


## FOREST CONSERVATION EVALUATION TOOL (FCET)

### INSTRUCTIONS

 This document describes the functions of the FCET. For a brief overview of underlying methods and data please see “FCET Metadata.pdf,” which can be downloaded from the FCET dashboard. For new users, it will be helpful to read that document before reading this one.

***Citing the FCET:*** Blackman, A. and A. Egorenkov. 2018. Forest Conservation Evaluation Tool. Washington, DC: Resources for the Future.

***Accessing the FCET:*** The FCET is available at: <http://fc-evaluation-tool.net> and <http://fcet.servirglobal.net>

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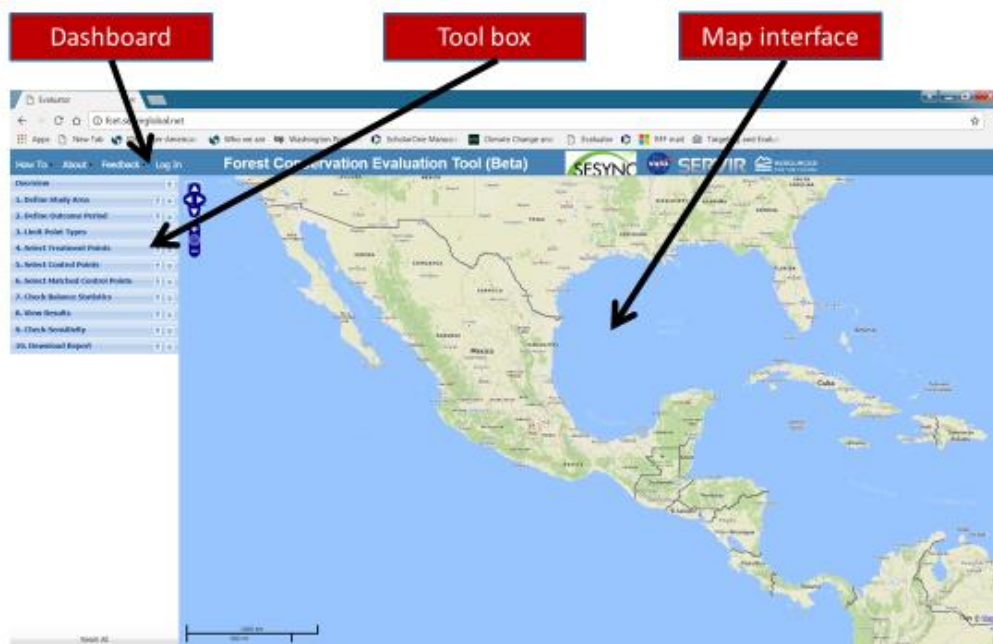
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## FOREST CONSERVATION EVALUATION TOOL (FCET)

The Forest Conservation Evaluation Tool (FCET) measures the effect on deforestation of spatially delimited forest conservation policies (e.g. protected areas and payments for environmental services areas) controlling for the characteristics of the land where these policies are located.

The tool has three basic components, a Dashboard, a Tool Box, and a Map Interface.

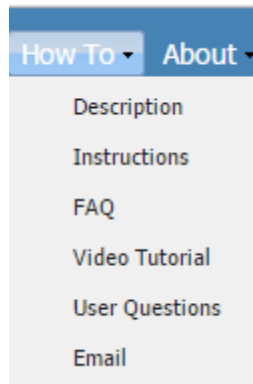


### A. DASHBOARD

The Dashboard contains four pull-down menus that provide links to background documents and contact information. Note that the redundancy (e.g., contact information is included in several links) is intentional.

#### A.1. HOW TO

The “How to” pull down menu features the following links



#### **A.1.1. Description**

Contains a document that provides a brief overview of the FCET

#### **A.1.2. Instructions**

Contains the document you are reading.

#### **A.1.3. FAQ (under construction, to be added)**

Contains a document with answers to frequently asked questions

#### **A.1.4. Video tutorial (under construction, to be added)**

Contains a video tutorial on using the FCET

#### **A.1.5. User questions**

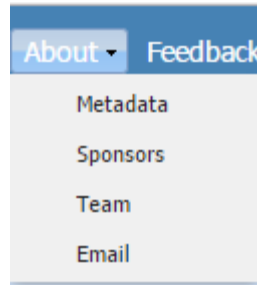
Contains a digital guestbook in which users can post questions about the FCET. The FCET team at RFF will check the guestbook periodically.

#### **A.1.6. Email**

Contains email address that can be used to contact the FCET team: [fc-evaluation-tool@rff.org](mailto:fc-evaluation-tool@rff.org)

### **A.2. ABOUT**

The “About” pull down menu features the following links



#### **A.2.1. Metadata**

Contains a document that provides details on the FCET's methods and data.

#### **A.2.2. Sponsors**

Contains information on the organizations that have provided funding for the development and maintenance of the FCET.

#### **A.2.3. Team**

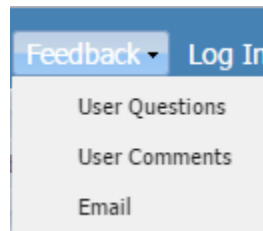
Contains a document with information on the team that built and is maintaining the FCET

#### **A.2.4. Email**

Contains email address that can be used to contact the FCET team: [fc-evaluation-tool@rff.org](mailto:fc-evaluation-tool@rff.org)

### **A.3. FEEDBACK**

The "Feedback" pull down menu features the following links



#### **A.3.1. User questions** (under construction, to be added)

Contains a digital guestbook in which users can post questions about the FCET. The FCET team at RFF will check the guestbook periodically.

### A.3.2. User comments (under construction, to be added)

Contains a digital guestbook in which users can post comments about the FCET. The FCET team at RFF will check the guestbook periodically.

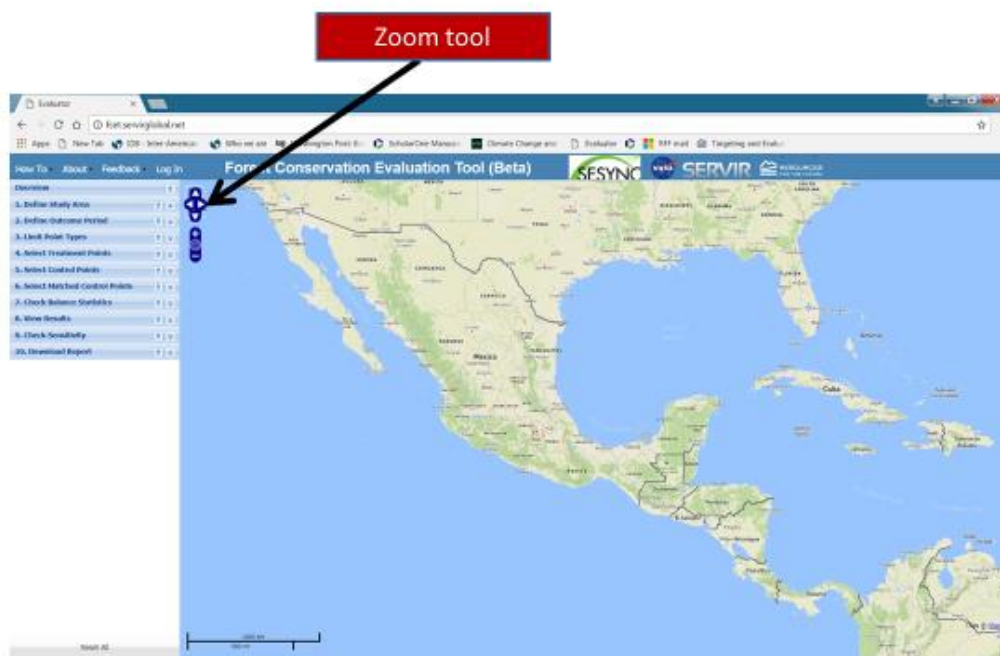
### A.3.3. Email

Contains email address that can be used to contact the FCET team: [fc-evaluation-tool@rff.org](mailto:fc-evaluation-tool@rff.org)

## B. MAP INTERFACE

The Map Interface displays FCET data and outputs. We explore these data and outputs below. Here, we briefly cover navigation within the interface.

FCET navigation uses the same tools as Google Map and Open Street Map, and should be familiar to anyone who has used that website.



### B.1. ZOOMING

Zoom in and out two ways: (i) use the zoom tool pictures above, or (ii) use the scroll button on the mouse.


## B.2. PANNING


Pan by clicking and dragging the map.

## C. TOOLBOX


The Tool Box contains the following ten “tools”, each of which can be expanded or collapsed by clicking on the downward or upward pointing arrow on the right-hand-side of the tool.



 The toolbox was designed to lead users through the ten steps needed to analyze the effectiveness of a forest conservation policy. Each of these ten steps corresponds to a tool (submenu) in the toolbox. In order for the FCET to function correctly, it is critically important that you click through the Tools in order, starting at Tool #1 and moving to Tool #10, and close each tool before opening the next. **Green** colored “submit” buttons communicate your modeling choices to FCET; you must click on them in order to proceed to the next step.

 After you have clicked on the **green** “submit” buttons, a red check mark like the one pictured below will appear next to the question mark icon indicating that the tasks associated with the “Define Study Area” tool have been successfully completed.



 Clicking on the question mark icon next to each tool launches an **information pop-up box** that provides a brief guidance on the use of the tool. We highly recommend that novice users take advantage of these pop-up boxes.

## OVERVIEW


The overview function provides a brief introduction to the use the subsequent ten tools. Its function is purely informational. Clicking on the question mark icon launches an pop-up box that provides the introductory information in the preceding subsection.

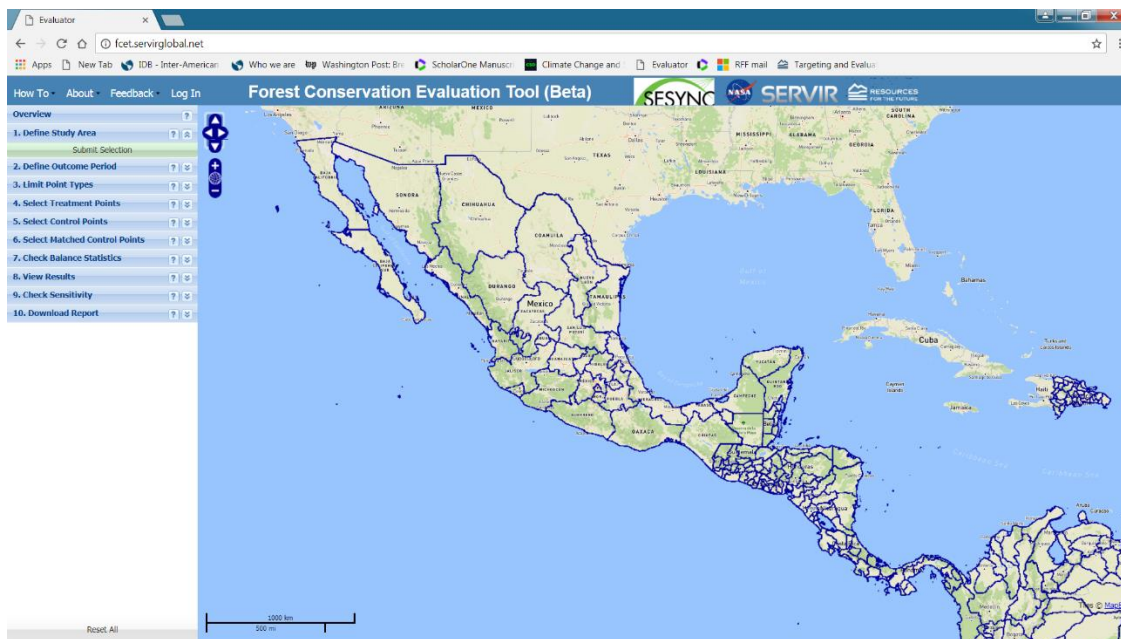
## TOOL 1. DEFINE STUDY AREA

This tool allows the user to defines a *study area*—an area comprised of first-level administrative units (e.g., states in Mexico, departments in Guatemala) where the effect of the forest conservation policy will be evaluated.



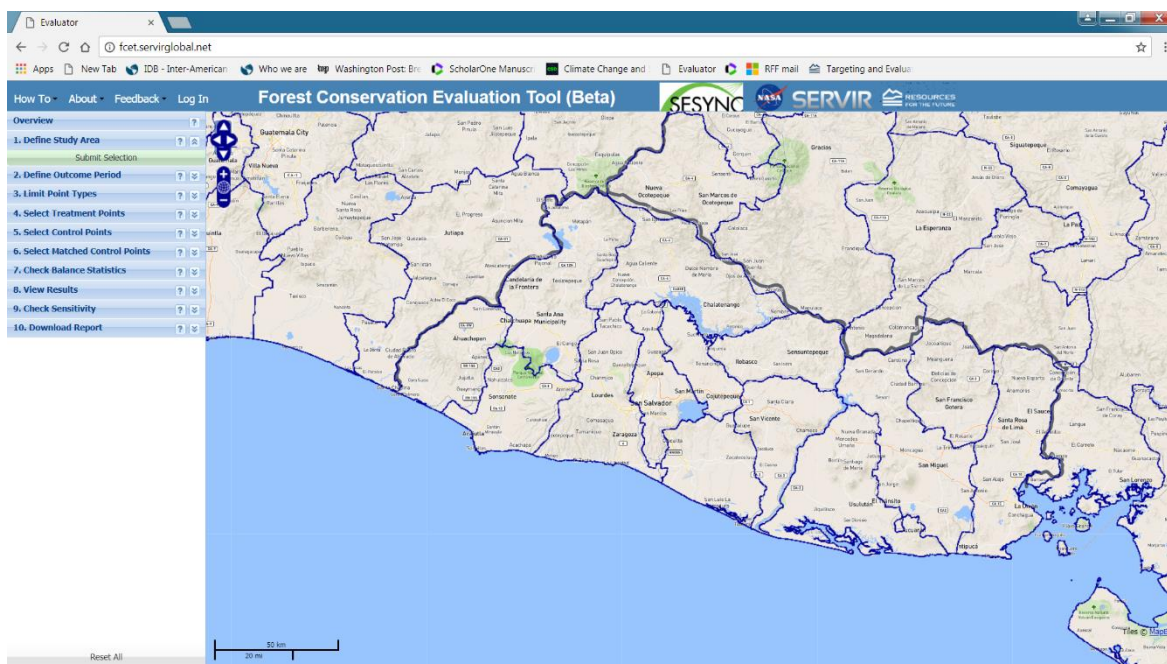
Once this tool is opened, the boundaries of first and second-level administrative units appear in blue on the map interface.

 The FCET's current geographic scope is Latin America: Mexico, Central America, the Dominican Republic, and South America.




To determine which countries administrative units belongs to, the user can zoom in to the administrative unit in question. Country borders appear in the basemap in bold black lines. El Salvador is pictured below. Note that the black and blue borders do not always line up perfectly. That is due to discrepancies between the underlying basemap and shape files for first-level administrative units.




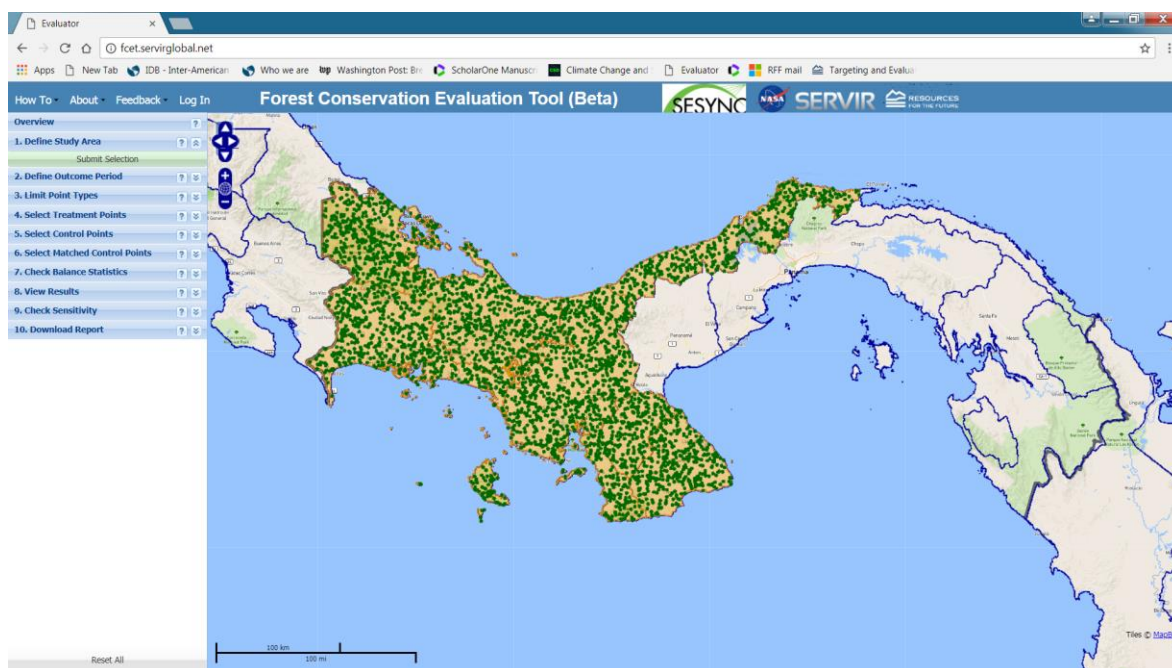



Add administrative units to your study area by *single*-clicking on them. De-select units by clicking on the a second time.

 When selecting administrative units, be careful to click on them one time only. Double-clicking on an administrative unit will select it and then deselect it.

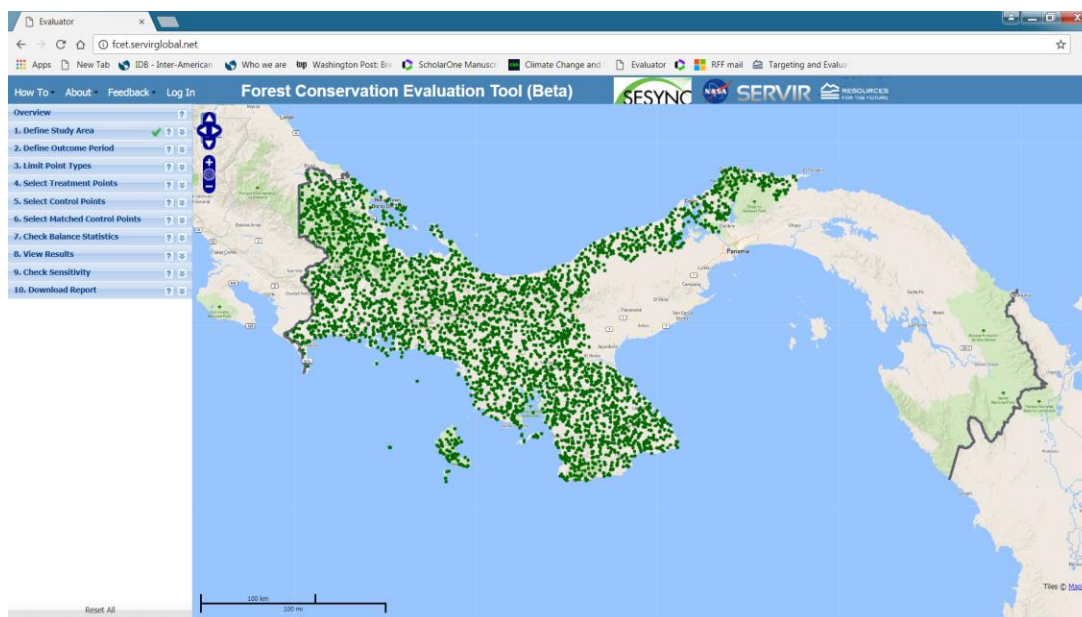
When selected, administrative units will turn beige and forested sample points inside the unit will be displayed in green. The figure below shows FCET map when all administrative units (provinces) in Western Panama are selected.

 As discussed in “FCET.Metadata.pdf,” the spatial unit of analysis the FCET uses to measure the effect of a forest conservation policy is a dimensionless point. The FCET relies on a sample of million points. These points were chosen by overlaying a 1km rectangular grid on Latin America and then selecting all points at the intersection of the gridlines.



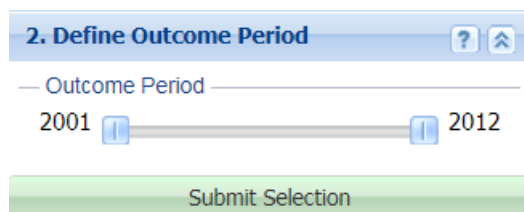
 To minimize the computational load associated with displaying points, the FCET does not display all forested sample points (i.e., forested points corresponding to the 1km rectangular grid) in selected administrative units. Rather it displays a random sample of these points. The number of points per unit of land displayed increases as the user zooms in. When sufficiently zoomed in, the FCET displays all forested points on the 1km rectangular sampling grid, that is, all of the points it uses to analyze policy effectiveness.

Once the administrative units that comprise the study area have been selected, click on the “Submit Selection” button in the “Define Study Area” tool. The beige background in the selected administrative units will disappear, the “Define Study Area” tool will close, and a red check mark will appear next to the question mark icon indicating that the tasks associated with the “Define Study Area” tool have been successfully completed.

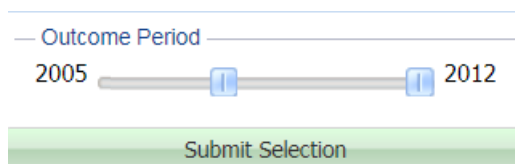


## TOOL 2. DEFINE OUTCOME PERIOD

This tool allows users to select outcome period—the range of years between 2000–2012 over which the effect of the policy on deforestation will be measured. The default is to use the entire 12-year range. However, some users may want to use subsets of that range, e.g., 2000–2005 or 2004–2012. To do that, move the sliders in the tool: the left-hand slider determines the start of the outcome period and the right-hand slider determines the end.



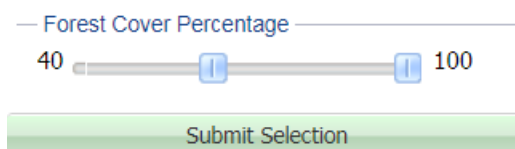
When sliders are repositioned, the year to which they correspond appears to the left and/or right of the sliders. The figure below shows the sliders positioned to select an outcome period of 2005–2012.



Once the sliders reflect the desired outcome period, click on the green “submit selection” button to communicate your choices to FCET. Having done that, a red check mark will appear next to the question mark icon indicating that the tasks associated with the “Define Outcome Period” tool have been successfully completed. Before proceeding to Tool 3, users must manually close Tool 2 using up/down arrow button in the top righthand corner of the tool.

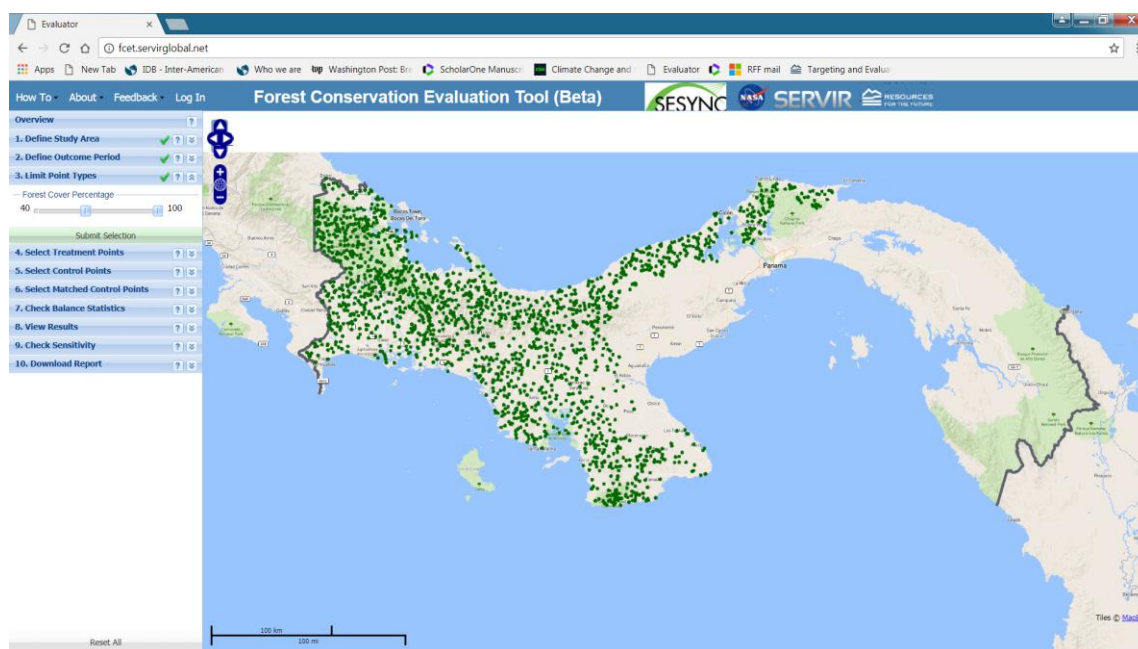
### TOOL 3. LIMIT POINT TYPES

This tool allows users to set minimum and maximum thresholds for year 2000 forest cover that determine which points from among all of the points on the 1km rectangular sampling grid are used in the analysis of policy effectiveness. For example, if the user set a minimum threshold of 40% and a maximum threshold of 100 percent, then points 40–100 percent forest cover in 2000 would be included in the analysis. Minimum and maximum thresholds are set using slider similar to that used to select the outcome period. As illustrated in the figure below, the selected thresholds are displayed to the left and right of the slider.



**⚠ Note that points are dimensionless and therefore technically speaking cannot have characteristics such as percent forest cover, slope, population density etc. The characteristics that correspond to each point are drawn from data layers used to construct our point-level data. For example, ‘percent forest cover’ for a given point corresponds to the 30mx30m pixel on which that point falls in the underlying 2000 forest cover map generated by Hansen et al. (2013).**

Note that the higher the percent forest cover threshold selected, the smaller the number of points in the study sample, and as a result, the smaller the number of green points per unit of land the FCET displays. The figure below illustrates the display when the forest cover threshold is set at 40 percent (versus 25 percent in the previous figure).



Before proceeding to Tool 4, users must manually close Tool 3 using up/down arrow button in the top righthand corner of the tool.

## TOOL 4. SELECT TREATMENT POINTS

This tool allows users to select *treatment points*: those forested points in the study area that have been affected by the forest conservation policy. This can be accomplished in three ways, each of which is described below: (i) uploading a shapefile, (ii) using the manual section tool, and (iii) using on-board data on the location of protected areas (PAs).



4. Select Treatment Points

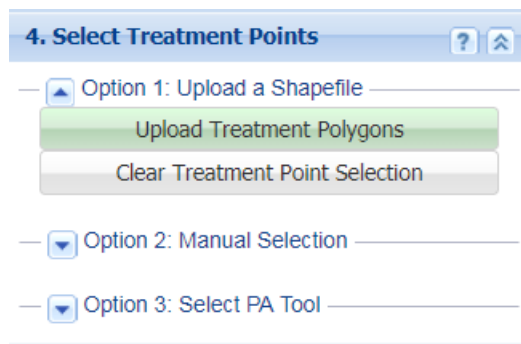
Option 1: Upload a Shapefile

Option 2: Manual Selection

Option 3: Select PA Tool

### Option 1: Upload a Shapefile

This subtool allows users to upload a shapefile that identifies treatment points, for example the boundaries of payments for environmental services (PES) contract areas. Clicking on “Option 1: Upload a Shapefile,” in the “Select Treatment Areas” tool launches opens the subtool.



4. Select Treatment Points

Option 1: Upload a Shapefile

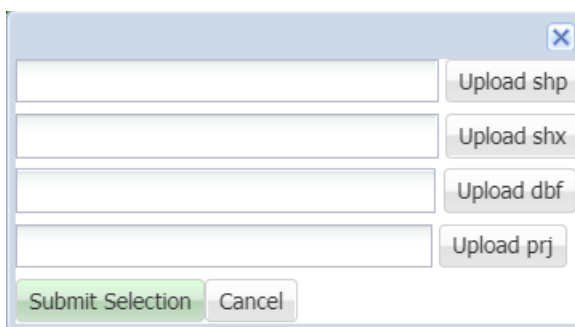
Upload Treatment Polygons

Clear Treatment Point Selection

Option 2: Manual Selection

Option 3: Select PA Tool

The next step is to click on the “Upload Treatment Polygons” button, which launches the pop-up box pictured below.



Upload shp

Upload shx

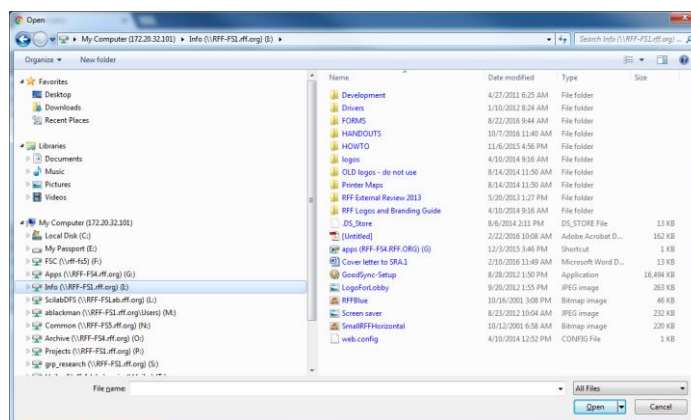
Upload dbf

Upload prj

Submit Selection Cancel



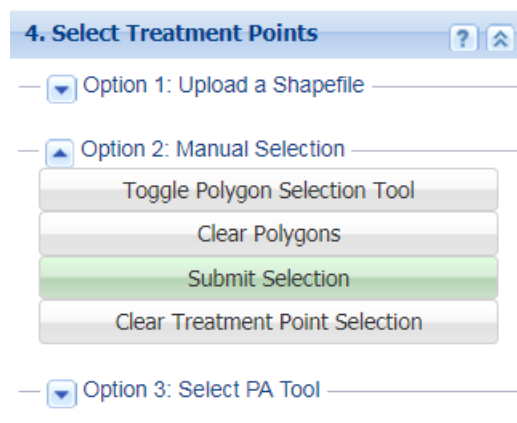
Users must upload four files: a shp, shx, dbf, and prj file. Clicking on the corresponding button in the pop-up box launches a File Explorer window that allows users to browse to, and then “open”, the appropriate file. When the files have been identified, the user must click on “Submit.”




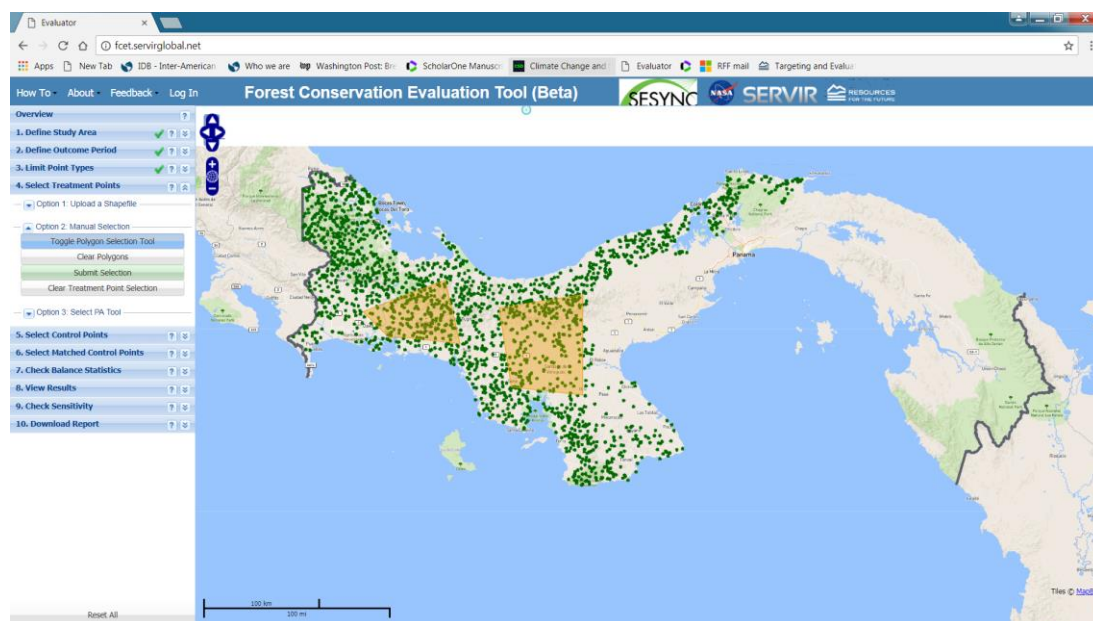
At any time, users can restart the process of uploading treatment polygons by clicking on the “Clear Treatment Area Selection” button in the subtool menu.

## Option 2: Manual Selection

This subtool allows users to manually delimit the boundaries of polygons that identify treatment points. Three steps are involved.

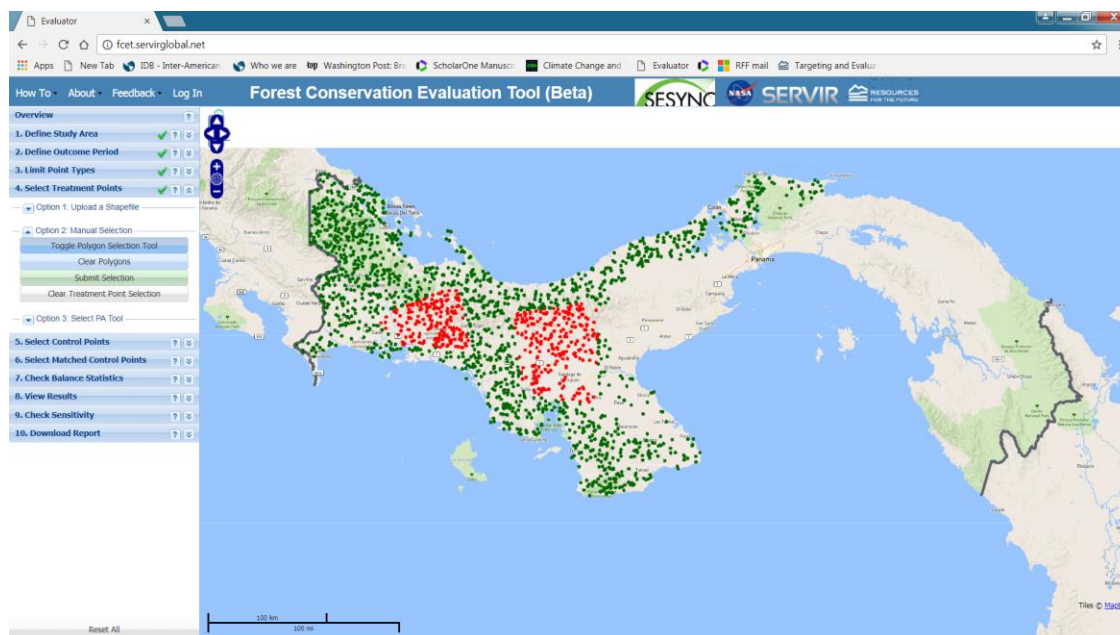


The first substep is to click on the “Toggle Polygon Selection Tool” button. That changes the arrow cursor into an arrow attached to a circle . To delimit a polygon or set of polygons that identify treatment points, position the circle at each vertex of the polygon and single-click, and then double click on the final vertex. That will color the interior of the polygon beige. Repeat that process to create additional polygons.



If the user makes a mistake in positioning vertices and delimiting treatment polygons, they can clear the mistake and restart the process by clicking on the “Clear Polygons” button in the subtool menu.

After the polygons have been delimited, click the “Submit Selection” button to enter them into FCET. The treatment points will be displayed in red and the beige coloring of the polygons will persist. To make the beige polygons disappear, click on “Clear Polygons.” The red-colored points will persist.



At any time, users can restart the manual treatment point selection process by clicking on the “Clear Treatment Area Selection” button in the subtool menu.

### Option 3: Select PA Tool

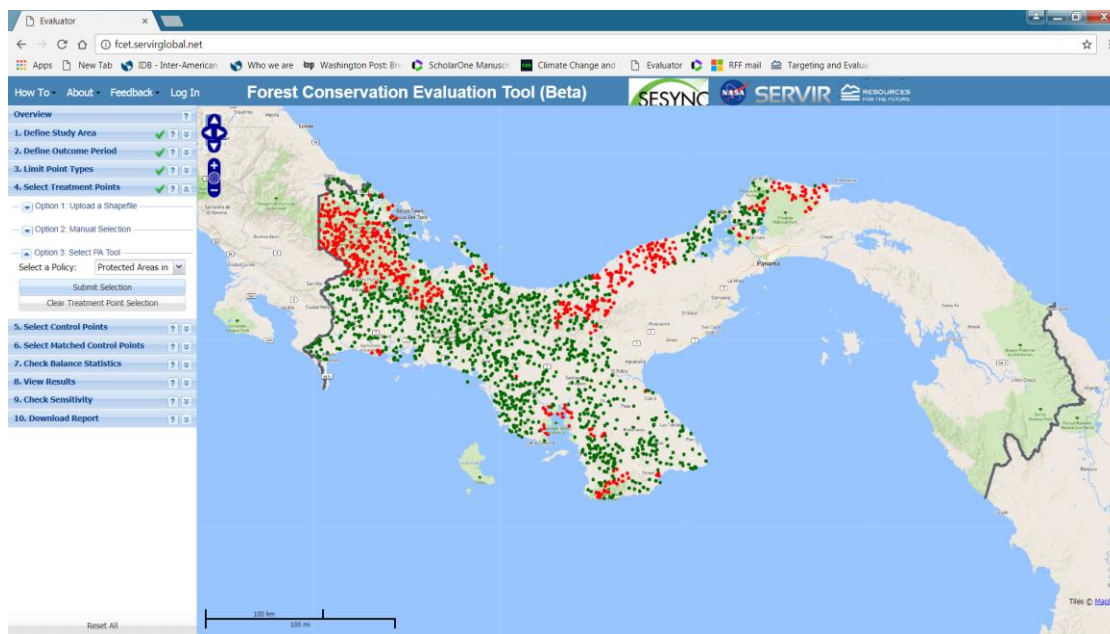
This subtool can be used when protected areas (PAs) are the conservation policy being evaluated. The subtool delimits the boundaries of PAs in the study area using World Data Base of Protected Areas (WDPA) data (for details see “FCET Metadata.pdf,” which can be downloaded from the FCET dashboard).

This subtool entails three steps. First, click on the down arrow next to “Select a Policy.” A menu will appear with three options: (i) “Protected Areas in Central America” (which includes the Dominican Republic), (ii) “Protected Areas in Mexico” and (iii) “Protected Areas in South America.”

Second, click on the appropriate option given the location of the study area, and that option will appear next to “Select a Policy.”

Finally, click on “Submit Selection.” Points inside PAs will be displayed in red.





At any time, users can restart the treatment point selection process by clicking on the “Clear Treatment Area Selection” button in the subtool menu.

Before proceeding to Tool 5, users must manually close Tool 4 using up/down arrow button in the top righthand corner of the tool.

## TOOL 5. SELECT CONTROL POINTS

This tool allows users to select *control points*: points in the study area not affected by the forest conservation policy that likely to include at least some points ‘similar’ to those affected by the policy. Control points are those from among which matched control points are selected in Tool 6 discussed below. Users may want to only use certain points as control points if they believe that they have unobserved characteristics, that is characteristics not captured by the observable characteristics (covariates) included in Tool 6. Users can select control points in three ways, each of which corresponds to a subtool described below: Option 1: select the entire study area; Option 2: upload a shapefile; and Option 3: use the manual section subtool.

**5. Select Control Points**
?
⬆

☒
Option 1: Entire Study Area

☐
Option 2: Upload a Shapefile

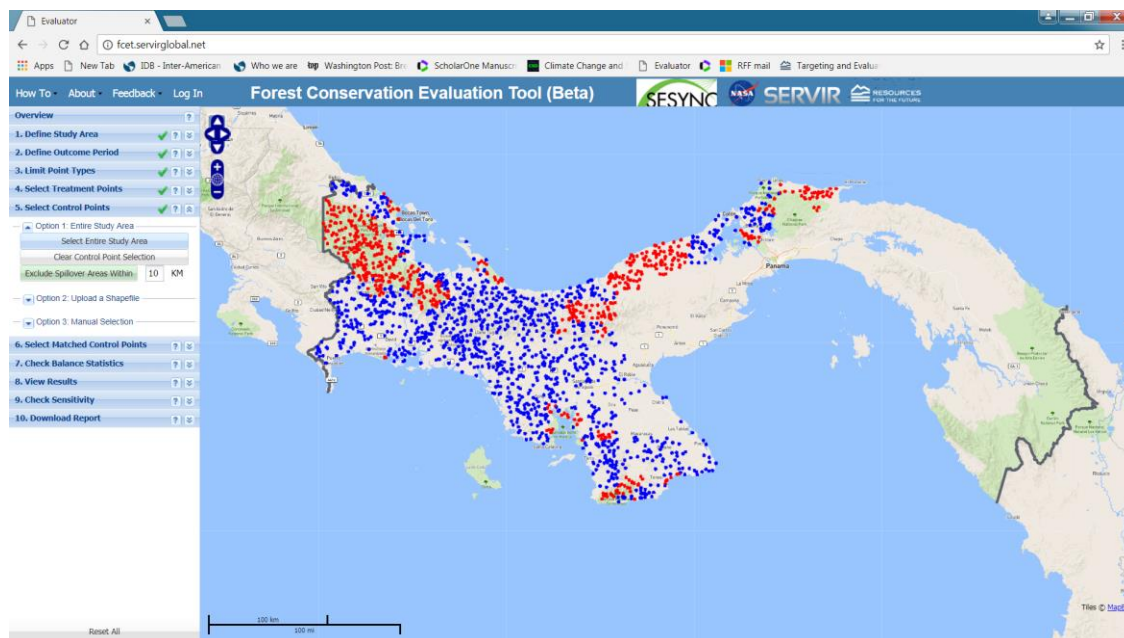
☐
Option 3: Manual Selection

### Option 1. Entire Study Area

This subtool selects all or part of the points in the entire study area except the treatment points.

### 5. Select Control Points

Clicking on the “Select Entire Study Area” button does just that. Control points are displayed in blue.



This subtool for selecting control points, along with the other three subtools allows users to exclude from the set of control points all points within a certain distance from treatment points. The purpose of this means of selecting control points is to control for potential spillover, that is, the effect of the policy on deforestation in areas outside of those in which the policy is implemented. For example, in some cases, PAs have been shown to increase deforestation just outside of the borders because farmers, loggers, ranchers and other agents shift their activities from inside PAs to nearby areas outside. In other cases, PAs have been shown to reduce deforestation in nearby areas because they enhance monitoring and enforcement of land use change restrictions.

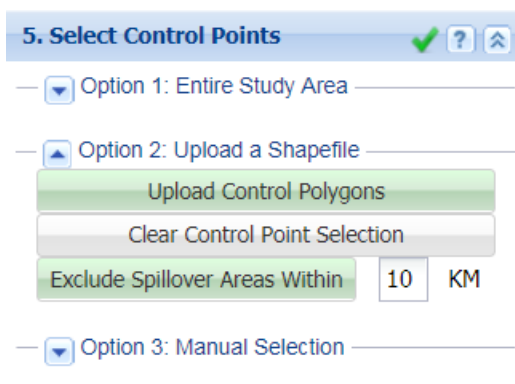
To implement this option, after having clicked on “Select Entire Study Area” enter in the box next to “Exclude spillover areas within” the appropriate distance, and then click on the “Exclude Spillover Areas Within” button.

 The “Exclude Spillover Areas Within” function is not currently available.

At any time, users can restart the control point selection process by clicking on the “Clear Control Area Selection” button in the subtool menu.

### Option 2: Upload a Shapefile

For the most part, this subtool works in the same way as the “Upload a Shapefile” subtool used to select treatment areas. Please see the explanation of that subtool above. In the case of selecting control (versus treatment) points, the only difference in functionality is that allows the user to exclude points in spillover areas in the same way as in Option 1.



**5. Select Control Points** ✓ ? ↕

— ☐ Option 1: Entire Study Area —

— ☒ Option 2: Upload a Shapefile —

Upload Control Polygons

Clear Control Point Selection

Exclude Spillover Areas Within 10 KM

— ☐ Option 3: Manual Selection —

 The “Exclude Spillover Areas Within” function is not currently available.

### Option 3: Manual Selection

For the most part, this subtool works in the same way as the “Manual Selection” subtool used to select treatment areas. Please see the explanation of that subtool above. In the case of selecting control (versus treatment) points, the only difference in functionality is that the user can exclude points in spillover areas in the same way as in Option 1.

 The “Exclude Spillover Areas Within” function is not currently available.

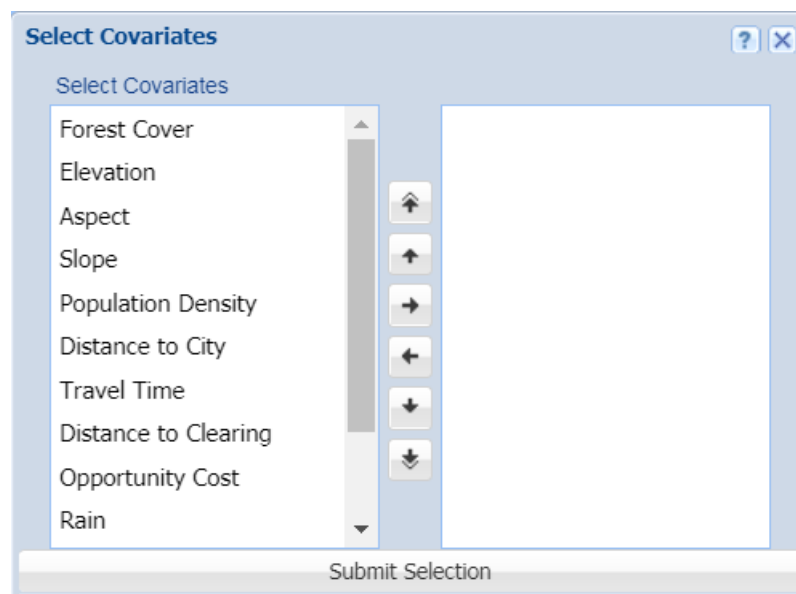
## TOOL 6. SELECT MATCHED CONTROL POINTS

This tool allows users to select matched control points, that is, control points that are similar to treatment points in terms of characteristics that affect deforestation. The FCET estimates the effect of forest conservation policies on deforestation by comparing the deforestation rates on treatment points with rates on matched control points. As discussed in “FCET Metadata.pdf,” which can be downloaded from the FCET dashboard, the FCET uses propensity score matching (PSM) to select matched control points. To select matched control points the user must complete three steps.




### Step 6.1. Select Covariates

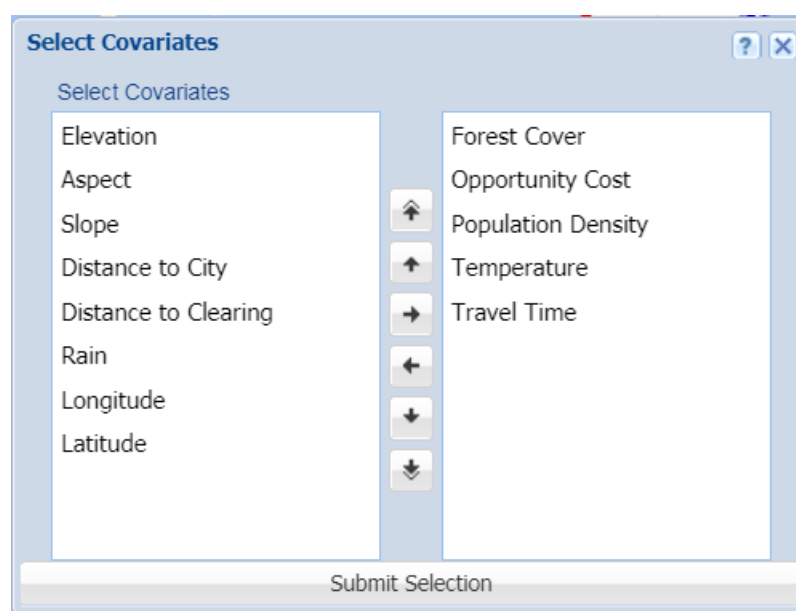
The first step is to select from a pre-determined list of 13 land characteristics (covariates), those that will be used to define ‘similarity.’ To do that, first click on the “Select Covariates” button.

Clicking on this button launches this pop-up box



**!** Definitions and a detailed description of the 13 covariates in the pop-up box are included “FCET Metadata.pdf,” which can be downloaded from the FCET dashboard.

Select covariates from this list by clicking on them and then clicking on the  button. As in Microsoft applications, you may use shift-click and control-click to select multiple covariates. Clicking on the  button moves selected covariates from the left-hand-side panel in the pop-up box to the right-hand-side panel. In case you change your mind or make a mistake, you can click the  button to move covariates from the right-hand-side panel back to the left-hand-side.

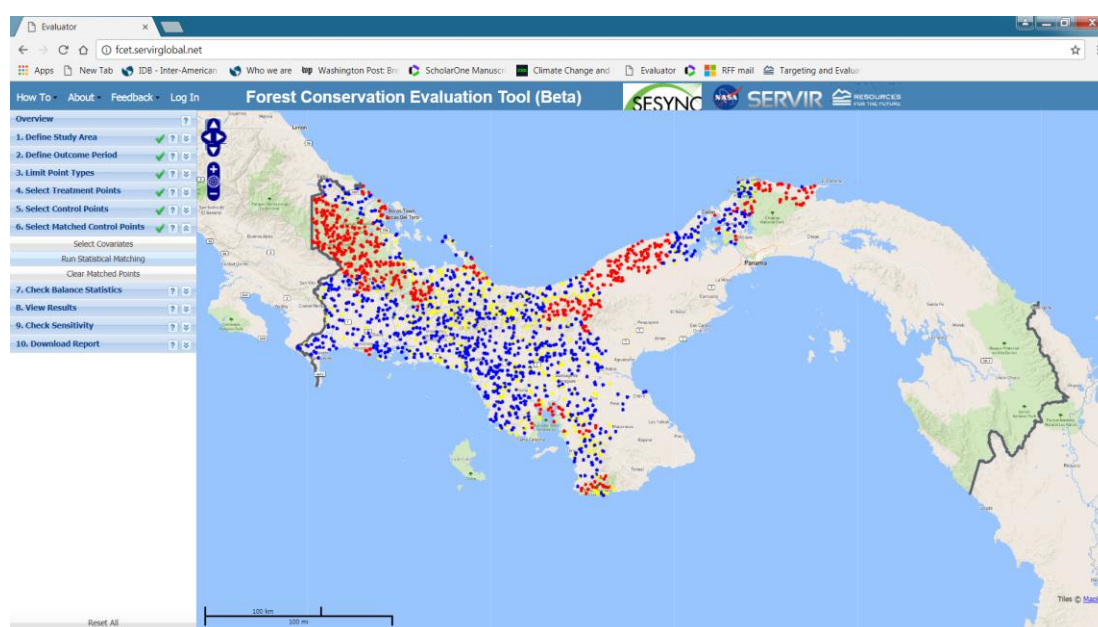


Once you have finalized the list of covariates you want to use, click on “Submit Selection” button. When you do that, the pop-up box will disappear.

## Step 6.2. Run Statistical Matching

Click on the “Run Statistical Matching” button. FCET will think for a minute or two, during which time it will display a “wait” symbol. When done, FCET will display matched control points in yellow.

 The FCET will not select matched control points until the user clicks on the “Run Statistical Matching” button.

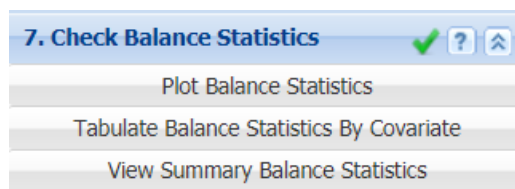


At any time, users can restart the process of selecting matched control points by clicking on the “Clear Matched Points” button in the subtool menu.

Before proceeding to Tool 7, users must manually close Tool 6 using up/down arrow button in the top righthand corner of the tool.

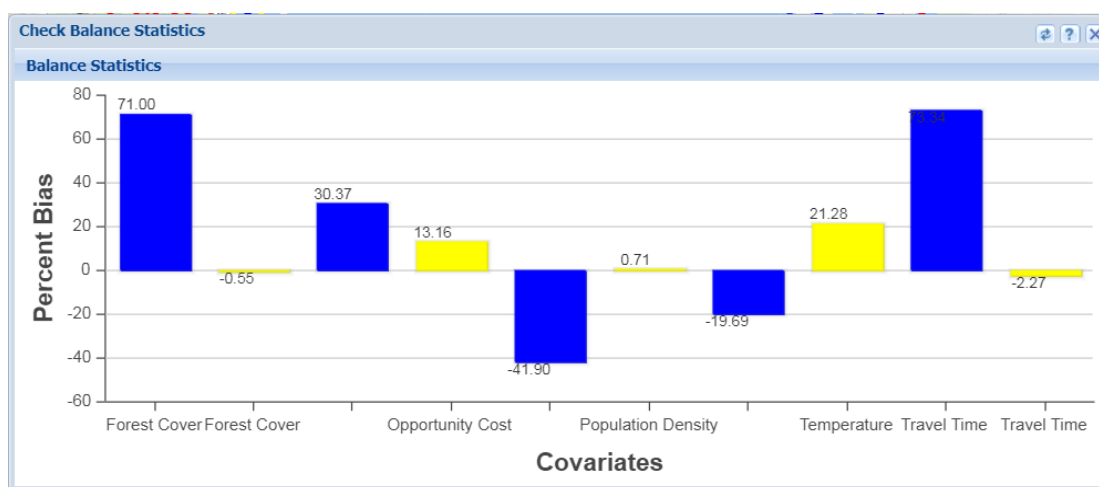
## TOOL 7. CHECK BALANCE STATISTICS

This tool allows users to generate *balance statistics*—statistics (in tabular and graphical format) that give the user an idea of how similar the matched control points are to the treatment points. The tool includes three subtools, each of which is discussed below.



### Step 7.1. Plot Balance Statistics

Clicking on “Plot Balance Statistics” launches a pop-up box that displays the following graph:



For each of the covariates used to define similarity (i.e., used in the propensity score matching), the figure displays the pre-match bias in blue, and the post-match bias in yellow. The pre-match bias measures the extent to which the mean of the covariate for the sample of treatment points differs from the mean for the sample of control points (all control points, not just the matched control points). Technically, it is the variance normalized difference in those means. The post-match bias measures the extent to which the mean of the covariate for the sample of treatment points differs from the mean for the sample of matched control points. In general, post-match bias will be significantly smaller than the pre-match bias.

### Step 7.2. Tabulate Balance Statistics

Clicking on “Tabulate Balance Statistics” launches a pop-up box that displays the following table:



Check Balance Statistics							
Balance Statistics							
Variable	Sample	Treated	Control	% Bias	% Bias Reducti...	t	p > t
Forest Cover	Unmatched	92.55	82.88	71.00	99.23	48.91	0.00
Forest Cover	Matched	92.55	92.63	-0.55	99.23	8.61	0.00
Opportunity Cost	Unmatched	182.10	150.11	30.37	56.66	23.03	0.00
Opportunity Cost	Matched	182.10	168.23	13.16	56.66	13.34	0.00
Population Dens...	Unmatched	18.94	32.03	-41.90	98.31	-30.26	0.00
Population Dens...	Matched	18.94	18.72	0.71	98.31	-3.94	0.00
Temperature	Unmatched	14685.32	14893.00	-19.69	-8.09	-14.94	0.00
Temperature	Matched	14685.32	14460.83	21.28	-8.09	-3.23	0.00
Travel Time	Unmatched	651.34	393.15	73.34	96.90	57.10	0.00
Travel Time	Matched	651.34	659.35	-2.27	96.90	14.26	0.00

The table includes two rows for each covariate used to define similarity (i.e., used in the propensity score matching). The top row (“unmatched sample”) includes statistics that measure the extent to which the mean of the covariate for the sample of treatment points differs from the mean for the sample of control points (all control points, not just the matched control points). The bottom row (“matched sample”) includes the same statistics but here measuring the extent to which the mean of the covariate for the sample of treatment points differs from the mean for the sample of matched control points. The statistics in each row include: the mean of the treated sample, the mean of the control or matched control sample, the % bias, the % bias reduction after versus before matching, the t-statistic for the statistical test of the null hypothesis that the two sample means are equal, and the probability value for that test.

### Step 7.3. View Summary Balance Statistics

Clicking on “View Summary Balance Statistics” launches a pop-up box that displays the following table:

Check Balance Statistics					
Balance Statistics					
Sample	Pseudo R-Squar...	Likelihood Ratio	Likelihood P-Val...	Mean Bias	Median Bias
Unmatched	0.16	5391.85	0.00	47.26	41.90
Matched	0.01	149.07	0.00	7.60	2.27

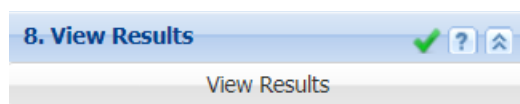
This table includes summary statistics that indicate how similar the sample of treatment points is to the sample of control points (top row) and the sample of matched control points (bottom row). These summary statistics include pseudo R-squared, likelihood ratio, likelihood p-value, mean bias, and median bias. A description of each of these statistics is included in the “FCET Metadata.pdf,” which can be downloaded from the FCET dashboard.

Before proceeding to Tool 8, users must manually close Tool 7 using up/down arrow button in the top righthand corner of the tool.

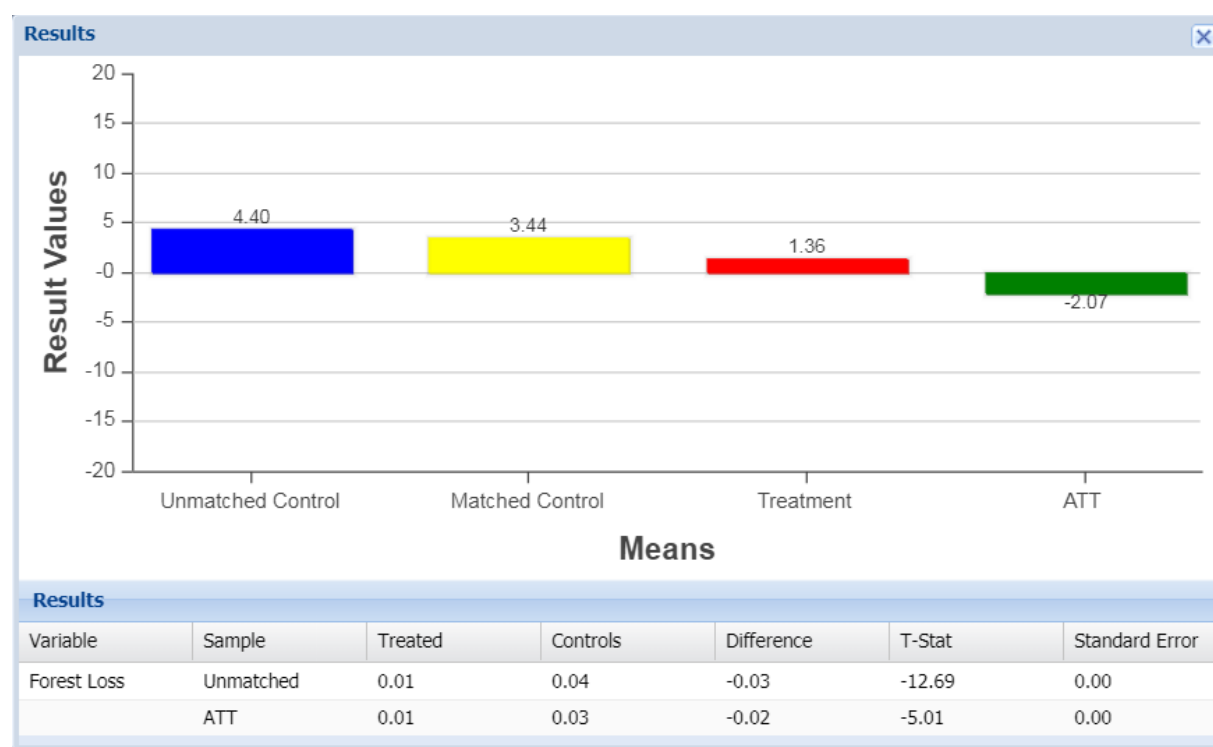


## TOOL 8. RESULTS

This tool allows users to view the results of the analysis of the forest conservation policy's effect on deforestation in in tabular and graphical format.



Clicking on the “View Results” button launches a pop-up box that includes results in both graphical and tabular format.



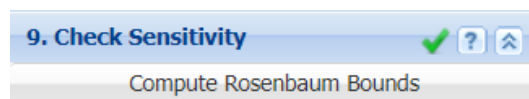
The figure represents the deforestation rates on unmatched control points (blue bar), matched control points (yellow bar), and treated points (red bar). It also represents the difference between the deforestation rate on matched control points and treated points (green bar) which is the effect of forest conservation policy on deforestation (also known as the average treatment effect on the treated ATT), the FCET's main result.

The table presents information similar to the figure, but in a different format. The top row (unmatched sample) represents the deforestation rate on treated points, unmatched control points, the difference between these rates, a t-statistic for the statistical test that this difference is equal to zero, and the standard error on the difference. The bottom row (ATT) represents the same information for treated points and matched control points.

Before proceeding to Tool 9, users must manually close Tool 8 using up/down arrow button in the top righthand corner of the tool.

## TOOL 9. CHECK SENSITIVITY

This tool gives the user a sense of how robust and reliable are FCET results. More specifically, it checks the sensitivity to unobserved heterogeneity of the FCET's estimate of the effect of the forest conservation policy on deforestation. Further detail on this sensitivity analysis is provided "FCET Metadata.pdf," which can be downloaded from the FCET dashboard.



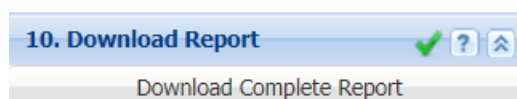
Clicking on "Compute Rosenbaum Bounds" button generates the following table. Again, guidance on how to interpret the table is provided in "FCET Metadata.pdf."

Check Sensitivity					
Rosenbaum Bounds					
Gamma	Q+	Q-	P-Value+	P-Value-	
0.1	10.94	43.27	0.00	0.00	
0.2	4.51	29.59	0.00	0.00	
0.3	1.04	23.32	0.15	0.00	
0.4	1.27	19.46	0.10	0.00	
0.5	3.17	16.73	0.00	0.00	
0.6	4.75	14.66	0.00	0.00	
0.7	6.12	13.00	0.00	0.00	
0.8	7.32	11.62	0.00	0.00	
0.9	8.42	10.44	0.00	0.00	
1.0	9.41	9.41	0.00	0.00	

Before proceeding to Tool 10, users must manually close Tool 9 using up/down arrow button in the top righthand corner of the tool.

## TOOL 10. REPORT

This tool outputs a report in pdf format, that contains all of the choices the user has made in completing Steps 1-7 above, and all of the results and sensitivity analyses the FCET has generated in Steps 8 and 9. To download the pdf, simply click on the "Download Complete Report" button.



The first page of the report looks like this:

## Forest Conservation Evaluation Tool Results

### Date of Study

Study started on: 23rd April 2018 15:52 UTC

Report generated on: 23rd April 2018 16:12 UTC

### Define Study Area

Selected Regions: Bocas del Toro, Panama; Chiriquí, Panama; Ngöbe Buglé, Panama; Veraguas, Panama; Herrera, Panama; Los Santos, Panama; Colón, Panama

### Define Outcome Period

Start year: 2004

End year: 2012

### Limit Plot Types

Minimum forest cover: 40%

Maximum forest cover: 100%

### Select Treatment Areas

Option used: Select Policy

### Select Control Areas

Option used: Entire Study Area

### Select Matched Control Plots

Matching method: Propensity Score Matching

Matching estimator: Nearest Neighbor 1-1

Covariates: Forest Cover, Opportunity Cost, Population Density, Temperature, Travel Time