DRAFT VegMachine User Manual
(February 2016)

VegMachine is a tool for summarizing long term, spatial and temporal changes in land cover from decades of satellite imagery. It allows you to select areas of interest, then generate simple reports and analyses of how land cover is changing in those areas over time.

The satellite image data used in VegMachine is produced by the Remote Sensing Centre in the Queensland Department of Science, Information Technology and Innovation, using the Landsat archive began earth observation in 1986. Landsat imagery has been developed into multiple products used in VegMachine including Fractional Cover and Ground Cover.

VegMachine should work on most web connected devices running a Chrome or Firefox browser. This draft document is written for larger screen devices. It is still relevant to smaller devices but users should be aware that programming will rearrange the main screen layout to optimize use of the screen space.

Please note that in this document *Italicised Print* indicates text that should be visible on the screen

1. Starting VegMachine

When you enter the VegMachine (VM) website you will see that the window is shadowed by the *Data Collection* popup (Fig 1). You will need to click the *OK* button to use the site.

Once you enter the website, you'll see that the main page has three main panels (Fig 2);

- the menu bar,
- the *Map Panel,* and,
- the *Output Panel.*

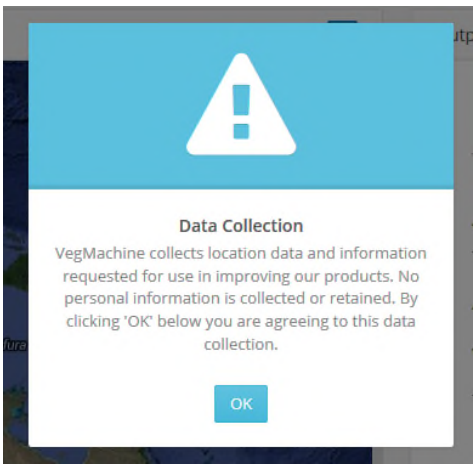

Fig 1. Data collection popup.

These three panels operate much as you would expect. The menu is used to drive most of VM's functionality, the *Map Panel* is where you view imagery and draw or import your polygon mapping (such as paddock and property boundaries), and the *Output Panel* is where you will see graphs generated in your analyses. Below is a simple guide to each of the panels.

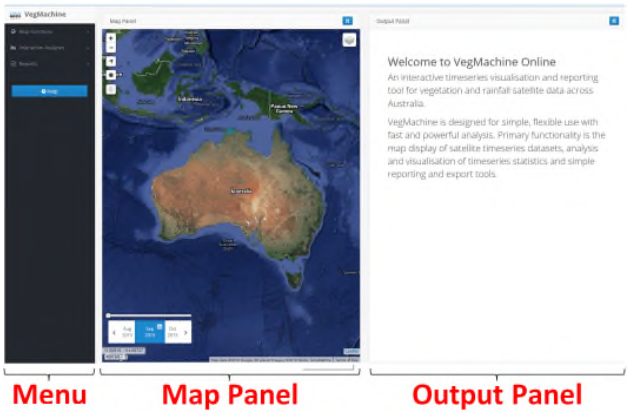

Fig 2. Main VM page with three major panels highlighted

2. The menu panel

Fig 3 shows the fully expanded VM menu panel. The menu panel includes additional drop downs for *Map Functions*, *Interactive Analyses* and *Reports*, as well as a help button. These are explained below in the order they appear on the menu panel

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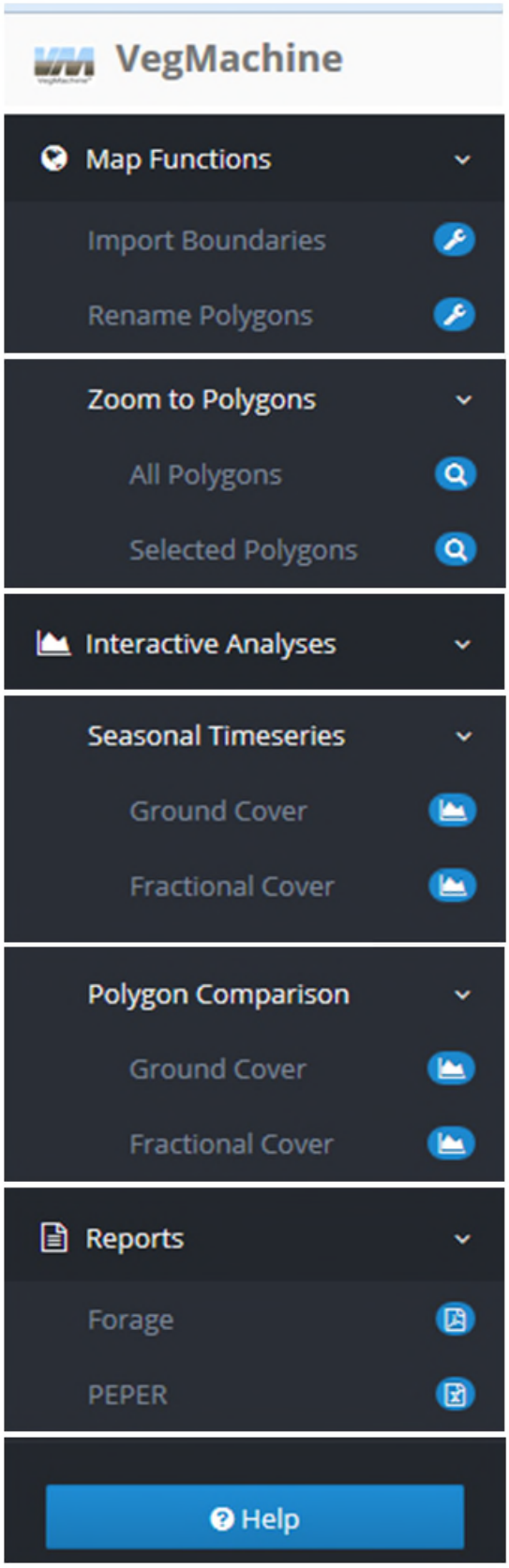

Fig 3. Expanded menu panel.

2.1 *VegMachine* name and logo

Clicking on this area hides / unhides the menu panel.

2.2 *Map Functions >Import Boundaries*

This tool imports existing digital polygon mapping (e.g. paddocks on a grazing property). A variety of formats are permitted (shp, KML, KMZ, GeoJSON). Multipart files like shapes though should be zipped in a single file for upload.

1. Click *Map Functions >Import Boundaries.*
2. The *Import Polygon Boundary* popup will open.
3. In the *Polygon File* box browse to find your polygon file and add it here.
4. In the *Source SRS* box, a dropdown menu will allow you to select the correct EPSG value for your file. Table 1 lists some of the more common EPSG values and their corresponding projections.
5. In the *Label Field* box enter the name of the field in your data that stores the polygon names. If you don't know you can leave this blank and add the names later (2.3)
6. Click the upload button, and your polygons should appear in the *Map Panel*.

Table 1. Common Australian EPSG codes.

EPSG	Projection
3577	Australian Albers
3112	Lambert
4283	GDA94
4326	WGS84
32751	WGS84 SUTM51
32752	WGS84 SUTM52
32753	WGS84 SUTM53
32754	WGS84 SUTM54
32755	WGS84 SUTM55
32756	WGS84 SUTM56
28351	GDA94 MGA51
28352	GDA94 MGA52
28353	GDA94 MGA53
28354	GDA94 MGA54
28355	GDA94 MGA55
28356	GDA94 MGA56

2.3 *Map Functions >Rename Polygons*

This tool can rename any polygon mapped in the *Map Panel* regardless of whether they were imported (2.2) or drawn (3.3).

1. Zoom to the polygon(s) you wish to rename.
2. Click inside the polygon you want to rename. It will change colour from white to yellow to show it has been selected.
3. Click *Map Functions > Rename Polygons*. This will open the *Rename Selected Polygons* popup.
4. Enter the new name for your polygon in the *New Name* box then click *Rename*.
5. The popup will close and now when you hover over the polygon with your cursor the new name will be visible. Note that you can rename more than one polygon in one action by selecting multiple polygons at step 2.

2.4 *Map Functions > Zoom to Polygons*

This tool includes two options. *All Polygons* adjusts the *Map Panel* so that all mapped polygons are visible in the panel. *Selected Polygons* adjusts the *Map Panel* so that all selected polygons are visible in the panel.

2.5 *Interactive Analyses > Seasonal Timeseries*

This tool provides an analysis of land cover change in a single user specified polygon. It offers *Ground Cover* and *Fractional Cover* options. See section 5 for more information on which of these options best suits your needs.

1. Select at least one polygon from those plotted in the *Map Panel*. If more than one polygon is selected, VM treats the group as a single polygon and returns an analysis for the combined group.
2. Click *Interactive Analyses > Seasonal Timeseries* then either *Fractional Cover* or *Ground Cover*. The timeseries analysis will appear in the *Output Panel*. See section 5 for more details on how to interpret this analysis.

2.6 *Interactive Analyses > Polygon Comparison*

This tool compares land cover change between two user selected polygons. It offers *Ground Cover* and *Fractional Cover* options. See section 5 for more information on the data that best suits your needs.

1. Select two polygons from those plotted in the *Map Panel to compare*.
2. Click *Interactive Analyses > Polygon Comparison* then either *Fractional Cover* or *Ground Cover*. The *Polygon Comparison* will appear in the *Output Panel*. See section 5 for more details on how to interpret this analysis.

2.7 *Reports > Forage*

This provides a multi-polygon analysis of *Ground Cover* change, such as a paddock-by-paddock analysis of cover within a grazing property. This report is delivered as a pdf file via email.

1. Select all plotted polygons you wish to include in your Forage report
2. Click *Reports > Forage*. This will open the *Forage Reports* popup.
3. Leave *Report Type* as is.
4. Enter the *Email* address that will receive the report.
5. Add an identifier for the *Location Label*. This will be inserted in the report.
6. Click the *Submit* button.
7. A popup window will open that says *Your request has been sent. You should receive an email shortly.*
8. Click OK to shut the popup and wait for your email.
9. The report includes material on report interpretation.

2.8 *Reports > PEPER*

PEPER uses the Universal Soil Loss Equation to estimate the amount of sediment lost from a site under historical cover levels (*Total Cover* component of *Ground Cover*) and compares this to expected sediment loss at a user specified level of cover. This report is delivered as a csv file that can be read in Microsoft Excel.

1. Select the polygon you wish to include in your PEPER report.
2. Click *Reports > PEPER*. This will open the *FORAGE Report* popup.

3. Select a *Buffer Distance*.
4. Select a *Comparison Cover Amount (%)*.

This is the target ground cover level for your polygon.

5. Click *Submit*. The *Opening results.csv* popup will open and give you the option of saving the file or opening it. See section 6 for details on how to interpret the report

3. The *Map Panel*

The *Map Panel* is where spatial information is presented and where you can interact with the mapping. There are a number of features and tools in this window, located in the upper left, upper right and lower left (Fig 4). These are explained below.

Fig 4. *Map Panel* tools and features

3.1 ***Zoom in / Zoom out*** (Fig 5A)

Click these to zoom in or out on the *Map Panel* area. If you are using a mouse, you can also zoom in and out by rolling the scroll wheel while the cursor over the *Map Panel*.

3.2 ***Show me where I am*** (Fig 5B)

This centres the map at your current location. For devices without GPS, results are unlikely to be accurate.

Fig 5. Upper left *Map Panel* tools.

3.3 ***Draw a polygon*** (Fig 5C)

This tool allows you to draw polygons in the *Map Panel*.

1. Click the *Draw a Polygon* tool.
2. Click in the *Map Panel* at the first point on the perimeter of the polygon you are drawing.
3. Continue clicking around the perimeter.
4. Close the polygon by clicking on the first point. You should now be able to hover over the polygon and see its name.

3.4 ***Delete Layers*** (Fig 5D)

This tool allows you to delete any of the polygons mapped in the *Map Panel*.

1. Click the *Delete Layers* tool.
2. Click any polygon you want to delete. It will disappear immediately.
3. If you accidentally delete the wrong polygon, click the *Cancel* option on the *Delete Layers* tool, then return to step 1.
4. When you have deleted the required polygons, click the *Save* option on the *Delete Layers* tool.

3.5 ***Search*** (Fig 5E)

This allows basic search similar to Google mapping.

1. Click the *Search* tool.

2. Type the location into the search window.
3. If the location is in the search database, it will appear under the search box. Click the suggestion and the map will centre on the point and mark it.

3.6 *Fullscreen toggle*

Clicking the  symbol in the upper right of the Map Panel extends the *Map Panel* across the full screen. Click again to return to standard *Map Panel* size.

3.7 Map layers

Hovering over this icon  on the upper left of the *Map Panel* will open a popup of all available imagery (Fig 6). *Hybrid* and *Roads* are listed at the top, and these are your base maps. One of these is always selected but you can toggle between them. The remainder are timeseries of Landsat derived images that can be viewed by selecting one in this popup box and then using the tools in the lower left of the *Map Panel* to view the images (3.8 and 3.9).

3.8 Transparency slider (Fig 7A)

This tool only works if one of the image timeseries has been selected in the map layer popup (3.7). If imagery is selected the selected images will fade on/off over either the *Hybrid* or *Roads* image as the slider is moved left / right. Note that images may not be available for very recent months as image compilation is incomplete for these dates.

3.9 Image date selector (Fig 7B)

This tool only works if one of the image timeseries has been selected in the Map Layer popup (3.7) and if the transparency slider (3.8) is not located full right.

You can use this tool to view different image dates in the selected timeseries. Click the arrows at either end of the selector to move between image dates. Please note all images are seasonal (three monthly), so only change four times in any year, not monthly. Also, images may not be available for very recent months as image compilation is incomplete for these dates.

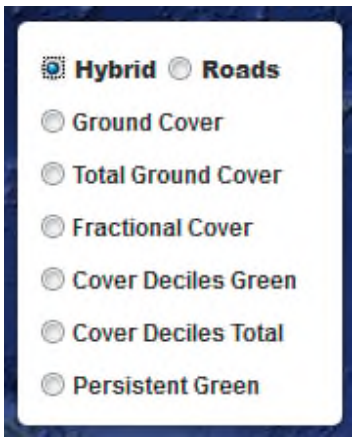

Fig 6. Map layer selection

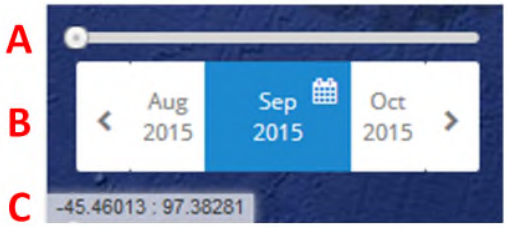

Fig 7. Lower left *Map Panel* tools

3.10 Cursor coordinates (Fig 7C)

This panel shows the latitude and longitude of the cursor at any point in the *Map Panel*.

4. The *Output Panel*

The output panel only operates when one of the *Interactive Analyses* is requested. The layout of the panel is very similar, regardless of the type of analysis requested. General layout is discussed below followed by more specific details of individual analyses.

The *Output Panel* incorporates six main sections (Fig 8 A-F). These are explained below in order from top to bottom of the *Output Panel*.

4.1 Upper left tools (Fig 8a)

Save chart data as CSV. This exports the graph and rainfall data as spreadsheet (csv) data.

Save chart as PNG. This exports the *Output Panel* as an image (png) file.

Fullscreen Toggle. This toggles the *Output Panel* to and from full screen coverage.

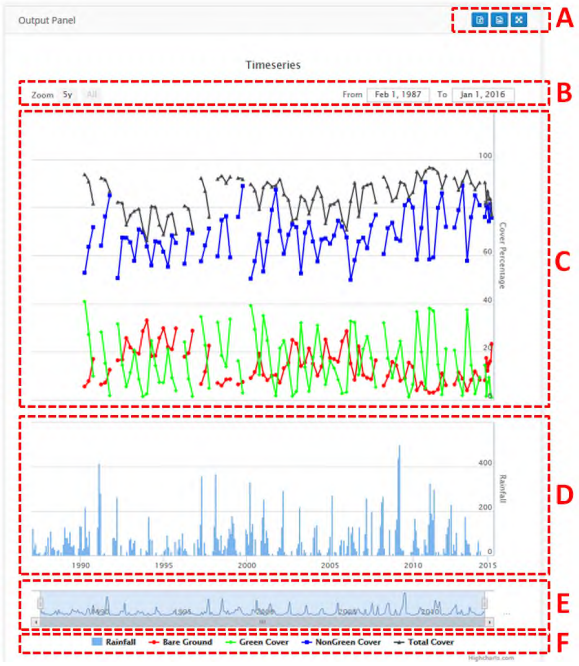

Fig 8. Main sections of the Output Panel

4.2 Date selector (Fig 8B)

These tools allow you to zoom to different parts of the cover (Fig 8C) and rainfall (Fig 8D) charts. Zoom charts to the most recent 5 years by clicking the *5y* button, to the full time series by cliking the *All* button or choose a start and a finish date via the *From* and *To* text boxes. Note that in the latter case, you can use full dates, decimal dates or four digit years.

4.3 Cover chart (Fig 8C)

This chart plots percentage cover values from polygons selected for analysis. The colours of the chart traces correspond to those in the legend (Fig 8F). If you hover over this pane, the graphed values for the date you are on will appear in the chart.

4.4 Rainfall chart (Fig 8D)

The rainfall chart plots monthly rainfall at the location of the selected polygon(s). Data are derived from Bureau of Meteorology datasets. If you hover over this pane, the graphed values for the date you are on will appear in the chart.

4.5 Date zoom pane (Fig 8E)

The trace in this pane shows the moving monthly average rainfall for the selected polygon(s). It also features two sliding widgets that can be moved along the pane to redefine the start and end dates of the rainfall and cover charts.

4.6 Chart legend (Fig 8F)

This identifies the source of data shown in the cover and rainfall charts. Individual traces can be removed from, or returned to, the charts by clicking the corresponding index in the legend.

5. Understanding *Interactive Analyses*

Interactive Analyses are designed for simple, on-the-fly analysis of land cover change. Here are some key pointers for running and interpreting these analyses.

You can run two types of *Interactive Analyses* in VM – a *Seasonal Timeseries* or a *Polygon Comparison*. *Seasonal Timeseries* analysis looks at cover change on a single polygon (or a group of polygons analysed as a single polygon), whereas *Polygon Comparison* compares cover change between two selected polygons.

The cover charts for *Seasonal Timeseries* and *Polygon Comparison* analyses are quite different. A *Seasonal Timeseries* chart (Fig 9A) displays four cover traces derived from cover in the selected polygon; *Bare Ground*, *Green Cover*, *Non Green Cover* and *Total Cover*. The corresponding chart for a *Polygon Comparison* (Fig 9B) shows only the traces for *Median* total cover in the two selected

polygons. These two traces are banded by the 20th and 80th percentile of cover for each polygon to give some idea of cover variation around the median trace.

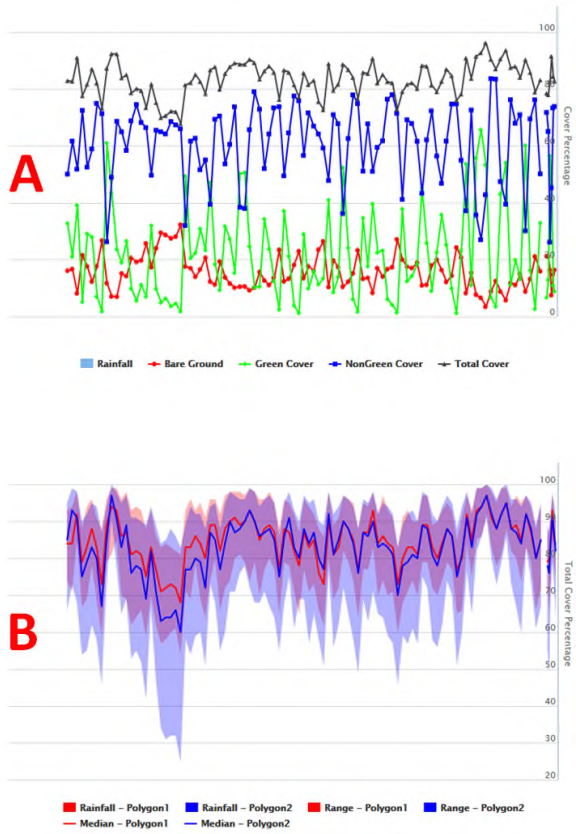

Fig 9. Cover chart and Legends for *Seasonal Timeseries* (A) and *Polygon Comparison* (B).

Both analyses can use either *Fractional Data* or *Ground Cover* data, and it is important to understand how these two compare. Both products divide total land cover into three discrete parts, *Bare Ground*, *Green Cover* and *Non Green Cover*, and these appear in the chart legend. The three parts should sum at any date to 100% (allow for some sampling and rounding error). *Total Cover* will also appear in the legend, and this is simply the sum of *Green Cover* and *Non Green Cover*.

The difference between *Fractional Cover* and *Ground Cover* is really about the viewpoint. *Fractional Cover* looks at all cover as seen from the sky, whereas *Ground Cover* looks at cover as it might be seen from at or near ground level. So for example, *Bare Ground* under green tree canopy is ignored in *Fractional Cover* data because it is not obscured by *Green Cover* of the canopy when viewed from high altitude, whereas the green tree canopy is ignored in *Ground Cover* measurements and the *Bare Ground* is counted (Fig 10).

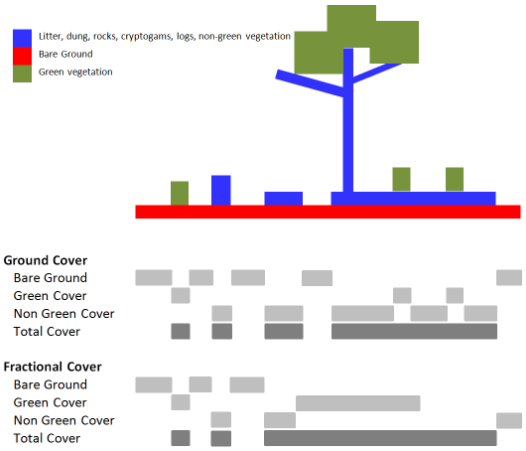

Fig 10. Partitioning of *Ground Cover* and *Fractional Cover* measurements.

6. Understanding *Reports*

VM *Reports* differ from *Interactive Analyses* in two ways; they are delivered to your device as files that you can store, and they aren't displayed in the *Output Panel*. Two types of reports are available through VM, *Forage* and *PEPER*, and both are explained in more detail below.

Forage reports

These reports take a set of polygons and compare cover change within each polygon to similar country in a 50km buffer around the polygon. Here are some key points about *Forage* reports.

- Forage reports are delivered by email in PDF format.
- The cover analysed in these reports is always the *Total Cover* component of *Ground Cover*.
- *Forage* reports consist of the following pages
  - A context page that includes a map of all polygons including polygon names,

basic location data and interpretation assistance.

- A page describing layout and interpretation of single polygon analyses.
- A single page analysis of cover change for each selected polygon.
- A summary page that compares key statistics from all selected polygons.

PEPER reports

The PEPER report (Fig 11) is delivered as a csv file you can open in excel. It is a very simple report that provides statistics on modelled sediment loss under historical and aspirational levels of *Total Cover* using the Universal Soil Loss Equation.

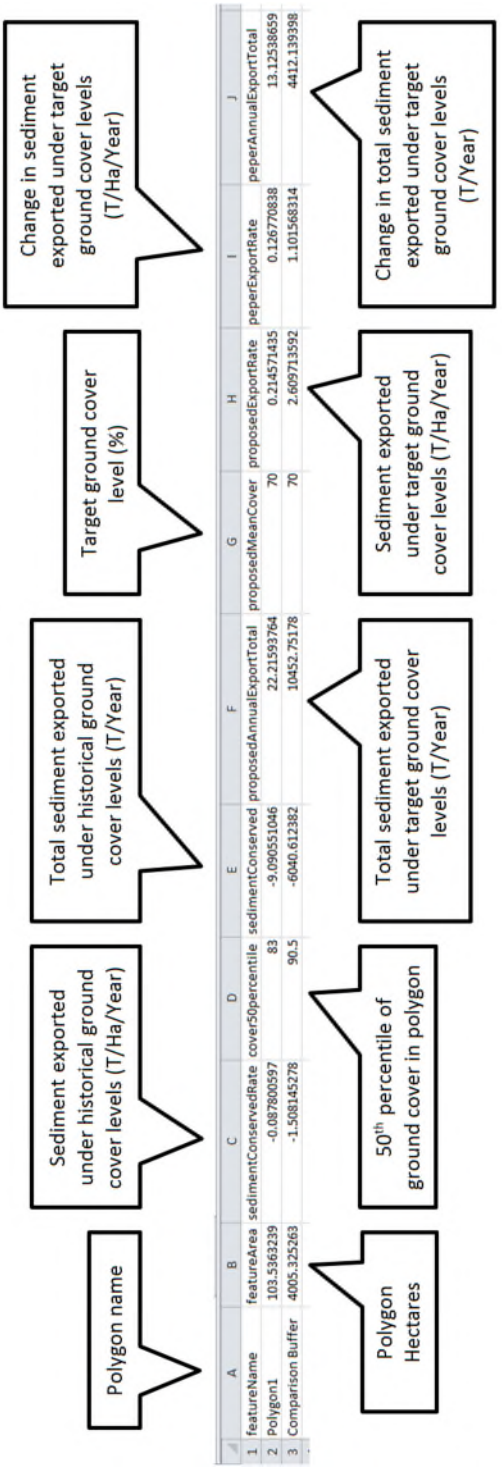

Fig 11. PEPER report explained.

Acknowledgements

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