Tutorial

ANALYZING THE TERRA-i OUTPUT DATA:

Calculate changed area in terms of hectares

Suggested citation:
PAZ-GARCIA, P. & COCA-CASTRO, A. (2014) Analyzing the Terra-i output data:
Calculate changed area in terms of hectares. Tutorial for the Terra-i project. Version 2.

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

ANALYZING THE TERRA-i OUTPUT DATA:
Calculate changed area in terms of hectares
Tutorial

Description

The following tutorial contains information related to methods for analyzing the Terra-i detections using the tools from the ArcGIS v.9.x/10x software. Specifically, this tutorial explains how to get values in terms of area from the Terra-i vegetation cover change data, loss or gain, making the conversion from pixel values to values in hectares (or other measure unit of preference).

To get values in terms of area, users can use two simple tools; the first is with the *Statistics tool* and the second through the *Tabulate Area* tool, being the latter with which the Terra-i system usually reports change data in the download tab of the visualization tool.

Getting started:

To start you must download data from Terra-i detections for the area of interest, as indicated in the tutorial of data download. Similarly, to extract the data, you must define an area of interest which you wish to calculate the area of change. A mask must be created (preferably in polygon / shapefile format). A further explanation is given through the following example files.

Input data:

- Cumulative detections of vegetation loss

File name: h10v08_decrease_2008-1_2008-353.asc.gz

Steps:

1. Download the Terra-i data from the website http://www.terra-i.org/terra-i/data.html
2. Unzip the file downloaded

Consideration from the Terra-i data:

- This data is in WGS84 geographic projection (EPSG: 4326). For subsequent analysis of over-extraction position with other layers of information you must define this projection to ASCII file downloaded.
- The data contains values that represent change detections every 16 days, the dates are indicated in Julian day. It also has a value of 0 representing the area unchanged. The value range is from 0 (no change) to 353 (last 16-time period of year).

Analyzing the Terra-i output data:

STEP 1: Extracting Terra-i from a target area

To get the value of vegetation area changed in terms of hectares for a target area, you must extract data from Terra-i with a layer or mask of the area of interest to be analyzed. For this, the *Extract by mask* tool must be used from the ArcToolBox.

Preliminary consideration for the target area layer

The data layer (shapefile or raster) with which will be used to extract the Terra-i data must have a projection equal to the Terra-i ASCII file downloaded (WGS84 geographical / EPSG: 4326).

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

1. Extract by mask

The tool, located in ArcToolbox - Spatial Analyst Tools - Extraction - Extract by mask (Figure 1), works for extracting the raster cells that correspond to the extent defined by a mask (shapefile or raster).

Input Raster: Raster (h10v08_decrease_2008-1_2008-353.asc)
Input raster or feature mask: mask file (raster or shapefile)
Output raster: full path for the Terra-i extracted area (Figure 2)
Environment Settings: the following parameters must be configured (Figure 3)

- Cell Size (Raster Analysis Section > Cell Size): type 0.00208333333 or select any Terra-i file to set automatically its value to 0.00208333333
- Projection (Output Coordinates Section): set WGS84 geographic
- Align the extracted file to the Terra-i pixels (Processing Extent Section > Snap Raster): select the Terra-i ASCII file (h10v08_decrease_2008-1_2008-353.asc) as reference file.

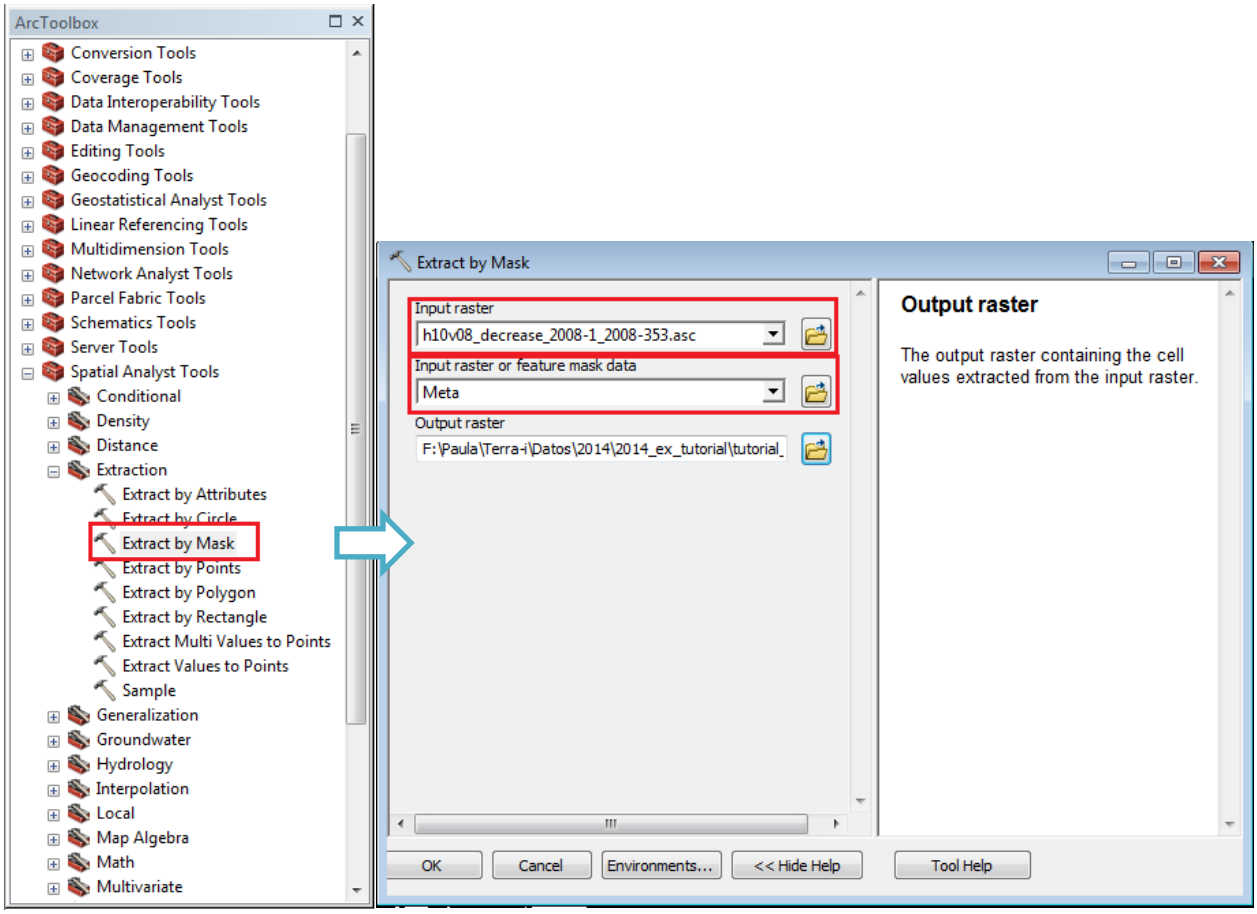

Figure 1. Extract by mask

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

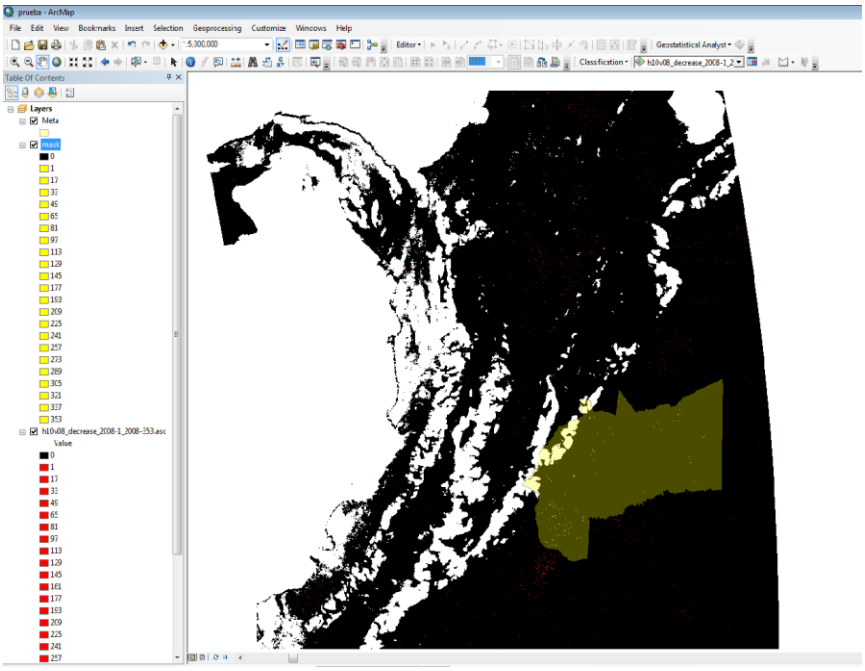

Figure 2. Extracted Terra-i area from a mask using the Extract by mask tool

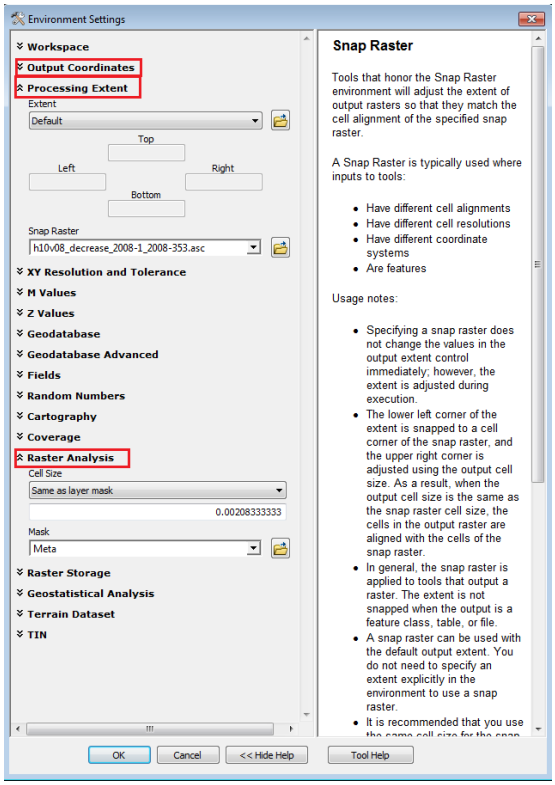

Figure 3. Environment Settings to configure the parameters for extracting by mask

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

STEP 2: Calculate area in terms of hectares

To calculate the total area of the Terra-i change detections the pixel values have to be converted to terms of hectare. For this there are two methods whose description is as follows:

2.1 Statistics tool

The values from 1 to 353 of the VALUE column from the attributes tables must be selected to analyze a complete year. After a right-click must be done in the Statistics section, selecting the COUNT field. The value is the sum total of pixels corresponding to the detection (Figure 5). It is important to highlight that the value of 0 indicates unchanged area.

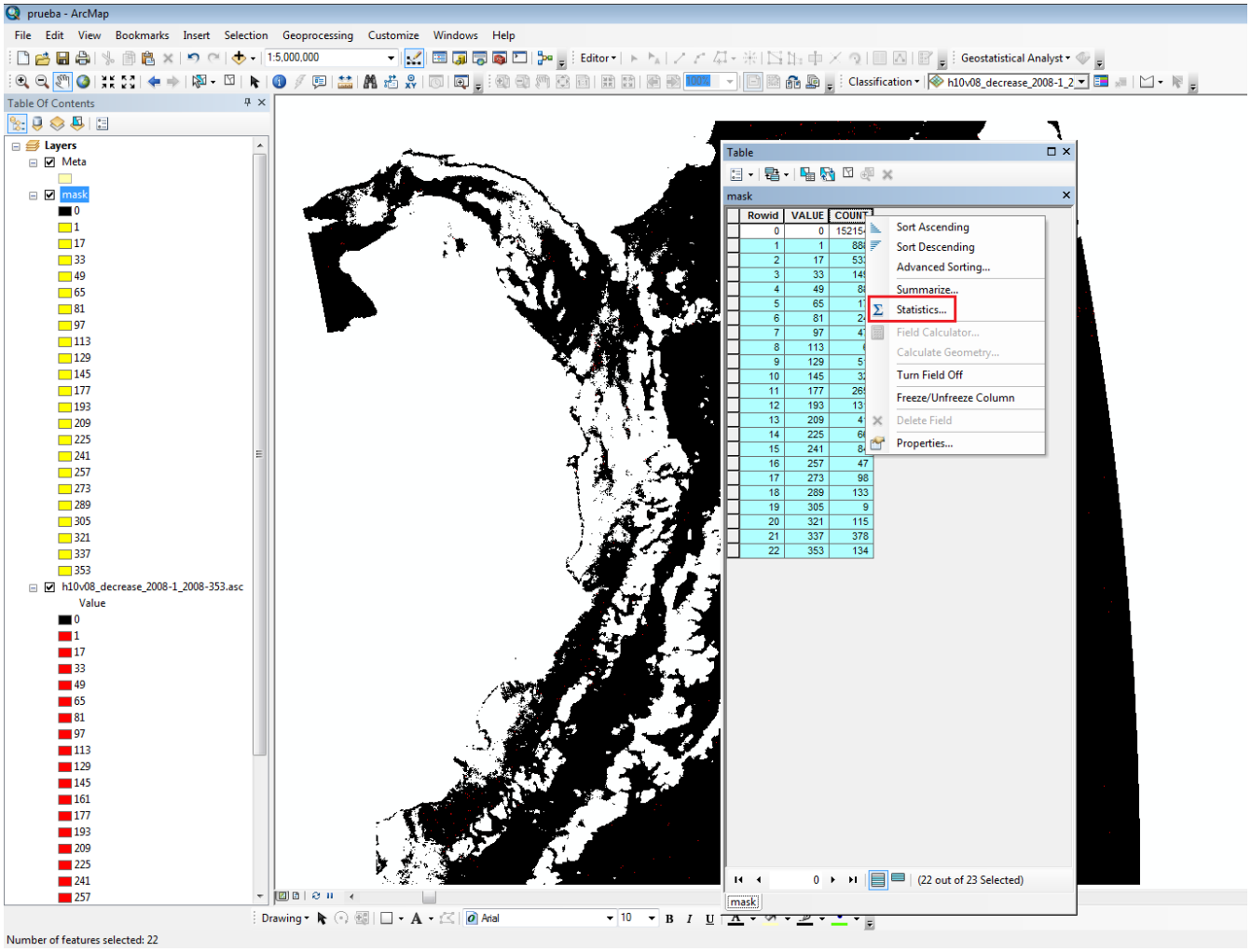

Figure 2. Selection of pixel values representing 16-days period detections dates from 1 to 353, and extraction of total change area in terms of pixels using the Statistics tool and summing the COUNT column

Multiple statistics such as minimum, maximum, sum of pixels, mean, standard deviation can be accessed through the Statistics tool (Figure 5). To obtain an approximate value of the changed area, a multiplication must be done between the total sum of the change detection pixels and a pixel cell size of Terra-i (250m X 250m = 62500m^2).

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

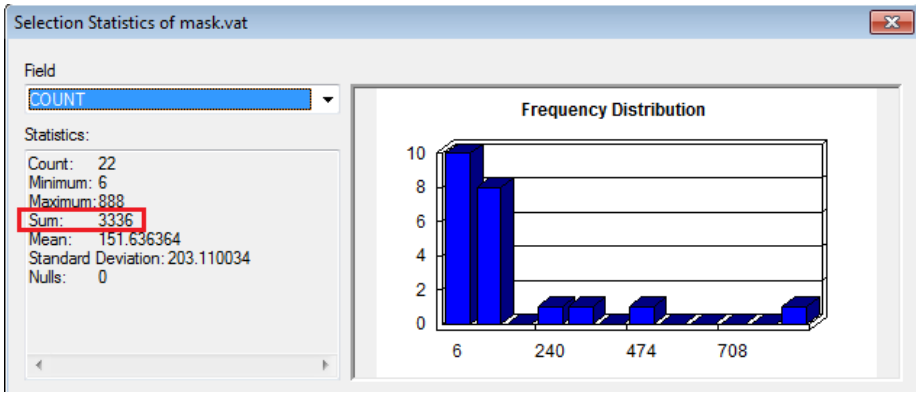

Figure 3. Total sum of pixels using the Statistics tool

As result with this method the total sum of pixels for the year 2008 in the department of Meta, Colombia gave a total of 3,336 pixels that according to the calculations (3,336 x 62,500 = 208,500,000 m2 / 10000) correspond to **20,850 Ha**

2.2 Tabulate Area Tool

This tool, located in *ArcToolbox> Spatial Analyst> Tabulate Area*, allows to calculate areas between two datasets (feature or raster) and provides tables as outputs.

To calculate the value of change in terms of hectares the input data set must be transformed from the default WGS84 geographic projection to a projected projection designed to allow the calculation in terms of area. For Terra-i purposes, the projected Lambert Azimuthal Equal Area (LAE) projection is used. To project data from Terra-i the *Project Raster* tool is used. In the case of the mask files, which are in shapefile format, the *Project tool* must be used.

2.2.1 Projecting the data

When the raster file or feature already has a default projection defined (i.e. WGS84 geographic) the next step to transform it to a projected projection (i.e. Lambert Azimuthal Equal Area) using the Project Raster tool, located in the *ArcToolbox> Data Managements Tools> Projections and Transformations> Raster is used> Project Raster.*

Input data: Raster file to project
Output Coordinate System: New projected projection

While selecting the input data, the pop-up window of the tool inform if the raster has a defined projection. Otherwise the raster has not defined a projection, the Define Projection tool (*ArcToolbox> Data Managements Tools> Projections and Transformations> Raster> Define Projection*) must be used.

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

An important step to set the resolution of the data, under the assumption that come from the raw MODIS satellite data, is to put in the field of cellsize a value of 250, which is like the Terra-i team prefers to configure to delivered data in the visualization online tool.

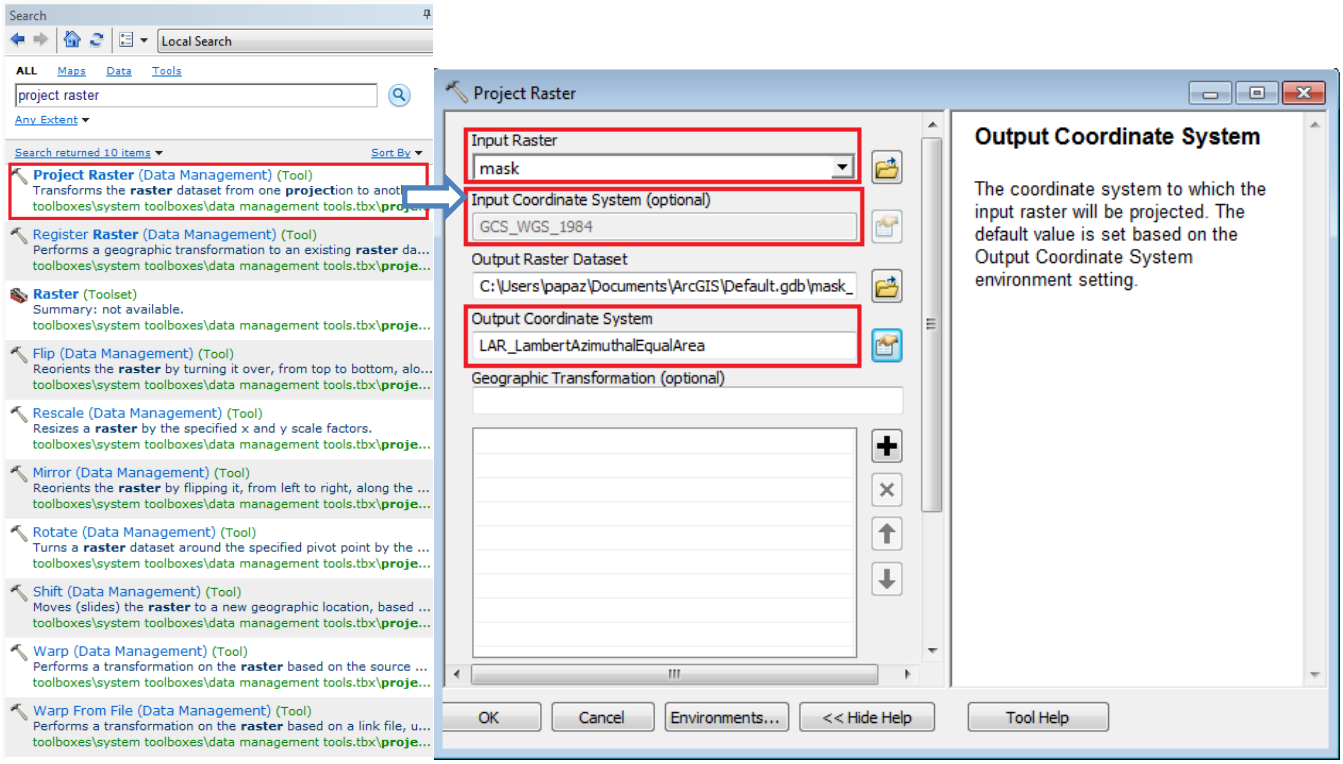

Figure 4. Project Raster tool used to define a new projection (i.e. Lambert Azimuthal Equal Area) for a dataset

The same procedure must be performed for the mask shapefile file to avoid no inconsistencies in values. Thus, the Project tool (*ArcToolbox> Data Managements Tools> Projections and Transformations> Feature> Project*) should be used.

2.2.2 Generating the tabular data with the area values

After configuring the data in projected projection, the next step is to use the Tabulate Area tool, which requires being configured by parameter (Figure 7).

Input raster or featured zone: Terra-i data in projected projection (i.e. LAE projection)
Zone field: select Value
Input raster or feature class data: input layer of target area in projected projection
Class field: determines which field will classify the first input data
Output table: full path to save the results (preferibaly it should finish with .dbf extention)
Cell Size: Verify the cellsize is the same as the first input data (i.e. set 250 for the Terra-i data)

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org

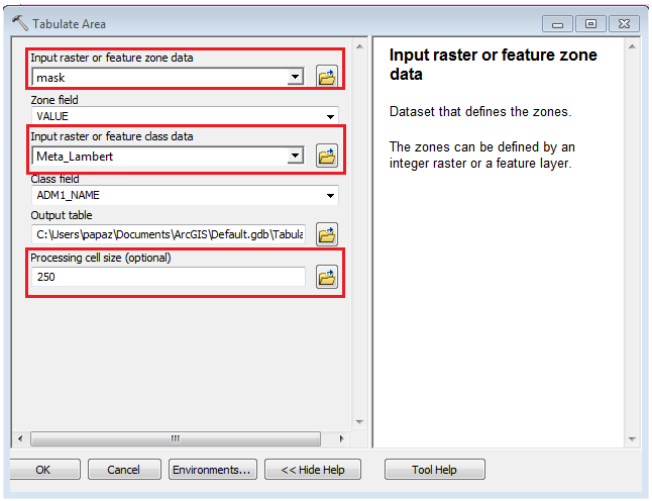

Figure 5. Tabulate Area tool, parameters setting

The tool output is a table in dbf format (or another that user defines), which can be opened in Microsoft® EXCEL or other tabular data reader (Figure 8). With this tool you can get the value in hectares making the selection of the values of interest, in this case from 1 to 353. In that way, under the LAE projection the total area loss in the example file is **14,991.06 Ha**. This value is not so far regarding the method of calculation area with the Statistics tool. However, the **Terra-i team RECOMMENDS** using the method with the Tabulate Area tool. According to previous experiences, this method is flexible to perform calculations by different regions of interest or polygons that are included in the mask file.

C26 =SUM(C3:C24)/10000

	A	B	C	D
	OBJECTID	VALUE	META	
	1	0	69344920804.50000000000	
	2	1	39067621.23530000000	
	3	17	23515394.45080000000	
	4	33	7054618.33524000000	
	5	49	4168638.10719000000	
	6	65	801661.17445900000	
	7	81	961993.40935100000	
	8	97	2030874.97530000000	
	9	113	320664.46978400000	
	10	129	2244651.28849000000	
	11	145	1549878.27062000000	
	12	177	12559358.39990000000	
	13	193	5665072.29951000000	
	14	209	1710210.50551000000	
	15	225	2992868.38465000000	
	16	241	4061749.95059000000	
	17	257	2084319.05359000000	
	18	273	4489302.57697000000	
	19	289	5878848.61270000000	
	20	305	374108.54808100000	
	21	321	5077187.43824000000	
	22	337	17476213.60320000000	
	23	353	5825404.53440000000	
	SUMA		14991.06396238750	

Figure 6. Changed area calculated in terms of hectares

Prepared by Paula Paz-Garcia† and Alejandro Coca-Castro†
Author's e-mail address: †p.paz, a.coca @cgiar.org