it
Modification date	Mod_date	6 6 I	6 digit number (day/month/year)	Date the data was last updated
Comments	Comments	50 50 C	Alphanumeric	Additional comments
Plus other items necessary for the cover				

Line cover

Attribute	Arc/Info Item	Item definition	Attribute Domain	Definition
Feature	Feature	25 25 C	Alphanumeric	Name of the feature
Feature ID	Feature_ID	10 10 I	Integer	Unique permanent feature ID
Feature type	Feature_type	13 13 C	River	1 = Single river, 2 = double river, 3 = stream, etc
Source	Source	40 40 C	Alphanumeric	Source data from which the feature was captured
Source date	Source_date	6 6 i	6 digit number (day/month/year)	Date of the source data
Editor/creator	Editor	35 35 C	Alphanumeric	Who captured the data and later edits it
Modification date	Mod_date	6 6 i	6 digit number (day/month/year)	Date the data was last updated
Comments	Comment	30 30 c	Alphanumeric	Additional comments
Plus other items necessary for the cover				

Point cover

Attribute	Arc/Info Item	Item definition	Attribute Domain	Definition
Feature	Feature	25 25 C	Alphanumeric	Name of the feature
Feature ID	Feature_ID	10 10 I	Integer	Unique permanent feature ID
Feature type	Feature_type	13 13 C	River	1 = Single river, 2 = double river, 3 = stream, etc
Source	Source	40 40 C	Alphanumeric	Source data from which the feature was captured
Source date	Source_date	6 6 i	6 digit number (day/month/year)	Date of the source data
Editor/creator	Editor	35 35 C	Alphanumeric	Who captured the data and later edits it
Modification date	Mod_date	6 6 i	6 digit number (day/month/year)	Date the data was last updated
Comments	Comment	30 30 c	Alphanumeric	Additional comments
Plus other items necessary for the cover				

(4) Standard feature codes: A manual is to be produced with all the feature codes that is assigned to different features. This will enable consistency among all coverages created and enable new data creators to code lines/ polygons/points correctly and in the same way. This also makes it easy for researchers to select specific features required to perform an analysis. (see S Castano)

For example: Roads may have **feature-id:**

1000 Cart path
1001 Footpath
1002 Trail
1003 track
1004 Single dirt road
1005 Unpaved road
.....
1015 Highway

(5) Data Dictionary of Coverages: A data dictionary is a document that contains the definition of a feature code (as illustrated in point (4)). This enables future users to identify the features in the coverage or grid. This is especially important for grids since these are numeric.

(6) Archive data and projects: A problem in the past has been the loss of data or poor archiving of completed projects and data. A directory has been setup on astorm for completed projects (/raid2/geodata/projects). When a project is completed it should be properly documented, archived and stored where it will be available to all persons within the lab. This will be read only so new edits will not possible.

Accompanying these projects users should include: - metadata records (using MetaLite), detailed documentation on how the data was created and in the case of applications a user's manual. The completed project will be written to CDROM and submitted to the GIS library, CIAT library (if necessary) to enable easy access to the information.

(7) Tools to access the data and search for data
Three sets of tools can be used to search the data available in the GIS lab. These include:
(a) Arcview Extension (J Klass, 1999 - created to access the digital data),
(b) Web search http://gis.ciat.cgiar.org/ESRI (J Klass, 1997 with web programming by A Nelson), and
(c) Documentation of MetaLite on gisserver (J Klass, 1999).

Digital data at CIAT include the data created at the GIS lab at CIAT, information downloaded from the internet and through the collaboration of various institutes throughout Central America and the Caribbean.

All the data sets were processed using Arc/INFO 7.1 on a UNIX workstation.

Data Information

The data used in this analysis were collected from various sources, including surveys and creating data layers by the digitizing team, past and present students, senior scientists and researchers at CIAT. All the data has been processed in the GIS lab at CIAT using a range of available GIS and remote sensing software. These include Arc/Info [ESRI], Arcview3 GIS [ESRI], PCI, Imagine [Erdas] and Idrisi [Clark University].

The information used in the whitefly study included;

- Data obtained via the internet from sites such as the USGS
- National agricultural censuses
- CIAT's climate database
- Personal communications from national program staff visiting CIAT
- Personal communication with national program staff in each of the study sites

The source of each data set is briefly discussed with a more detailed explanation of the steps taken in the development of coverages/surfaces, also known as themes or layers, to be used in the analysis. The data included the creation of environmental data (includes climate surfaces), the location of crops and location of whitefly transmitted gemini-viruses.

The data that has been collected and included on the cdrom has been summarized in Table 1.1.1. Table 1.1.1 summarizes, by country, the data that was available at the time. The table highlights areas where data is missing and can aid in developing future data collection strategies.

Table 1.1.1: Summary of available data by country

Theme	Mexico	Belize	Guatemala	Honduras	Nicaragua	El Salvador	Costa Rica	Panama	Cuba	Haiti	South America
Climate:											
Min Monthly Temp (Jan to Dec)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Max MonthlyTemp (Jan to Dec)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monthly Rainfall (Jan to Dec)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Evapotranspiration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other:											
Accessibility	✓	✓	✓	✓	✓	✓	✓	✓			✓
DEM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hillshade	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Slope	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aspect	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rivers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Roads	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Towns	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Soils	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Landuse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Holdridge Life zones	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boundaries:											
Country Boundaries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Admin Boundaries L2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Admin Boundaries L3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Admin Boundaries L4				✓		✓					

2.1 Environmental Data:

The environmental data is composed of data sets describing the environment. The source and the scale of the data available is listed in Table 2.1.1 followed by a more detailed explanation of each data set.

Table 2.1.1: Summary of Environmental Data Sets

Description	Geog Locn	Cover name	Feat	Projection	Source	Scale
Dem (elevation)	LAC	Dem1km	grid	DD(wgs84)	USGS	1km
Rivers	LAC	rios	line	DD(wgs84)	DCW (1984)	1:1000000
Roads	LAC	roads	line	DD(wgs84)	DCW (1984)	1:1000000
Towns with popn	LAC	Town_all	point	DD(wgs84)	DCW (1984)	1:1000000
Municipio Boundary	LAC	Lacmun_r	poly	DD(wgs84)	DCW / CIAT	1:1000000
Access	LAC	Access_g	grid	DD(wgs84)	CIAT (1998)	0.019
Lancover (USGS)	LAC	Lacusgs	grid	DD(wgs84)	USGS (1996)	0.016
Landcover (IGBP)	LAC	lacigbp	grid	DD(wgs84)	USGS (1996)	0.016
Slope	LAC	Slope	grid	DD(wgs84)	USGS (1996)	0.016
Aspect	LAC	Aspect	grid	DD(wgs84)	USGS (1996)	0.016
Holdridge Lifezones	LAC	Hold_g	Grid	DD(wgs84)	CIAT (199)	0.167

2.2 Digital Chart of the World (DCW)

The Digital Chart of the World (DCW) (1984) is a global coverage of topographic information equivalent in detail to a 1:1,000,000 scale map. There are 17 thematic layers ranging from airport points to road and river networks. The DCW and the Operational Navigation Chart (ONC) series are products of NIMA (USGS, 1999b). For the purpose of this study the DCW layer was used as a base map for the administration level boundaries, as is discussed in further detail later in this section.

The accuracy of the contours collected from ONCs source is ±610 meters, while that of the spot elevations is 30 meters. For all features derived from the ONC, the absolute horizontal accuracy is 2040 meters rounded to the nearest 5 meters at 90% Circular Error (CE), World Geodetic System (WGS84). The absolute horizontal accuracy of the DCW for all features derived from Jet Navigation Charts (JNCs) is 4270 meters at 90% Circular Error. The absolute vertical accuracy of the DCW is the same as for the original ONC and JNC lithographs at 90% Linear Error (LE), Mean Sea Level (MSL) (USGS, 1995).

2.3 USGS Digital Elevation Model (DEM)

The DEM was developed by the U.S. Geological Survey's EROS Data Center, Sioux Falls, South Dakota, 1996. The elevations are regularly spaced at 30-arc seconds (0.008333333 degrees), approximately 1 kilometer (USGS, 1997). The DEM was derived from eight data sources, both vector and raster. These include the digital terrain elevation data (DTED) with a horizontal grid spacing of 3-arc seconds (90 meters), digital chart of the world (DCW), the USGS 1 –degree DEM's, Army map Service (AMS) 1:1,000,000-scale maps and the International map of the world (IMW) 1:1,000,000-scale map. For Central America the main sources used was from the DTED with enhancements made by the DCW data (USGS, 1999b; USGS, 1997).

Of the DCW data, the hypsography and drainage layers were the most applicable to be included in the DEM generation, since these contain topographic information. For elevations below 305 metres, the primary contour interval on the source ONC's is 305 meters with supplemental contours at 76 meters intervals. For higher elevations the supplemental contours are at 152-meter intervals. The DTED and USGS DEM's have a vertical accuracy of + or - 30 meters linear error at the 90 percent confidence level (USGS, 1997).

Refer to: dem1km, hillshade, slope, aspect

Hillshade: A shaded relief was created in arc/info using the hillshade command using *dem1km.*

Slope: The slope surface was created in arc/info using the slope command using *dem1km.*

Aspect: The aspect grid was created in arc/info using the aspect command using *dem1km*.

2.4 USGS Land Cover

The U.S. Geological Survey (USGS), the University of Nebraska-Lincoln (UNL), and the European Commission's Joint Research Centre (JRC) generated a 1-km resolution global land cover database. The land cover was developed on a continent-by-continent basis with a 1-km nominal spatial resolution, based upon 1-km Advanced Very High-Resolution Radiometer (AVHRR) data from April 1992 through March 1993. The final land cover is composed of several data sources; AVHRR Data, Digital Elevation Model (DEM) Data, Ecoregions Data and Map Data (USGS, 1999c).

The final land cover was determined using a 'convergence of evidence approach' which used three interpreters to insure consistency. This included the seasonal land cover regions as defined by the Global Ecosystem framework which were

cross-reference to the land cover classes of the Simple Biosphere Model (SIB), Simple Biosphere 2 Model, the Biosphere Atmosphere Transfer Scheme (BATS), International Geosphere Biosphere Programme (IGBP), and the USGS/Anderson (USGS, 1999c).

The final task associated with this step is the generation of the derived data sets,including land cover and seasonal measures. In this step, the seasonal land cover regions are aggregated (or renumbered) into the appropriate classes of the output classification legends. Urban areas, extracted from the Digital Chart of the World (Defense Mapping Agency, 1992) are added to three of the derived data sets: Global Ecosystems, IGBP Land Cover, and the USGS Land Use/Land Cover system.

Refer to: Lacusgs, lacigbp

2.5 Accessibility

The accessibility surface was created at CIAT by A. Nelson (1998) using the following information and methodology. The accessibility model is a land based model and does not account for air travel, which may play an important role for more remote areas. The model also ignores the transport of perishable goods that are often freighted by air. Coastal access by launch or ferry is also ignored. The projection used to create the surfaces was Lambert equal area azimuthal.

The model is based on the cost distance function in arc /info which requires a point based grid for source locations and a friction surface which defines the ease with which each cell can be traversed. The influencing factors which composed the friction surface include: -roads, rail, navigable rivers, slope, land cover, urban areas

The data sources included:
(roads (DCW); rail (DCW); rivers (DCW);
slope (GTOPO30: http://edcwww.cr.usgs.gov/landdaac/gtopo30/gtopo30.html);
land cover (IGBP:http://edcwww.cr.usgs.gov/landdaac/glcc/glcc.html);
urban areas
(NOAA:http://www.ngdc.noaa.gov:8080/production/html/biomass/night.html))

Each of these is in the form of a 1km resolution grid that is classified to describe it's contribution to the friction surface. The factors were combined in arc/info to create a friction surface.

Refer to: access_g

Reference: ftp://geog.leeds.ac.uk/pub/andynelson/accessibility.doc

Or /raid2/geodata/data_info/accessibility.pdf

2.6 Climate data information

The CIAT climate surfaces were developed by P Jones at CIAT, and are based on 30 year climate averages from about 10,000 stations in Latin America (Jones *et al.* 1999). The surfaces were interpolated using 'the inverse square of the distance between the five nearest stations and the interpolated point'. The temperature surfaces were 'standardized to the elevation of the pixel in the DEM using a lapse rate model' (Jones *et al.* 1999). The surfaces were include the following;

Climate Data:

Table 2.6.1: Summary of climate surfaces

Description	Geog Locn	Cover name	Feat	Projection	Source	Resolution
Rainfall Jan 91	LAC	Pre01	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Feb 91	LAC	Pre02	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Mar 91	LAC	Pre03	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Apr 91	LAC	Pre04	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall May 91	LAC	Pre05	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Jun 91	LAC	Pre06	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Jul 91	LAC	Pre07	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Aug 91	LAC	Pre08	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Sep 91	LAC	Pre09	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Oct 91	LAC	Pre010	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Nov 91	LAC	Pre011	grid	DD(wgs84)	Pjones (CIAT)	0.167
Rainfall Dec 91	LAC	pre012	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Jan 91	LAC	Xt01	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Feb 91	LAC	Xt02	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Mar 91	LAC	Xt03	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Apr 91	LAC	Xt04	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp May 91	LAC	Xt05	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Jun 91	LAC	Xt06	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Jul 91	LAC	Xt07	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Aug 91	LAC	Xt08	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Sep 91	LAC	Xt09	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Oct 91	LAC	Xt010	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Nov 91	LAC	Xt011	grid	DD(wgs84)	Pjones (CIAT)	0.167
Max Temp Dec 91	LAC	xt012	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Jan 91	LAC	It01	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Feb 91	LAC	It02	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Mar 91	LAC	It03	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Apr 91	LAC	It04	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp May 91	LAC	It05	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Jun 91	LAC	It06	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Jul 91	LAC	It07	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Aug 91	LAC	It08	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Sep 91	LAC	It09	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Oct 91	LAC	It010	grid	DD(wgs84)	Pjones (CIAT)	0.167

Description	Geog Locn	Cover name	Feat	Projection	Source	Resolution
Min Temp Nov 91	LAC	lt011	grid	DD(wgs84)	Pjones (CIAT)	0.167
Min Temp Dec 91	LAC	lt012	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Jan	Cen Am	etp01	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Feb	Cen Am	etp02	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Mar	Cen Am	etp03	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Apr	Cen Am	etp04	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration May	Cen Am	etp05	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Jun	Cen Am	etp06	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Jul	Cen Am	etp07	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Aug	Cen Am	etp08	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Sep	Cen Am	etp09	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Oct	Cen Am	etp10	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Nov	Cen Am	etp11	grid	DD(wgs84)	Pjones (CIAT)	0.167
Evapotranspiration Dec	Cen Am	etp12	grid	DD(wgs84)	Pjones (CIAT)	0.167

Using the surfaces in Table 2.6.1 additional climate surfaces were created. These include annual surfaces (rainfall, minimum temperature, maximum temperature), diurnal and mean monthly temperature, as listed in Table 2.6.2.

Table 2.6.2: Additional climate surfaces

Description	Geog Locn	Cover name	Feat	Projection	Source	Resolution
Annual Rainfall	LAC	Annrain	grid	DD(wgs84)	CIAT 1998	0.167
Annual Min Temp	LAC	Annxt	grid	DD(wgs84)	CIAT 1998	0.167
Annual Max Temp	LAC	Annit	grid	DD(wgs84)	CIAT 1998	0.167

Table 2.6.3: Summary of method and errors for the climate surfaces

Surface	Source	Method	Known Error
Monthly Rainfall (Jan to Dec)	Jones P. G. (1997) Digital coverage of annual rainfall for Latin America. CIAT. Cali. Colombia	Constructed from interpolated climate file based on NOAA 10 minute grid DEM and CIAT climate database Interpolation from approximatly 10,000 met stations each pixel estimated from the nearest 5 stations using inverse square distance weighting.	Due to mismatch when splicing files. Missing pixels at col 394, row 333 long -53.2, lat -21.57 col 419, row 332 long -49.03, lat -21.4 col 447, row 330 long 44.4, lat -21.7
Mean maximum monthly temperature (Jan to Dec)	Jones P. G. (1997) Digital coverage of climate, Latin America. CIAT. Cali. Colombia	Constructed from interpolated climate file based on NOAA 10 minute grid DEM and CIAT climate database. Interpolation from approximatly 10,000 met stations each pixel estimated from the nearest 5 stations using inverse square distance weighting. Corrected to elevation of the pixel by a lapse rate model for the mean tropical atmosphere from night soundings in the Caribbean. Data from Rhiel, H. (1979) Climate and weather in the tropicas. Academic Press London. p 62.	Due to mismatch when splicing files. Missing pixels at col 394, row 333 long -53.2, lat -21.57 col 419, row 332 long -49.03, lat -21.4 col 447, row 330 long 44.4, lat -21.7
Mean minimum monthly temperature (Jan to Dec)	Jones P. G. (1997) Digital coverage of climate, Latin America. CIAT. Cali. Colombia	Constructed from interpolated climate file based on NOAA 10 minute grid DEM and CIAT climate database. Interpolation from approximatly 10,000 met stations each pixel estimated from the nearest 5 stations using inverse square distance weighting. Corrected to elevation of the pixel by a lapse rate model for the mean tropical atmosphere from night soundings in the Caribbean. Data from Rhiel, H. (1979) Climate and weather in the tropicas. Academic Press London. p 62.	Due to mismatch when splicing files. Missing pixels at col 394, row 333 long -53.2, lat -21.57 col 419, row 332 long -49.03, lat -21.4 col 447, row 330 long 44.4, lat -21.7
Mean monthly evapotranspiration (Jan to Dec)	Jones P. G. (1997) Digital coverage of climate, Latin America. CIAT. Cali. Colombia	Constructed from interpolated climate file based on NOAA 10 minute grid DEM and CIAT climate database. Interpolation from approximatly 10,000 met stations each pixel estimated from the nearest 5 stations using inverse square distance weighting. Calculated after Linacre E. T. (1977). A simple formula for estimating evaporation rates in various climates, using temperature data alone. Agric. Met. 18:409-424	Due to mismatch when splicing files. Missing pixels at col 394, row 333 long -53.2, lat -21.57 col 419, row 332 long -49.03, lat -21.4 col 447, row 330 long 44.4, lat -21.7
Annual	CIAT 1998	Sum of all months / 12 except for rainfall	"

2.7 Holdridge LifeZones

Constructed from interpolated climate file based on NOAA 10 minute grid DEM and CIAT climate database. Interpolation from approximately 10,000 met stations each estimated from the nearest 5 stations using inverse square distance weighting. The Holdridge classifications were defined by Holdridge, (1967).

Refer to: hold_g

Reference: Jones P. G. (1998) Holdridge life Zones of Latin America, Digital image. CIAT. Cali. Colombia

Holdridge, L.R., 1967. Life zone ecology. Tropical Science Center, San Jose, Costa Rica

2.8 CIAT's Administration Boundary Coverage

The information contained in the administration boundary coverage was digitized in the GIS lab at CIAT in 1996. The boundaries were digitized country by country and adjusted to the DCW (Digital Chart of the World) country boundary. The information contained in the coverage includes three administration boundary levels; the country boundary, province or department and municipalities. The boundary information was obtained from maps of various scales, as listed in Table 2.9.1 (Barona, 1997).

Refer to: adm_lac

Jones, P. G. and Bell, W. C. (1997) Coverage of Latin America Administrative Divisions. Version 1.1 Apr 1997 digital dataset. CIAT Cali Colombia

Table 2.8.1: Scale of administration boundary level by country

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
El Salvador	Department	District	Cantons	1997	1:20,000	Direccion General de Estadistica y Censos, Unidad de Cartografia1987. Mapa de la Republica de El Salvador, Division Politico- Administrativa. Copia Heliografica.
Guatemala	States	District			1:75,000	Mapa de la Regionalizacion de la Republica de Guatemala. Ministerio de Agricultura. Copia Heliografica
Honduras	Department	Municipality		1987	1:12,000 – 1:30,000	Instituto Geografico Nacional. Secretaria de Comunicaciones, Obras Publicas y Transporte. 1987. Proyeccion Transversal de Mercator. Planchas y escalas: Dpto. de Choluteca 1:200000 Dpto. de Atlantida 1:200000 Dpto. de Comayagua 1:200000 Dpto. de Colon 1:200000 Dpto. Santa Barbara 1:200000 Dpto. de Cortes 1:200000 Dpto. de Fco.Morazan 1:200000 Dpto. de Paraiso 1:230000 Dpto. Gracias a Dios 1:300000 Dpto. Intibuca 1:150000 Dpto. Islas de la Bahia 1:200000 Dpto. La Paz 1:120000 Dpto. de Lempira 1:200000 Dpto. de Copan 1:200000 Dpto. de Olancho 1:350000 Dpto. de Yoro 1:230000 Dpto. Ocotepeque 1:120000 Dpto. Valle 1:200000
Costa Rica	Provinces	Cantons		1984	1:1500,000	Instituto Geografico Nacional. 1984. Mapa de Provincias y Cantones.
Panama	Province	District	Corregimientos	1990	1:1000000	Ministerio de Obras Publicas Instituto Geografico Nacional "TOMMY GUARDIA". 1990. Mapa de la Republica de Panama Division Politico - Administrativa.
Nicaragua	Department	Municipality		1993	1:750.000	Instituto Nicaraguense de Estudios Territoriales. Ministerio de Construccion y Transporte. 1993. Mapa de la Republica de Nicaragua Division Politico- Administrativo. Proyeccion Transversal de Mercator
Mexico	State	Municipality		1981	1:1000.000	Mapa Geoestadistico. Secretaria de Programacion y Presupuesto. (S.P.P.). 4 hojas: Norte, Centro, Noroeste y Sureste
Belize	State				1:750.000	Mapa de la Regionalizacion de la Republica de Guatemala. Ministerio de Agricultura. Copia Heliografica

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
*Argentina	Provinces	Department	Cabeceras			Atlas de Suelos de la Republica de Argentina. Inta y la Fundacion Argentina. Para el caso de Argentina, utilizan Provincias, Departamentos y cabeceras, como division politica, pero lo que denominan Provincia corresponde a una primera division que es como una region. Para este caso tenemos la informacion de las tres variables pero solo utilizamos atlas_s y atlas_t que seria las divisiones en dos niveles que son los que hemos utilizado para todos los paises
Bolivia	Department	Provinces				Instituto Geografico Militar. 1980. Mapa de la Republica de Bolivia. Escala 1:1500000. Proyeccion Conica Conforme de Lambert
Brasil	States	Municipality				1- Amazonas Sociedade Comercial e Representacoes Graficas Ltda. Mapa do Estado de Amazonas. Escala 1:1500000. 2- Acre Distribucao Politico-Administrativo do Estado do Acre. FUNTAC, Fundacao de Tecnologia do Estado do Acre. 1990. Escala 1:2500000. Pertenece al Atlas Educativo de Acre. 3- Alagoas Polimapas Editora Limitada. 1980. Mapa Polivisual de Alagoas. Politico Turistico, Reg. Didactico. Escala 1:400000. 4- Bahia Sociedade Comercial e Representacoes Graficas Ltda. 1976. Mapa do Estado da Bahia. Escala 1:1200000. 5- Ceara Sociedade Comercial e Representacoes Graficas Ltda. 1974. Mapa do Estado do Ceara. 1974. Escala 1:500000. 6- Espiritu Santo Polimapas Editora Limitada. 1979. Mapa Rodoviario Estado de

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
						Espiritu Santo. Escala 1:400000. 7- Goias y Tocantins Geomapas Producoes Cartograficas Ltda. Mapa do Estado Goias Politico - Administrativo. Escala 1:1500000. 8- Maranhao Polimapas Editora Ltda. Mapa Polivisaul do Maranhao e Piaui. 1978-1980. Escala 1:1135000. 9- Mato Grosso do Norte Polimapas Editora Ltda. 1979. Mapa Rodoviario Mato Grosso, Politico, Turistico, Escolar, Polivisual. Escala 1:2000000. 10- Matogrosso do Sul Polimapas Editora Ltda. 1979. Mapa Estado do Mato Grosso do Sul, Rodoviario Turistico. Escala 1:1000000. 11- Minas Gerais Polimapas Editora 1979. Mapa Estado de Minas Gerais, Politico e Rodoviario. Escala 1:1350000. 12- Para y Amapa Polimapas Editora Ltda. Mapa Rodoviario Turistico, Escolar, Polivisual. 1979. Escala 1:2000000. 13- Paraiba Instituto Brasileiro de Geografia. 1970. Mapa Estado do Paraiba. Proyeccion Policonica. Escala 1:500000. 14- Parana Geomapas Producciones Cartograficas Ltda. Mapa Rodoviario e Politico. 1979. Escala 1:870000.

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
						15- Pernambuco Polimapas. 1978. Editora Ltda.Mapa Polivisual do Estado Pernambuco. Rodoviario, Politico, Turistico, Reg. Escala 1:710000. 16- Rio de Janeiro Secretaria de Planejamento da Presidencia da Republica. Fundacao Instituto Brasileiro de Geografia e Estadistica 1975. Mapa Estado do Rio de Janeiro. Escala 1:400000. 17- Rio Grande do Sul Geomapas Producciones Cartograficas Ltda.1977. Mapa Rio Grande do Sul. Escala 1:1000000. 18- Rio Grande do Norte Polimapas Editora Ltda. 1979. Mapa Rodoviario Estado do Rio Grande do Norte. Turistico, Escolar, Polivisual. Escala 1:500000. 19 - Rondonia Preservar. 1988. Mapa do Estado de Rondonia-Zoneamento Socio Economico Ecologico. Escala 1:1000000. 20- Santa Catarina Polimapas Editora Ltda. 1980. Mapa Polivisual de Santa Catarina, Politico, Turistico. Did. Reg. Rodof. Escala 1:500000. 21- Sao Paulo Polimapas Editora Ltda. 1979. Mapa Polivisual Sao Paulo. Politico, Regional, Escolar, Rodoferroviario. Escala 1:1000000. 22- Sergipe Instituto Brasilero de Geografia y Estadistica. CONDESE Y COEGE - IBGE. 1974. Mapa do Estado de Sergipe. Escala 1:400000.

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
Colombia	Department	Municipality				Instituto Geografico "Agustin Codazzi". 1995. Mapa Digitalizado por el DANE. Plancha 1:500000.
Chile	Provinces	Comun				Instituto Nacional de Estadisticas. Sub Depto. Cartografia. Dpto. Geografia y Censos. 1981. Mapa Esquematico de Chile. 1981. Con la nueva Division Politica. Escala 1:3000000.
Ecuador	Provinces	Canton				Instituto Nacional de Estadistica y Censos. Division Politico Administrativa de la Republica del Ecuador. 1993. Planchas y Escalas: Prov. de Sucumbios 1:250000 Prov. de Napo 1:250000 Prov. de Manabi 1:250000 Prov. de Pastaza 1:250000 Prov. de Esmeraldas 1:250000 Prov. de Guayas 1:250000 Prov. de Los Rios 1:250000 Prov. El Oro 1:250000 Prov. de Galapagos 1:500000 Prov. de Carchi 1:250000 Prov. de Imbabura 1:250000 Prov. de Bolivar 1:250000 Prov. de Pichincha 1:250000 Prov. de Loja 1:250000 Prov. de Cotopaxi 1:250000 Prov. de Azuay 1:250000 Prov. de Tungurahua 1:250000 Prov. de Canar 1:250000 Prov. de Chimborazo 1:250000 Prov. de Morona Santiago 1:250000 Prov. de Zamora Chinchipe 1:250000
Guyane F.	Arrodissements	Canton	Comun			Institut Geographique National. Carte Touristique Guyane au 1:500000. 1995.
Guyana	Region	Sub-region				
Paraguay	Department	District				Direccion General de Estadistica, Encuesta y Censos. FNUAP-PNUD. 1995. Atlas de Necesidades Basicas Insatisfechas del Paraguay. Planchas y Escalas: Depto. Canindeyu 1:700000 Depto. Amambay 1:850000 Depto. Neembucu 1:750000 Depto. Central 1:400000 Depto. Paraguari 1:600000 Depto. Misiones 1:600000 Depto. Itapua 1:900000 Depto. Caazapa 1:650000 Depto.Alto Parana 1:800000 Depto. Caaguazu 1:800000

Country	Admin Level 2	Admin Level 3	Admin Level 4	Year	Digitized from Scale	Source
						Depto. Guaira 1:420000 Depto. Cordillera 1:400000 Depto. San Pedro 1:800000 Depto. Concepcion 1:750000 Depto. Occidental 1:3000000
Peru	Department	Provinces				Instituto Geografico Nacional. 1984. Mapa Fisico Politico del Peru. Proyeccion Mercator Transversa. Escala 1:1000000. 4 Hojas
Suriname	District	Resort				1- Distrikt Nickerie escala 1:300000 Hoja C.B.L. 469- 2- Distrikt Coronie escala 1:200000 Hoja C.B.L. 469-2 3- Distrikt Saramacca escala 1:200000 Hoja C.B.L. 469-3 4- Distrikt Wanica escala 1:50000 Hoja C.B.L. 469-4 5- Distrikt Commewijne escala 1:200000 Hoja C.B.L. 469-6 6- Distrikt Marowijne escala 1:200000 Hoja C.B.L. 469-7 7- Distrikt Para escala 1:200000 Hoja C.B.L. 469-8 8- Distrikt Paramaribo escala 1:25000 Hoja C.B.L. 469- 9- Distrikt Brokopondo escala 1:200000 Hoja C.B.L. 469-9 10-Distrikt Sipaliwini escala 1:1000000 HOja C.B.L. 469-10Q Las hojas anteriores son copias heliograficas.
Uruguay	Department					Servicio Geografico Militar. 1992. Mapa de la Republica Oriental del Uruguay, carta geografica division politica. escala 1:500000
Venezuela	States	Municipality	Parroquias			Oficina Central de Estadistica e Informatica Presidencia de la Republica. Direccion de Geografia y Cartografia. 1993. Mapa de la Division Politica Territorial de Venezuela. Copia Heliografica.

Source: Adapted from Barona (1997)

2.10 Crop Database

The CIAT Crop Production Database (By G Hyman from ***Crop distribution mapping: applications and techniques for broad scale analysis of crop geography*** working document 1998)

Maps of crop distributions are critical for commodity studies, agroecological modelling, and numerous environmental applications. Perhaps the most basic need is to know how many hectares have been cultivated, where the cultivation has occurred and how much food has been harvested. As part of CIAT's goal of analyzing land use patterns and dynamics, we have developed a database of crop production for Latin America. The information in this database, important for many CIAT activities and for those of our partners, has numerous uses for agricultural research. Agroecological modeling can help to determine if farmers are growing the most appropriate crops for the given biophysical environment. The crop distributions help modeling of climatic and other environmental changes and their effects on agriculture. For example, modeling of expected changes in crop distributions caused by global warming requires accurate maps of the current spatial extent of crops. Crop distributions will be critical for continental-scale land degradation research. The georeferenced digital data allows us to make the link between environmental degradation and agriculture. For CGIAR scientists and our NARS partners, crop distribution mapping can help guide our crop improvement programs by aiding breeders to understand the relationships between crops and the environmental constraints in which they are grown.

In the past, CIAT has developed digital maps of crop distributions and densities for Latin America, Africa, and Asia, focussing on the CIAT commodities. In 1996, as part of the Ecoregional Project for Latin America, we initiated a program to improve our contacts with crop data providers, update our previous crop distribution maps, map new crops, and automate the process for future updates. This year our focus has been on database development and automated mapping of crop distributions

CIAT has obtained the most recent crop distribution data at the best available geographic resolution for the 21 mainland Latin American. Table 2.10.1 shows the date of our most recent crop data, the number of crops we hold data for, the collection method and the administrative level of the information. The range of dates of the information points out only one difficulty of merging data from individual countries across a broad region. The geographic detail of the data also varies. For example, Honduras recently completed a relatively detailed agricultural census; in contrast, Costa Rica's last census was in 1984. Their current data is available only at the national level. Many countries provide sample data rather than census data. The sample data is derived by accepted international standards and may actually be better than the census data due to the difficulties of carrying out a complete census. Nevertheless all the information must be carefully studied to assess its comparability from one country to the

next. We are investigating data quality problems in our efforts to reduce errors and provide metadata. We have linked over 75% of the tabular crop data to the third-level administrative division maps. Thus far our efforts have focused on the principal crops of the region and those of particular interest to the CGIAR system. However, this project has purposely sought to look at the broad range of crops in order to take a more comprehensive view of the agricultural sector in Latin America. From the column labeled

Table 2.10.1: CIAT Crop distribution database

Country	Admin Level	Year	# of Crops	Collection Method
Belize	Department	1994	**42**	Census
Costa Rica	Country	1993-95	**14**	Sample
El Salvador	Region	1994	**7**	Sample
Guatemala	Departament	1989-95	**6**	Sample
Honduras	Municipality	1993	**63**	Census
Mexico	Municipality	1991	**78**	Census
Nicaragua	Departament	1995	**9**	Sample
Panama	Municipality	1990-91	**17**	Census
Argentina	Department	1991	**6**	Census
Bolivia	Municipality	1987-95	**20**	Sample
Brazil	Municipality	1993	**62**	Census
Chile	Department	1979-94	**40**	Sample
Colombia	Department	1993	**26**	Sample
Ecuador	Region	1991-93	**93**	Sample
Guayana	Comuna	1993-94	**19**	Census
Guayana Fr.	District	1994	**9**	Census
Paraguay	Department	1995	**35**	Sample
Peru	District	1993	**229**	Sample
Suriname	Municipality	1990-91	**44**	Census
Uruguay	Department	1993	**61**	Census
Venezuela	Federal District	1984-85	**25**	Sample

Note that we have taken a much more comprehensive approach to agricultural land use analysis by collecting data for a large number of crops. This is a significant advance over our previous work when we only studied our core commodities.

"**# of crops**" in Table 2.10.1, note that we have gone far beyond our previous focus on CGIAR core crops.

Table 2.10.2: Crops by country

Country	Year	Crop
El Salvador	1994	Algodon, Arroz, Frijol, Maicillo, Maiz
Guatemala	1995	Arroz, Frijol, Maiz, Mani, Sorgo, Trigo
Honduras	1993	Frijol, Maiz
Costa Rica	1995	Maiz
Panama	1991	Arroz, Frijol, Maiz, Yuca
Nicaragua	1995	Arroz, Café, Frijol, Maiz, Pasto, Sorgo
Mexico	1991	Ajonjoli, Alfalfa, Arroz, Café, Cana De Azucar, Cartamo, Frijol, Garbanzo Forrajero, Garbanzo Blanco, Maiz, Pastos, Sorgo, Soya, Trigo
Belize	1994	Achiote, Aji, Arroz, Banano, Cacao, Cacao, Café, Calabaza, Cana De Azucar, Cebolla, Col, Frijol, Garbanzo, Maiz, Mani, Melon, Name, Nueces, Papa, Papaya, Pepino, Pimenton, Pina, Sandia, Sorgo, Tomate, Yuca, Zanahoria
***Argentina**	1991	Algodon Girasol Maiz Pastos Soya Trigo
Bolivia	1995	Alfalfa, Algodon, Arroz,Arveja, Banano, Café, Cana De Azucar, Girasol, Haba, Maiz, Mani, Papa, Platano, Quinua, Sorgo, Sorgo, Soya, Tomate, Trigo, Uva, Yuca,
Brasil	1993	Abacate, Aceituna,Ajo, Algodon, Arroz, Arveja, Avena, Banano, Cacao, Café, Cana De Azucar Castanas,Caucho, Cebada, Cebolla, Centeno, Coco, Fique, Frijol, Guarana, Haba, Hierba Mate Higo, Higuerilla Lima, Lino, Maiz, Malva, Mandarina, Mango, Mani, Maracuya, Melon, Naranja, Nuez,Palmito, Papa, Pera, Pimienta, Pina,Sandia, Sorgo, Soya, Tabaco, Tomate, Trigo, Uva, Yuca,
Colombia	1993	Ajonjoli, Algodon, Arracacha, Arroz, Avena, Cacao, Cana De Azucar, Cebada, Coco, Fique, Frijol, Girasol, Maiz, Mani, Name, Palma Africana, Papa, Platano, Sorgo, Soya, Tabaco Negro, Tabaco Rubio, Yuca
Chile		Almendro, Arroz, Arveja, Avena, Cebada, Centeno, Chicharo, Ciruelo, Damasco, Durazno, Frijol, Garbanzo, Guindo Dulce, Kiwi, Lenteja, Limon, Lupino, Maiz, Manzana, Maravilla, Naranja, Nectarino, Nogal, Palto, Papa, Pera, Remolacha, Tabaco, Trigo, Uva

Country	Year	Crop
Ecuador	1995	Abaca, Achiote, Aguacate, Aji, Ajonjoli, Algodon, Anis, Arroz, Arveja, Avena, Babaco, Banano, Brocoli, Cacao, Café, Camote, Cana De Azucar, Capuli, Caucho, Cebada, Cebada, Cebolla, Cebolla, Centeno, Chirimoya, Chocho, Ciruela, Claudia, Coco, Col, Coliflor, Durazno, Esparrago, Frijol, Frutilla, Garbanzo, Girasol, Guava, Guayaba, Haba, Higuerilla, Lechuga, Lenteja, Lima, Limon, Linaza, Maiz, Mandarina, Mango, Mani, Manzana, Marigold, Melloco, Melon, Mora, Nabo, Naranja, Naranjilla, Oca, Paja, Palma Africana, Palmito, Papa, Papa China, Papaya, Pepinillo, Pera, Pimiento, Pina, Platano, Quinua, Rabano, Remolacha, Sandia, Sorgo, Soya, Soya, Tabaco, Te, Tomate, Tomate De Arbol, Toronja, Trigo, Uva, Yuca, Zanahoria
Guyane F.	1994	Arroz, Banano, Cana De Azucar, Legumbres, Madera, Pastos, Pina, Platano, Tuberculos
Guyana	1994	Arroz, Batata, Blackeye, Bora, Boulanger, Calabaza, Coco, Col, Eddoes, Maiz, Mani, Minica, Ochro, Papa Dulce, Pepino, Platano, Squash, Tannia, Tomate, Yuca
Paraguay	1995	Algodon, Arroz, Banano, Café, Cana De Azucar, Frijol, Frutilla, Locote, Maiz, Mani, Naranja, Papa, Pasto, Pina, Sandia, Sorgo, Soya, Tabaco, Tomate, Trigo, Tung, Yerbamate, Yuca, Zanahoria
Suriname	1991	Aguacate, Arroz, Banano, Boulanger, Cacao, Café, Cana De Azucar, Cereza, Coco, Col, Guayaba, Habichuela, Kouseband, Maiz, Mandarina, Mango, Mani, Markoesa, Melon, Mora, Naranja, Oerdie, Paksooi, Palace, Papaya, Pepino, Pimienta, Platano, Pomtayer, Sopropo, Soya, Tangerbad, Tomate, Toronja, Yuca, Zapallo, Zuurzak
Uruguay	1993	Arroz, Avena, Batata, Cana De Azucar, Cebada, Cebolla, Girasol, Maiz, Papa, Remolacha, Sorgo, Soya, Tomate, Trigo, Zapallo
Venezuela	1995	Aguacate, Ajo, Arroz, Café, Cambur, Cebolla, Durazno, Fresa, Frijol, Guayaba, Lechosa, Limon, Maiz, Mandarina, Mango, Melon, Naranja, Papa, Parchita, Patilla, Pimenton, Pina, Platano, Sorgo, Tomate, Uva, Yuca, Zanahoria

Country	Year	Crop
Peru	1993	Abaca, Acelga, Achiote, Achira, Achita, Agava, Aguaje, Aji, Ajo, Ajonjoli, Albahaca, Albaricoque, Alcachofa, Alcanfor, Alcaser, Algarrobo, Algodon, Almendro, Amapola, Ampi, Anis, Anona, Apio, Arbolpan, Arracacha, Arroz, Arveja, Avellana, Avena, Azafran, Barbasco, Berenjena, Berro, Betarraga, Boldo, Brocoli, Cabulla, Cacao, Café, Caigua, Caimito, Calabaza, Camote, Camucamu, Cana De Azucar, Canabrava, Canahua, Canamo, Canela, Capuli, Carambola, Cardomomo, Carrizo, Cartamo, Castana, Caupi, Cebada, Cebolla, Cedron, Centeno, Cerezo, Chanca, Chirimoyo, Chocho, Chope, Chuisan, Cidra, Cilantro, Cirolero, Cobo, Coca, Cocona, Cocotero, Col, Cola De Caballo, Colantao, Coliflor, Colsa, Comino, Crotalario, Cuya, Daledale, Dhil, Esparrago, Espinaca, Flores, Frambuesa, Fresa, Frijol, Garbanzo, Girasol, Gobo,Granadilla, Granado, Guanabano, Guarana, Guayabo, Guindo, Haba, Henequen, Hierbabuena, Higuera, Higuerilla, Huacatay, Humari, Hungurahui, Japchoy, Jebe, Jenjibre, Jojoba, Laurel, Lechuga, Lenteja, Leucaena, Lima, Limon, Linaza, Lino, Longapa, Lucuma, Maca, Macadamia, Macambo, Maiz, Mamey, Mandarina, Mango, Mangua, Mani, Manzana, Manzanilla, Maracuya, Maranon, Marigold, Mashua, Masma, Mauna, Melocoton, Melon,Membrillo, Menta, Morera, Mostaza, Muela, Muhuil, Nabo, Naranjo, Nispero, Nogal, Numia, Olivo, Olluco, Oregano, Pajuro, Palillo, Pallar, Palma Aceitera, Palma Datilera, Palmito, Palto, Panamito, Papa, Papayo, Pecano, Pepinillo, Pepino, Peral, Perejil, Pijuayo, Pimenton, Pimienta, Pimiento, Pina, Pituca, Pitus, Plantas Aromaticas, Plantas Medicinales, Platano, Pomarrosa, Poro, Quina, Quinua, Rabano, Remolacha, Rijpalo, Ruda, Sabila, Sachain, Sachapa, Sambumba, Sandia, Sauco, Sicua, Sorgo,Soya,Tabaco, Tamarindo, Tangelo, Tangerina, Taperiba, Tara,Te,Tomate, Toronja, Toronjil, Totora, Trigo, Tuna, Umbo, Una De Gato, Uncucha, Uva, Uvilla, Uvos, Vainita, Valsamina, Vijao, Virraca, Vituca, Witino, Yacon, Yuca, Yunya, Yute, Zanahoria, Zango, Zapallo, Zapote, Zarandaja

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Climate Surfaces: P Jones, 1997, CIAT, Cali, Colombia

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- Monthly rainfall (Jan to Dec)
- Monthly evaporation (Jan to Dec) used a simple formula after Linacre E. T. (1977) for estimating evaporation rates in various climates, using temperature data alone. *Agric. Met.* **18**: 409-424
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Software

The data was collected by CIAT and the analysis was performed using the following software: ARC/INFO, ArcView GIS 3.1, Idrisi, PCI, Splus and Excel.