



Creating an Area-level Extract

Exercise

Objective: Use the IPUMS Terra website to obtain a customized dataset that can be used to answer research questions. This exercise uses area-level and raster data to explore temporal and spatial changes in Brazilian population and land cover.

IPUMS Terra: Area-level Data Extract Overview

RESEARCH QUESTIONS

Question 1

Examine the interoperable (raster and area-level) datasets for Brazil over three decennial censuses. What trends exist over time in education, employment, agriculture, urbanization, and deforestation?

Question 2

Examine the drivers of natural resource use in Brazil. How does population growth relate to natural resource consumption?

OBJECTIVES

- Create an IPUMS Terra account
- Create and download a IPUMS Terra area-level data extract
- Use IPUMS Terra to generate raster summarizations for geographic areas

TERRAPOP VARIABLES

Area-level variables

| | |
|-----------|--|
| POPTOTAL: | Total population for tabulated census areas |
| UNEMP: | Percent of population unemployed in each census area |
| PROF: | Percent of workers in professional, technical or managerial occupations in each census area |
| EDATTAIN: | Percent of population with a specific educational attainment in each census area |
| AGRIC: | Percent of employed persons in each census area working in agriculture, fishing, or forestry sectors |
| URBANIZ: | Percent of population living in urban areas |

Raster variables

| | |
|--------------|------------------------------------|
| EVRGRNBRDLF: | Area of evergreen broadleaf forest |
| URBAN: | Urban area |
| CROPLAND: | Area devoted to crops |

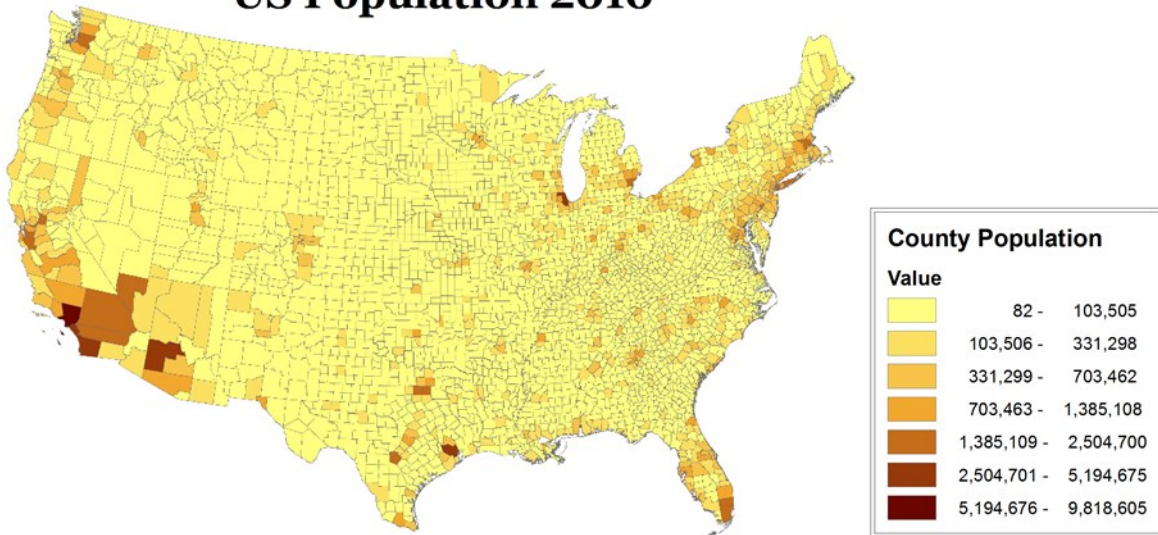
IPUMS Terra: Area-level Data Extract Overview

Data Type Descriptions

Area-level

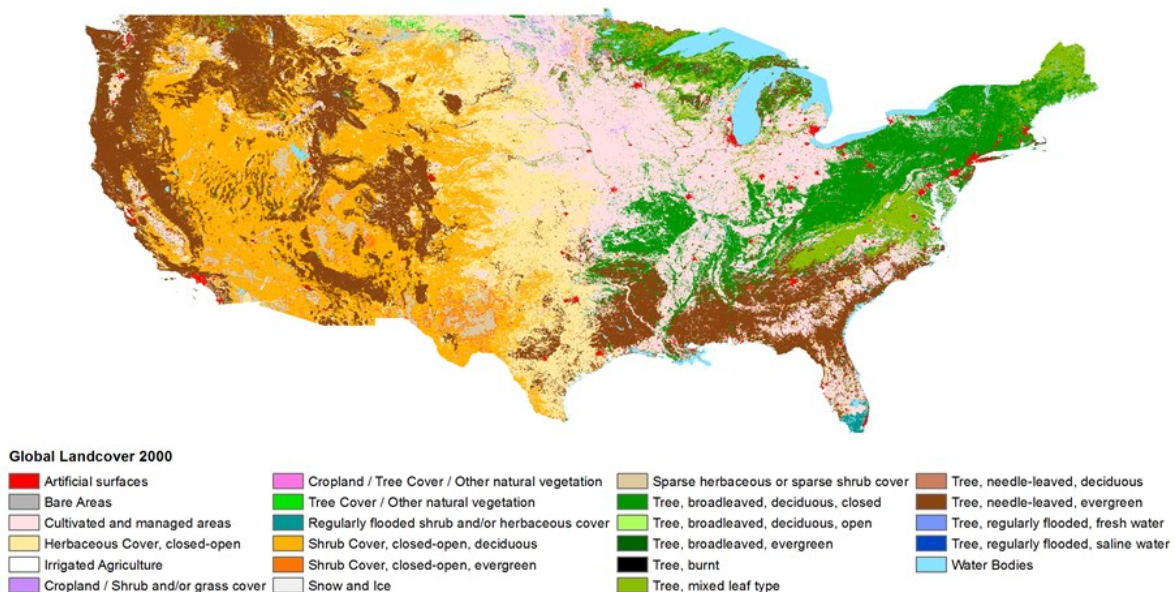
Area-level data describe geographic units defined by boundaries. Geographic units are grouped in sets, such as the counties of the United States or the states of Brazil. In IPUMS Terra, these sets of units are referred to as geographic levels. The data are structured as tables, with a row for each unit and a column for each variable. For example, you may have a table with a row for each county in the United States and columns containing the number of males and the number of females in each county.

US Population 2010



Raster

Raster data describe how the value of a variable varies over space. The data are structured as a grid of cells. Each cell is connected to a location, and contains the value of the variable at that location. For example, in a land cover raster, each cell indicates the type of land cover found at that location.



Step 1

Sign up

REGISTERING WITH IPUMS TERRA

The Minnesota Population Center uses a **common user management system** for several data projects: IPUMS Terra, IPUMS International, IPUMS USA, IPUMS CPS, IPUMS Higher Ed, IPUMS NAPP, IPUMS NHGIS, IPUMS Health Surveys, and IPUMS Time Use. If you have an existing account with any of these systems, you will use the same account for IPUMS Terra.

- Go to **<https://data.terrapop.org/>**
- If you have an existing MPC account, click **Login**. After logging in, you will be directed to the registration page for IPUMS Terra.
- If you do not have an MPC account, click on **Sign up** to register for access.

Note: Microdata access is NOT required for this exercise. Access to international microdata requires application and approval by the IPUMS International project.

What is IPUMS Terra?

IPUMS Terra integrates the world's population and environmental data including...

- Population censuses and surveys
- Land cover data classified from satellite imagery
- Temperature, precipitation, and related climate data
- Land use data derived from censuses and surveys in combination with remotely sensed data

Available Datasets

- Microdata Datasets
- Area-level Datasets
- Raster Datasets

Tutorials

- Microdata Output
- Area-level Output

Microdata Output
characteristics of individual people with attached contextual variables derived from area-level and/or raster data
[Read more](#) [Start Extract](#)

Area-level Output
characteristics of geographic units including aggregate population data and/or summaries from raster data
[Read more](#) [Continue Extract](#)

Raster Data Output
data in spatial grids potentially derived from area-level data
[Read more](#) [Start Extract](#)

Step 2

Email Confirmation and log in

NEW TERRAPOP REGISTRATION

Terrapop data are available free of charge. Before using the data, researchers must complete this registration and agree to abide by the usage license specified below. By completing this application, you agree to receive occasional email messages. Such messages will be infrequent, and we will safeguard the confidentiality of your email address.

EMAIL (Required)

PASSWORD (Required)

PASSWORD CONFIRMATION (Required)

FIRST NAME (GIVEN NAME) (Required)

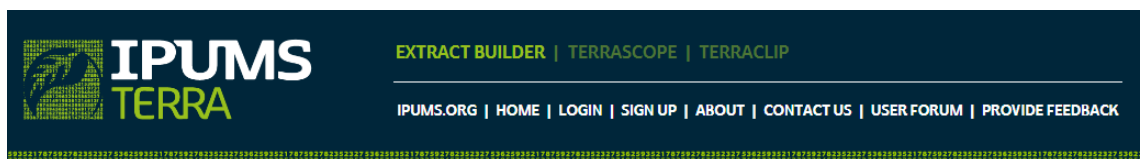
After you have registered with IPUMS Terra, an e-mail will be sent to your account notifying you of approval.

Note: Please be sure to check your trash/spam folders

- Open the e-mail and click on the confirmation link. You will then be logged into IPUMS Terra

Step 3

Start an
Area-level
Extract



What is IPUMS Terra?

IPUMS Terra integrates the world's population and environmental data including...

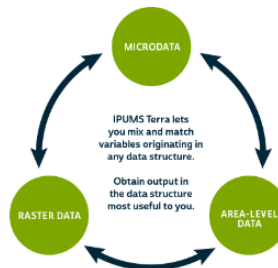
- Population censuses and surveys
- Land cover data classified from satellite imagery
- Temperature, precipitation, and related climate data
- Land use data derived from censuses and surveys in combination with remotely sensed data

Available Datasets

- [Microdata Datasets](#)
- [Area-level Datasets](#)
- [Raster Datasets](#)

Tutorials

- [Microdata Output](#)
- [Area-level Output](#)



Microdata Output

characteristics of individual people with attached contextual variables derived from area-level and/or raster data
[Read more](#)

[Start Extract](#)

Area-level Output

characteristics of geographic units including aggregate population data and/or summaries from raster data
[Read more](#)

[Start Extract](#)

Raster Data Output

data in spatial grids potentially derived from area-level data
[Read more](#)

[Start Extract](#)

The extract builder website guides researchers through the workflows for building data extracts. Choose the type of data structure you would like to receive as output for further analysis. In this tutorial, we will be working with aggregate or area-level data.

- Click on the **Start Extract** button for Area-level Output

Microdata Output

characteristics of individual people with attached contextual variables derived from area-level and/or raster data
[Read more](#)

[Start Extract](#)

Area-level Output

characteristics of geographic units including aggregate population data and/or summaries from raster data
[Read more](#)

[Start Extract](#)

Raster Data Output

data in spatial grids potentially derived from area-level data
[Read more](#)

[Start Extract](#)

Step 4

Examine the IPUMS Terra Interface

The IPUMS Terra interface for the first step of the workflow consists of the following elements:

Navigation Bar: Shows the major steps in the workflow, the sub-steps of the current step, and your progress through the workflow. The navigation bar steps will reflect the workflow you select. The step and sub-step you are currently on are highlighted in green.

Data Cart: Provides a summary of the data you have selected to include in your extract. The data cart is updated as you make selections throughout the workflow.

Availability Grid: Shows the availability of variables by dataset and enables selection of variables and datasets.

Variables Panel: Lists topics for which area-level variables are available. Clicking on a topic will populate the rows of the availability grid with the variables in that topic.

Datasets Panel: Lists countries in the IPUMS Terra system, and provides options to filter by time and hide countries without area-level data. Clicking on a continent will list the countries in the continent. Clicking on a country will populate the columns of the availability grid with the datasets available for that country. You may add all countries in a continent to the grid by clicking the “Browse All” line.

The screenshot displays the IPUMS Terra interface. At the top, the logo "IPUMS TERRA" is visible alongside links for "EXTRACT BUILDER", "TERRASCOPE", and "TERRACLIP". A "Navigation Bar" is positioned below the header, featuring a sequence of steps: "Change Output Type", "1 Select Area-Level Data" (highlighted in green), "2 Select Raster Data", and "3 Submit". A "Data Cart" is located in the top right corner, showing a summary of selected data. The main content area is divided into three panels: "Browse Variables" on the left, "Select Area-level Data" in the center, and "Browse Datasets" on the right. The "Browse Variables" panel lists various topics such as "Birthplace and Nativity", "Demographic", "Education", "Employment", "Household Amenities", "Household Characteristics", "Household Economic", and "Household Utilities". The "Select Area-level Data" panel includes a "Select Data" dropdown, a "What is this?" link, and two checkboxes: "Show only selected variables" and "Show only selected datasets". Below these are two empty boxes labeled "Variables" and "Datasets", both containing the text "Browsing None". The "Browse Datasets" panel shows a list of countries under the heading "Countries", with a "Browsing Options" dropdown. The "Variables" and "Datasets" labels are highlighted with yellow boxes. The footer of the interface includes the text "SCIENCE FOUNDATION MINNESOTA ALL RIGHTS RESERVED".

Step 5

Browse
datasets for
Brazil

- Click on **South America** in the Browse Datasets panel.

South American countries are listed with numbers in parentheses indicating how many years of data are available for the country.

| South America |
|-------------------|
| Browse All (49) |
| Argentina (5) |
| Bolivia (3) |
| Brazil (6) |
| Chile (5) |
| Colombia (5) |
| Ecuador (6) |

Step 6

Select
datasets

- Click on **Brazil**.
- The available datasets for Brazil appear as columns in the availability grid.
- Check the boxes to select years: **1991, 2000, 2010**.

Select Area-level Data

Select Data [What is this?](#)

- ☐ Show only selected variables ⓘ
- ☐ Show only selected datasets ⓘ

Variables

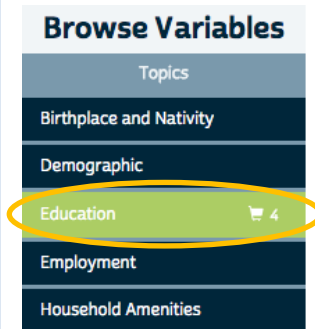
Browsing None

Datasets

| Brazil | | | | | |
|--------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 1960 | 1970 | 1980 | 1991 | 2000 | 2010 |
| IPUMS | IPUMS | IPUMS | IPUMS | IPUMS | IPUMS |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Step 7

Select Area-level variables



To see available variables, choose a topic in the Browse Variables panel.

- Choose the variable topic **Education**. The availability grid will be updated with available education variables.
- Choose the variable-group **EDATTAIN**, by checking the multi-select box.

EDATTAIN is available for Brazil in the years 1991, 2000, and 2010. The variables in the EDATTAIN group will be added to your Data Cart.

You can expand the variable group to see the individual variables by clicking the arrow widget

Note: EDATTAIN contains 4 variables for different types of education

Note: You can hide unselected datasets by clicking the "Show only selected datasets" toggle.

Select Area-level Data

Select Data [What is this?](#)

- ☐ Show only selected variables ⓘ
- ☒ Show only selected datasets ⓘ

Education Variables

| | | Datasets | | |
|-------------------------------------|-------------------|---------------|---------------|---------------|
| | | Brazil | | |
| | | 1991 IPUMS | 2000 IPUMS | 2010 IPUMS |
| <input checked="" type="checkbox"/> | SCHOOLAGE (3) | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | LITAGE (2) | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | EDATTAIN (4 of 4) | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | EDUCLESSPRIM | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | EDUCPRIMARY | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | EDUCSECOND | ✓ | ✓ | ✓ |
| <input checked="" type="checkbox"/> | EDUCTERTIARY | ✓ | ✓ | ✓ |

Step 8

Add Area-level Variables

Continue Adding variables to your extract by selecting the following area-level variables:

- Demographic → **POPTOTAL**
- Employment → **UNEMP**
- Employment → **PROF**
- Employment → **AGRIC**
- Urban → **URBANIZ**

IPUMS Terra also provides metadata about each variable. To access the metadata, you must first expose the individual variables within a variable group.

Employment Variables

| | | | |
|--|--|--------------|---------------------------------------|
| | | LABFORCE (3) | Labor force by sex |
| | | LFRATE (3) | Labor force participation rate by sex |
| | | CHILDEMP (1) | Employment rate of children |
| | | UNEMP (1) | Unemployment rate |
| | | PROF (1) | Workers in professional occupations |

Step 9

View Variable Metadata

- Once the variable group is open, click on the individual variable name **UNEMPLOY** to get additional metadata (eg., documentation about the variable, description, availability, and source).

Select Area-level Data

Select Data [What is this?](#)

- ☐ Show only selected variables ⓘ
- ☒ Show only selected datasets ⓘ

Datasets

| Brazil | | |
|---------------|---------------|---------------|
| 1991 IPUMS | 2000 IPUMS | 2010 IPUMS |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Employment Variables

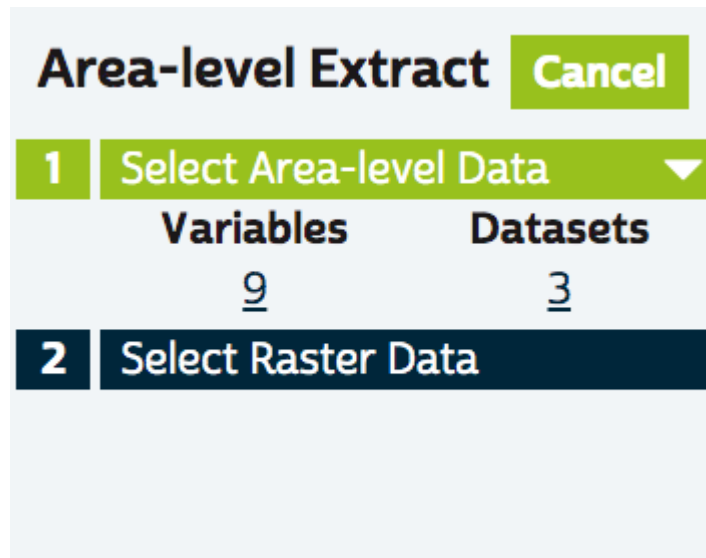
| | | | | | | |
|--|--|--------------|---------------------------------------|--|--|--|
| | | LABFORCE (3) | Labor force by sex | | | |
| | | LFRATE (3) | Labor force participation rate by sex | | | |
| | | CHILDEMP (1) | Employment rate of children | | | |
| | | UNEMP (1) | Unemployment rate | | | |
| | | UNEMPLOY | Unemployment rate | | | |
| | | PROF (1) | Workers in professional occupations | | | |

Step 10
Move to
Geographic
Level
Selection

When you have selected both area-level variables and area-level datasets, the NEXT button will become active and turn green, allowing you to move on to the next step.

NEXT

Note: Verify that your Data Cart has the correct number of variables and datasets.

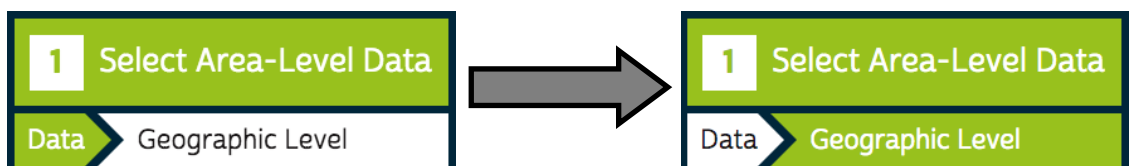


The dialog box is titled "Area-level Extract" with a "Cancel" button in the top right. It contains two main steps: Step 1, "Select Area-level Data", and Step 2, "Select Raster Data". Step 1 is currently active and highlighted in green. Below Step 1, there are two columns: "Variables" and "Datasets". Under "Variables", the number "9" is displayed with a horizontal line underneath it. Under "Datasets", the number "3" is displayed with a horizontal line underneath it. A small downward arrow is visible to the right of Step 1.

| Area-level Extract | |
|--------------------|------------------------|
| 1 | Select Area-level Data |
| Variables | Datasets |
| 9 | 3 |
| 2 | Select Raster Data |

The Navigation Bar indicates that the next step will be to select geographic levels.

- Click **NEXT** to move to the geographic level selection screen.



Step 9

Select a
Harmonized
Geographic
Level

Our research question involves examining how deforestation has changed between 1991 and 2010. In order to study change over time, it is important to use geographic units with boundaries that are consistent over the time frame under study. In IPUMS Terra, such units are referred to as Harmonized. If harmonized units are not used, apparent changes may be due to changing boundaries rather than actual change in deforestation.

Select Area-level Data

Select Geographic Level [What is this?](#)

Time Frame ⓘ

Administrative Level ⓘ

☒ Harmonized (Consistent)
 ☐ Year-specific
 ☐ Show number of units ⓘ

☒ Lowest Level Available
 ☐ 1st Administrative Level
 ☐ National

| Country | | Harmonized (Consistent) | Lowest Level Available |
|---------|------------|-------------------------|------------------------|
| Brazil | 1991 IPUMS | 1960 - 2000 | States |
| | 2000 IPUMS | | |
| | 2010 IPUMS | | |

For Brazil consistent geographic boundaries are only available over our full study time frame at the First Administrative Level, State.

- Change “Administrative Level” to **1st Administrative Level**. The cart will update to show your selections.

Select Area-level Data

Select Geographic Level [What is this?](#)

Time Frame ⓘ

Administrative Level ⓘ

☒ Harmonized (Consistent)
 ☐ Year-specific
 ☐ Show number of units ⓘ

☐ Lowest Level Available
 ☒ 1st Administrative Level
 ☐ National

| Country | | Harmonized (Consistent) | 1 st Administrative Level |
|---------|------------|-------------------------|--------------------------------------|
| Brazil | 1991 IPUMS | 1960 - 2000 | States |
| | 2000 IPUMS | | |
| | 2010 IPUMS | | |

Now the Geographic Level table shows that you have harmonized geographic units across the entire time period.

- Click **NEXT**



Step 10

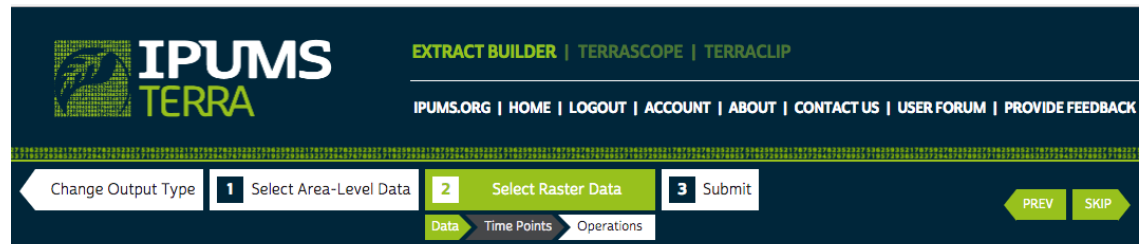
Select

Raster
variables

Now we will begin adding raster data to our cart.
You will need variables from the Land Cover topic

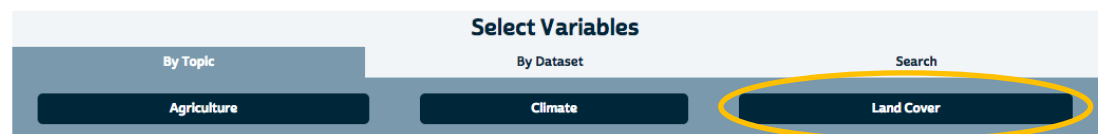
- Click on the **Land Cover** topic to list variable categories.
- Click on the **MODIS** variable category.

The MODIS variables will be listed.



Select Raster Data

Select Data [What is this?](#)



- Select three variables: **Evergreen Broadleaf**, **Urban and built-up**, and **Croplands**, as shown below, to add them to your cart.

| MODIS | | |
|--|------------------------------------|----------------------|
| Datasets in this topic | | |
| IGBP - Time Range: 2001 - 2012 Period: Annual | | |
| Variable | Description | Dataset |
| <input type="checkbox"/> IGBP_AREA_REFERENCE | IGBP Area Reference | IGBP |
| <input type="checkbox"/> IGBP | IGBP | IGBP |
| <input type="checkbox"/> IGBP_WATER | Water | IGBP |
| <input type="checkbox"/> IGBP_EVRGRNNDLLF | Evergreen Needleleaf | IGBP |
| <input checked="" type="checkbox"/> IGBP_EVRGRNBRDLF | Evergreen Broadleaf | IGBP |
| <input type="checkbox"/> IGBP_DECDNDLLF | Deciduous Needleleaf | IGBP |
| <input type="checkbox"/> IGBP_DECDBRDLF | Deciduous Broadleaf forest | IGBP |
| <input type="checkbox"/> IGBP_MXDFRST | Mixed forest | IGBP |
| <input type="checkbox"/> IGBP_CLSDSHRBLND | Closed shrublands | IGBP |
| <input type="checkbox"/> IGBP_OPENSHRBLND | Open shrublands | IGBP |
| <input type="checkbox"/> IGBP_WDYSVNNS | Woody savannas | IGBP |
| <input type="checkbox"/> IGBP_SAVANNAS | Savannas | IGBP |
| <input type="checkbox"/> IGBP_GRASLANDS | Grasslands | IGBP |
| <input type="checkbox"/> IGBP_PERMWTLNDS | Permanent wetlands | IGBP |
| <input checked="" type="checkbox"/> IGBP_CROPLAND | Croplands | IGBP |
| <input checked="" type="checkbox"/> IGBP_URBAN | Urban and built-up | IGBP |
| <input type="checkbox"/> IGBP_CRPLNDNVMS | Cropland/Natural vegetation mosaic | IGBP |

Note: Clicking on variable labels will provide additional metadata

- Click **NEXT** when you are finished adding variables.



Step 11

Select time points for Raster variables

MODIS data are available at annual time steps for 2001-2012. You must select which years to include in your extract. Ideally, the MODIS data years will match the census years of your area-level data.

Note: The Geographic Levels section of your cart shows the years of your area-level data, along with the Countries.

Area-level Extract Cancel

1 **Select Area-level Data** ▼

| Variables | Datasets |
|-----------|----------|
| <u>9</u> | <u>3</u> |

Geographic Levels

Countries
Brazil (1991, 2000, 2010)

Time Frame
Harmonized (Consistent)

Administrative Level
1st Administrative Level

- Click **“Switch to multiple time points”** so you can select multiple years

Select Raster Data

Select Time Points What is this?

Raster Dataset: IGBP

Time Range: 2001 - 2012
Period: Annual
Variables:
Evergreen Broadleaf (IGBP__EVRGRNBRDLF)
Croplands (IGBP__CROPLAND)
Urban and built-up (IGBP__URBAN)

Raster Time Point

Select a year

Switch to multiple time points

You have selected:

Select Raster Data

Select Time Points What is this?

Raster Dataset: IGBP

Time Range: 2001 - 2012
Period: Annual
Variables:
Evergreen Broadleaf (IGBP__EVRGRNBRDLF)
Croplands (IGBP__CROPLAND)
Urban and built-up (IGBP__URBAN)

Raster Time Point

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

Switch to single time points

You have selected:
2001
2010

The time points closest to the area-level years are 2001 and 2010.

- Click on years **2001** and **2010**
- Click **NEXT**



Step 12

Select Summarization Operations for Raster Variables

Because we are creating an extract for output as area-level data, we must summarize the raster variables over each geographic unit. Depending on the type of raster variable, there are several possible ways to perform the summarization. The raster variables we have chosen are all “Binary” type. In the original MODIS IGBP data, each cell has a value indicating the type of land cover at that location, such as Urban or Cropland. In the binary variables, the cells with a given land cover type, such as Urban, are given a value of 1 and all other cells are given a value of 0.

To summarize binary variables over geographic units, the options are Percent Area, which will calculate the percent of each unit’s area that is covered by the variable’s land cover type, and Total Area, which will calculate the total area (in hectares or square meters) of the variable’s land cover in each unit.

Select Raster Data

Select Aggregating Operations [What is this?](#)

| | Min | Max | Mean | Count | Mode | # Classes | Percent Area | Total Area |
|-----------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|
| Select All Available: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| IGBP | | | | | | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Land area = Binary | | | | | | | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

- Check **Percent Area** and **Total Area** on the Binary line of the table to select these operations for all of your selected variables.
- Click **NEXT** to go to the Submit step.

Note: You can see the individual variables by expanding the Binary section of the table.

Step 13

Check Data Cart

Review your cart in the right panel
Your data cart should match the screenshot below

Area-level Extract
Cancel

1 Select Area-level Data

| Variables | Datasets |
|--------------------------------------|----------|
| 9 | 3 |
| Geographic Levels | |
| Countries | |
| Brazil (1991, 2000, 2010) | |
| Time Frame | |
| Harmonized (Consistent) | |
| Administrative Level | |
| 1 st Administrative Level | |

2 Select Raster Data

| Variables | Datasets |
|-------------|----------|
| 3 | 1 |
| Time Points | |
| IGBP | |
| 2001 | |
| 2010 | |

Step 14

Submit
Extract

Submit Extract

Extract Details

Extract Title

Brazil education, employment, deforestation]

Extract Notes (Optional)

☐ Include boundary files ⓘ

☐ Send Extract to data grid ⓘ

- Give your extract a short, descriptive **Extract Title**, maybe, “Brazil education, employment, deforestation”. The Extract Title will appear in your Extract History.
- You may also provide more detailed **Extract Notes**, perhaps describing why you created the extract. These notes will appear on the extract details page. (The extract details page has not yet been implemented.)
- If you want the GIS shapefiles for the geographic levels used in your extract, check the box to “**Include boundary files.**” (Not required for this exercise)
- Click **Submit Extract**

SUBMIT EXTRACT

You will receive an email when the extract is ready

terrapop@umn.edu

3:18 PM (7 minutes ago) ☆

to me ▾

Your TerraPopulus extract 'Brazil education, employment, deforestation' is ready.

To retrieve your data, codebook, and command files, go to the link below.

https://data.terrapop.org/extracts/264169ad-8e14-11e5-8c97-b82a72e0b782/116_bundle.zip

Thank you for your support.


Sincerely,
The Terra Populus Team

Step 15

Download your extract

- To download the data, follow the link in the e-mail. You can also access your extracts on your account's Extract History page, as shown below.

The data will be delivered in a compressed format, make sure you have software available to extract the files.

[EXTRACT BUILDER](#) | [TERRASCOPE](#) | [TERRACLIP](#)

[IPUMS.ORG](#) | [HOME](#) | [LOGOUT](#) | [ACCOUNT](#) | [ABOUT](#) | [CONTACT US](#) | [USER FORUM](#) | [PROVIDE FEEDBACK](#)

[Extract History](#) | [Account](#)

Extract History

| Extract Request Number | Date Submitted | Title (click to edit) | Status | Resubmit | Download |
|------------------------|----------------|---|-----------|--------------------------|-----------------------------------|
| 1 | 23 Sep 16:05 | Argentina, Austria, Papua New Guinea boundary metadata test | completed | resubmit | download(2.21 MB) |
| 8 | 26 Sep 14:11 | Raster as Raster, GLC, WorldClim | completed | resubmit | download(0.64 MB) |
| 116 | 10 Oct 19:39 | Brazil education, employment, deforestation | completed | resubmit | download(0.03 MB) |