



Creating a Raster Extract

Exercise

Objective: Use the IPUMS Terra website to obtain customized datasets that can be used to answer research questions. This exercise uses raster datasets to explore education and agriculture in two economically different countries.

IPUMS Terra: Raster Data Extract Overview

RESEARCH QUESTIONS

Question 1

Examine relationships between education and agriculture in Zambia and Switzerland. Is there a correlation between educational attainment levels and crop/pasture land use in each country? Is the relationship similar across the two countries?

Question 2

Examine the tree cover present in Zambia and Switzerland. How does population relate to the presence of broadleaved trees? Compare relationships in both countries, for evergreen and deciduous broadleaved trees where applicable.

OBJECTIVES

- Create an IPUMS Terra account
- Create and download an IPUMS Terra raster data extract
- Use IPUMS Terra to rasterize area-level data

IPUMS TERRA VARIABLES

Area-level variables

POPTOTAL:	Total population for tabulated census areas
EDATTAIN:	Percent of population with a specific level of educational attainment in each census area

Raster variables

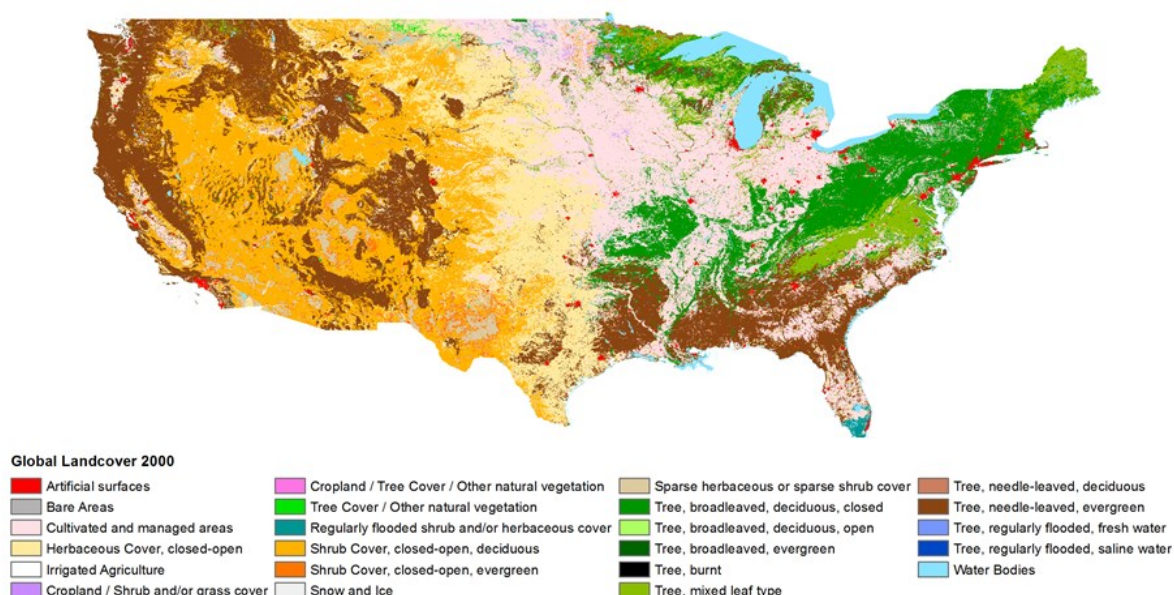
CROPLAND2000:	Area used as cropland
PASTURE2000:	Area used as pasture
LCBRDEVGRN:	Tree Cover, Broadleaved, Evergreen
LCDECIDCL:	Tree Cover, Broadleaved, Deciduous, Closed
LCDECIDOP:	Tree Cover, Broadleaved, Deciduous, Open

IPUMS Terra: Raster Data Extract Overview

Data Type Descriptions

Raster

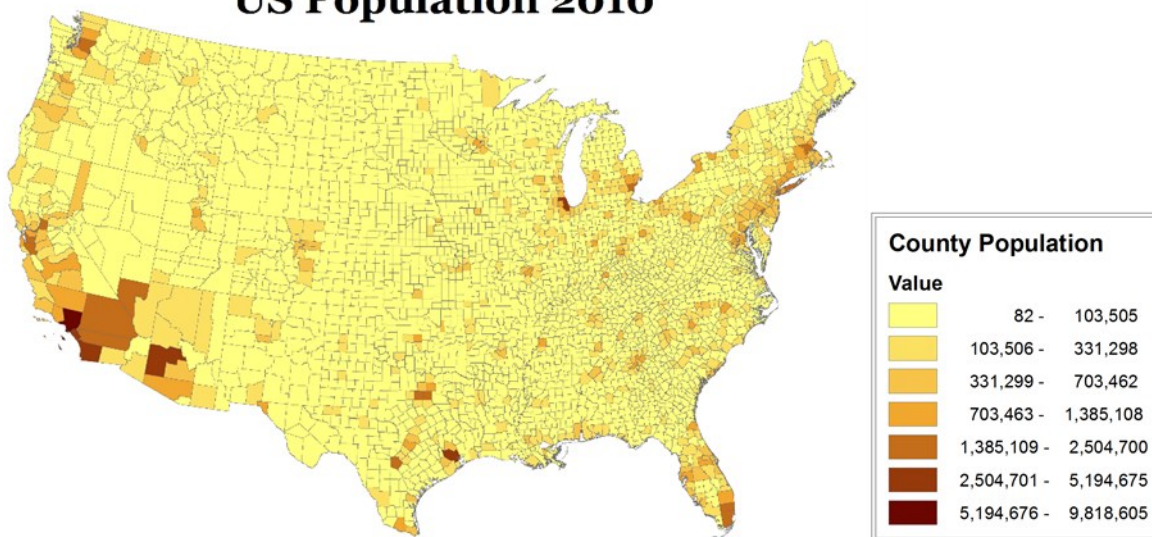
Raster data describe how the value of a variable varies over space. The data are structured as a grid of cells. Each cell is connected to a location, and contains the value of the variable at that location. For example, in a land cover raster, each cell indicates the type of land cover found at that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



Area-level

Area-level data describe geographic units defined by boundaries. 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



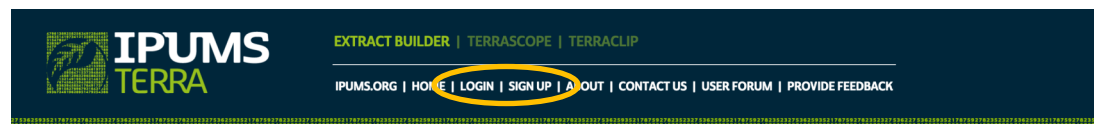
Step 1 Sign up

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...

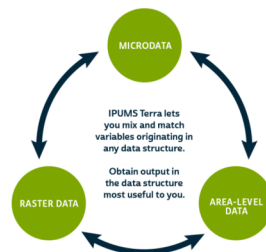
- Population censuses and surveys
- Land cover data classified from satellite imagery
- Temperature, precipitation, and related climate data
- Land use data derived from censuses and surveys in combination with remotely sensed data

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

[Start Extract](#)

Area-level Output

characteristics of geographic units including aggregate population data and/or summaries from raster data

[Continue Extract](#)

Raster Data Output

data in spatial grids potentially derived from area-level data

[Start Extract](#)

Step 2 Email Confirmation and log in

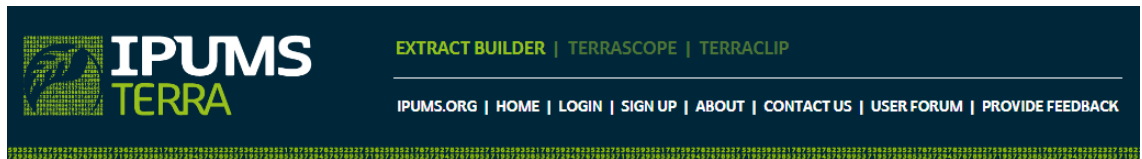
After you have registered with IPUMS Terra, an e-mail will be sent to your account notifying you of approval.

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 a
Raster
Extract



What is IPUMS Terra?

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

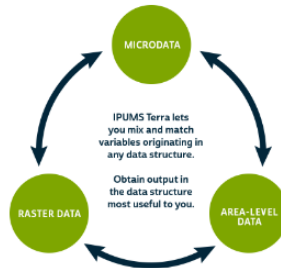
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Available Datasets

- [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 get raster data output.

- Click on the **Start Extract** button for Raster Data 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.

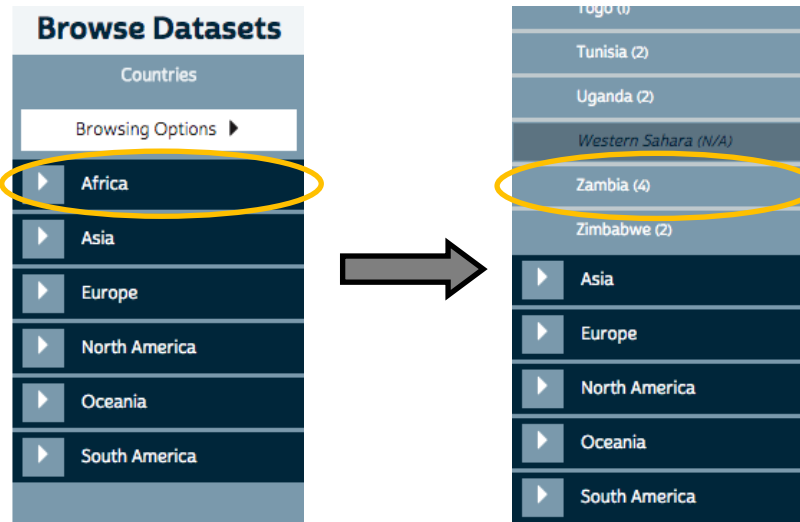
Datasets Panel: Lists countries in the IPUMS Terra system, and provides options to filter by time and hide countries without area-level data. Clicking on a continent will list the countries in the continent. Clicking on a country will populate the columns of the availability grid with the datasets available 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 Extract Builder interface. The top navigation bar includes the IPUMS Terra logo, the title 'EXTRACT BUILDER | TERRASCOPE | TERRACLIP', and links for 'OUT | CONTACT US | USER FORUM | PROVIDE FEEDBACK'. Below this is a 'Navigation Bar' with four steps: '1 Rasterize Area-Level Data' (highlighted in green), '2 Select Raster Data', '3 Templating Options', and '4 Submit'. A 'SKIP' button is located to the right of the navigation bar. On the left side, there is a 'Browse Variables' panel with a list of topics: Birthplace and Nativity, Demographic, Education, Employment, Household Amenities, Household: Dwelling Characteristics, Household Economic, and Household Utilities. The main area is titled 'Rasterize Area-level Data' and contains a 'Select Data' section with a 'What is this?' link. Below this are two sections: 'Variables' and 'Datasets', both showing 'Browsing None'. On the right side, there is a 'Data Cart' panel with a 'Raster Extract' button and a list of selected items: '1 Rasterize Area-level Data', '2 Select Raster Data', and '3 Templating Options'. Below the Data Cart is a 'Browse Datasets' panel with a 'Countries' section and a list of continents: Africa, Asia, Europe, North America, Oceania, and South America. At the bottom left, there is a 'Variables' panel with a list of variables. At the bottom right, there is a 'Datasets' panel with a list of datasets. The footer of the interface includes the text 'SCIENCE FOUNDATION MINNESOTA ALL RIGHTS RESERVED'.

Step 5

Browse datasets for Zambia

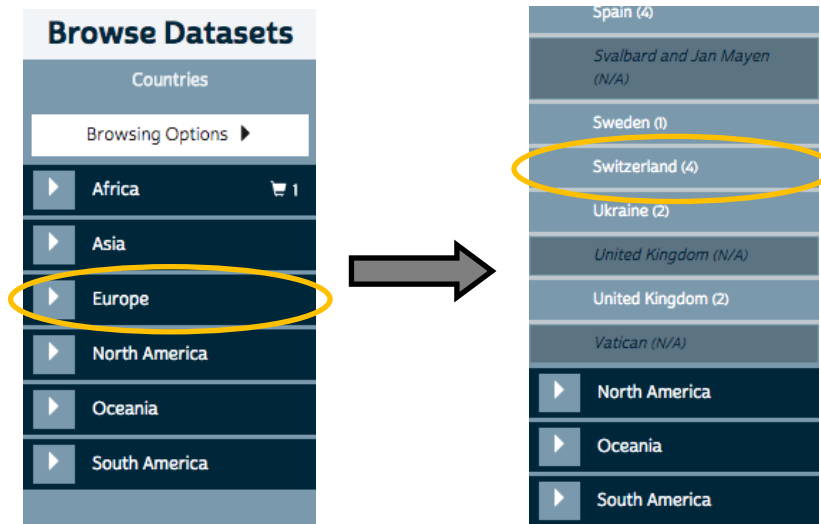
- Click on **Africa** in the Browse Datasets Panel. Countries are listed alphabetically, with numbers in parentheses indicating how many years of data are available for the country.
- Click on **Zambia**. The available datasets for Zambia appear as columns in the availability grid.



Step 6

Browse datasets for Switzerland

- Click on **Europe** in the Browse Datasets Panel
- Click on **Switzerland**. The available datasets for Switzerland will appear as columns in the availability grid.



Step 7

Select datasets

- Check the boxes to select year **2000** for both countries.

Rasterize Area-level Data

Select Data [What is this?](#)

☐ Show only selected variables ⓘ

☐ Show only selected datasets ⓘ

Variables

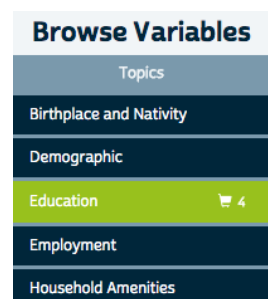
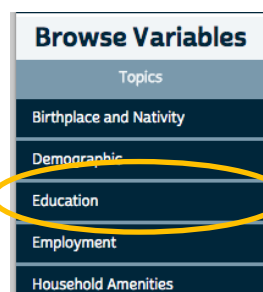
Browsing None

Datasets

Switzerland				Zambia			
1970	1980	1990	2000	1990	2000	2010	2010
IPUMS	IPUMS	IPUMS	IPUMS	IPUMS	IPUMS		IPUMS
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Step 8

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 Zambia and Switzerland in the year 2000. 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 levels of education.

Note: To hide unchecked datasets in each country, click on "show only selected datasets"

☐ Show only selected variables ⓘ

☒ Show only selected datasets ⓘ

Datasets

	Switzerland	Zambia
2000 IPUMS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Education Variables

		Switzerland	Zambia
<input type="checkbox"/> SCHOOLAGE (3)	School attendance by age	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> LITAGE (2)	Literacy by age	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> EDATTAIN (4 of 4)	Educational attainment		
<input checked="" type="checkbox"/> EDUCLESSPRIM	Percent of persons age 25+ with less than primary education	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> EDUCPRIMARY	Percent of persons age 25+ who completed primary education	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> EDUCSECOND	Percent of persons age 25+ who completed secondary education	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> EDUCTERTIARY	Percent of persons age 25+ who completed tertiary education	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> EDYEARS (1)	Years of schooling	<input type="checkbox"/>	<input type="checkbox"/>













Step 9

Add
Area-level
variables

- Continue Adding variables to your extract by selecting **Demographic** → **POPTOTAL**

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

Demographic Variables

	 POPTOTAL (1)	Total population
	 POPSEX (2)	Population by sex
	 POPAGE (17)	Population by age
	 POPAGEM (17)	Male population by age
	 POPAGEF (17)	Female population by age
	 MARSTSEX (15)	Marital status by sex

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

Step 10

View
Variable
Metadata



Rasterize Area-level Data

Select Data [What is this?](#)

































☐ Show only selected variables ⓘ

☒ Show only selected datasets ⓘ

Datasets

Switzerland	Zambia
2000 IPUMS 	2000 IPUMS 

Demographic Variables

	 POPTOTAL (1 of 1)	Total population		
	 TOTPOP	Total population		
	 POPSEX (2)	Population by sex		
	 POPAGE (17)	Population by age		
	 POPAGEM (17)	Male population by age		
	 POPAGEF (17)	Female population by age		
	 MARSTSEX (15)	Marital status by sex		
	 FERTILITY (2)	Children ever born, by age of woman		
	 OWNCHILD (1)	Own children in the household		

Step 11

Move to
Raster Data
Selection

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

NEXT

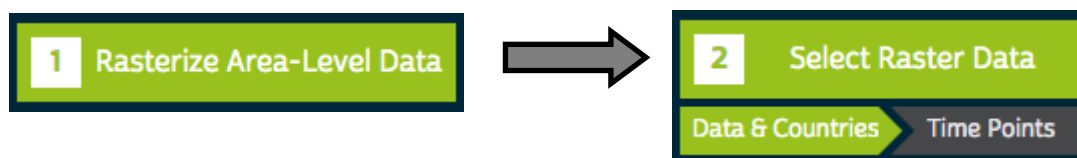
Note: Verify that your Data Cart has the correct number of variables and datasets.

The screenshot shows a dialog box titled "Raster Extract" with a "Cancel" button in the top right corner. The dialog contains three steps: 1. "Rasterize Area-level Data" (highlighted in green), which includes a table with "Variables" (5) and "Datasets" (2); 2. "Select Raster Data" (highlighted in dark blue); and 3. "Templating Options" (highlighted in grey).

Raster Extract					
1	Rasterize Area-level Data ▼				
	<table><tr><th>Variables</th><th>Datasets</th></tr><tr><td>5</td><td>2</td></tr></table>	Variables	Datasets	5	2
Variables	Datasets				
5	2				
2	Select Raster Data				
3	Templating Options				

The Navigation Bar indicates that the next step will be to select raster data

- Click **NEXT** to move to the Raster Data selection screen.



Step 12

Select
Raster
variables

Now we will begin adding raster data to our cart.

You will need variables from the Agriculture and Land Cover topics.

- Click the **Agriculture** topic to list variable categories.

Select Raster Data

Select Data & Countries [What is this?](#)

The screenshot shows the 'Select Variables' interface. On the left, under 'By Topic', the 'Agriculture' button is highlighted with a yellow circle. To the right, the 'Select Countries' panel shows 'Switzerland' and 'Zambia' selected.

- Click on the **Crop and Pasture lands** variable category.

The Crop and Pasture lands variables will be listed.

Select Raster Data

Select Data & Countries [What is this?](#)

The screenshot shows the 'Select Variables' interface with the 'Agriculture' topic selected. The 'Crop and Pasture lands' variable category is highlighted with a yellow circle. The list of variables under this category includes: Cereals (yield, area), Crop and Pasture lands, Fibers (yield, area), Forage (yield, area), Fruit (yield, area), Oil Crops (yield, area), Other Crops (yield, area), Pulses (yield, area), Roots and Tubers (yield, area), Sugar crops (yield, area), Tree Nuts (yield, area), and Vegetables and melons (yield, area).

- Select two variables, **CROPLAND2000** and **PASTURE2000**, to add them to your cart.

By Topic By Dataset Search

Agriculture

Climate Land Cover

▶ Cereals (yield, area)

▼ Crop and Pasture lands

Datasets in this topic
GLIAGLAND - Time Range: Circa 2000 Period: single snapshot

Variable	Description	Dataset
<input checked="" type="checkbox"/> CROPLAND2000	Area used as cropland	GLIAGLAND
<input checked="" type="checkbox"/> PASTURE2000	Area used as pasture	GLIAGLAND

Note: Clicking on variable labels will provide additional metadata

- Click on the **Land Cover** topic and then click on the **Global Land Cover 2000** variable category.

Select Variables

By Topic By Dataset Search

Agriculture Climate **Land Cover**

▶ Global Land Cover 2000

▶ MODIS

- After clicking **Global Land Cover 2000** select three variables, **LCBRDEVGRN**, **LCDECIDCL**, **LCDECIDOP**, to add them to your cart.

<input type="checkbox"/> LCARTIF	Artificial Surfaces and Associated Areas	GLC2000
<input type="checkbox"/> LCBARE	Bare Areas	GLC2000
<input checked="" type="checkbox"/> LCBRDEVGRN	Tree Cover, Broadleaved, Evergreen	GLC2000
<input checked="" type="checkbox"/> LCDECIDCL	Tree Cover, Broadleaved, Deciduous, Closed	GLC2000
<input checked="" type="checkbox"/> LCDECIDOP	Tree Cover, Broadleaved, Deciduous, Open	GLC2000
<input type="checkbox"/> LCGRSSHBRB	Grassland/Shrubland	GLC2000
<input type="checkbox"/> LCHERBAC	Herbaceous Cover (contains both pastures and natural)	GLC2000

- Click **NEXT** to go to the Submit step.

Step 13

Check data
cart and
Submit
extract

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

Raster Extract		Cancel
1	Rasterize Area-level Data ▼	
	Variables	Datasets
	5	2
2	Select Raster Data ▼	
	Variables	Countries
	5	2

- Give your extract a short, descriptive **Extract Title**, maybe, “Zambia and Switzerland, education, land cover and use, population.” 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.)

Submit Extract

Extract Details

Extract Title

TerraPop Extract_Zambia and Switzerland, education, land cover and use, population

Extract Notes (Optional)

☐ Send Extract to data grid ⓘ

- Click **Submit Extract**

SUBMIT EXTRACT

Step 14

Download your extract

You will receive an email when the extract is ready



terrapop@umn.edu

to me ▾

Your TerraPopulus extract 'TerraPop Extract_Zambia and Switzerland, education, land cover and use, population' is ready.

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

https://demo.terrapop.org/extracts/57d9deb0-d745-0133-bf82-005056a37c4e/5_bundle.zip

- 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.

Raster extracts are provided in geoTIFF format, suitable for analysis in GIS or other software for handling spatial data.

Extract History Account					
Extract History					
Extract Request Number	Date Submitted	Title (click to edit)	Status	Resubmit	Download
5	26 Jan 17:07	TerraPop Extract_Zambia and Switzerland, education, land cover and use, population	completed	resubmit	download (0.58 MB)