MDT-Web Help Documentation

Table of Contents

MDT-Web Description 2
Application Layout 2
MDT-Analysis Tools 3
Upload and Check Land Disturbance Data 3
Avoidance Analysis 4
Offset Analysis 6
Map Tools 12
Map Resources Panel 14
Technical Description of Application 14

MDT-Web Description

MDT-Web is an internet mapping application which aids users in avoiding and offsetting potential development impacts in Mongolia by following the Mongolia Offset Regulation (MOR) guidance policies established in 2014. This application was created by The Nature Conservancy (TNC) in partnership with Ministry of Environment, Green Development and Tourism of Mongolia (MEGD). This endeavour was part of a larger effort of building capacity within MEGD to support landscape-level conservation in the southern Gobi and was directly financed by the European Bank for Reconstruction and Development (EBRD) Shareholders Special Funds.

Similar to the desktop version of the Mitigation Design Tool (MDT - Desktop), the MDT-Web focuses on three main items; 1) assisting users in editing and checking land disturbance (LD) data to ensure data follows the necessary standards for using the LDs other tools, 2) provide users with the ability to relatively compare potential offset costs of planned LDs which allow users to examine ways to potentially reduce their offset compensation requirements while also avoiding those areas identified by law as being "no-go" zones to development , 3) produce all data necessary to produce an offset compensation plan including an offset cost report, impact assessment of LDs, and potential offset locations. Users who would like to obtain more information on any of the procedures or standards set for the MDT tools should reference the GIS Protocols and Procedures for Compliance with the Mongolian Offset Regulations document (GIS_PPC) available at http://s3.amazonaws.com/DevByDesign-Web/MonOffsetDesign/documents.html.

Application Layout

MDT-Web layout is comprised of two main components; the map resources panel (left section) and the map display (right section). The map resources panel gives users the ability to modify the displayed map and view information with regards to available data. The map canvas displays the spatial data associated with the application. A set of map tools (described in more detail under the Map Tools section) provides the users with a number of tools to aid in setting the view extent of the displayed map, an identify tool for obtaining feature level information, an add data tool allowing for users to add their own spatial data, and a print tool providing a variety of map output sizes and formats. Finally specific to following the MOR, the MDT Analysis menu is in the upper left portion of the map display with three menu choices; Upload Land Disturbances Data, Avoidance Analysis, and Offset Analysis. By clicking on the blue down arrow, the menu provides the user with the choices of these different analyses to be run. Each analysis is described in detail within the MDT Analysis section of this report.

Figure 1 MDT-Web application.

MDT-Analysis Tools

There are three tools available within the MDT-Web that users can access and run in order to follow the MOR; Upload Land Disturbance Data, Avoidance Analysis, and Offset Analysis. Each tool is accessed by clicking on the title of the tool within the MDT Analysis menu. This opens a dialog which guides users in performing the analysis.

Upload and Check Land Disturbance Data

The *Upload and Check Land Disturbance Data* tool (Figure 2) allows users to upload LD data they have created from other GIS or design software to the web tool and check their LD data for errors or missing parameters prior to using these data in other MDT-Web tools. The user must first upload a zip file containing one or two shapefiles representing the LDs. This requires all necessary files associated with a shapefile must be present within this zipped file (i.e. *.SHP, *.SHX, *.DBF, and *.PRJ). For more information on creating these shapefiles see the Step 1 – Mapping Land Disturbances section of the GIS_PCC. The tool requires up to two shapefiles be contained within the zip file and will automatically select a linear shapefile for the linear land disturbances and a polygon shapefile for the area land disturbances.

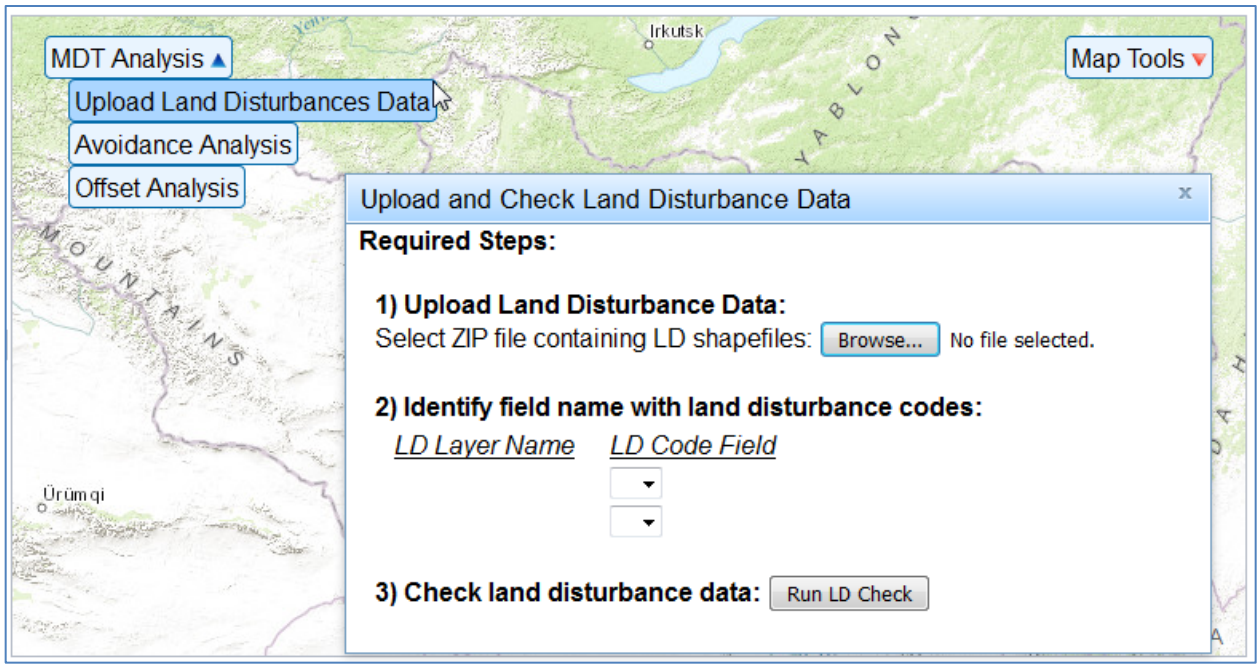

Figure 2 Upload and Check Land Disturbance Data tool.

Once the user selects a zip file with the Browse button, the application automatically displays (in purple) and zooms to the location of LDs. The name of each shapefile is listed under the LD Layer Name column and the user is then required to select the appropriate field containing the LD codes (see Step 1 – Mapping Land Disturbances section of the GIS_PPC). Once the user has selected the appropriate fields, they then can run a quality assessment analysis of these data by clicking on the *Run LD Check* button. This will automatically produce a legend for all potential land disturbance types and apply this legend to the land disturbance data. If errors in attribution are found, the application will identify these errors by drawing the LD in red. This allows for the user to quickly identify which LDs need to be fixed. Additionally by using the legend users can also see if a feature has been misattributed (e.g. road attributed as a pipeline).

To modify the attributes of any feature, the user can at this point click on a feature which will display an attribute dialog specific to that feature (Figure 3). Then the user can click on the Edit LD Code button to modify the attributes associate with the feature. This expands the attribute dialog giving users the option to select a different LD type in which to change the features LD type attribute (Figure 4).

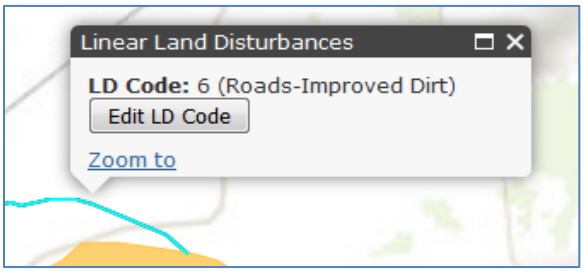

Figure 3 Attribute dialog for LD.

Note: If attributes have been changed the user must rerun the LD Check to update this information. Additionally both the *Avoidance* and *Offset Analysis* tools will not be available to the user until the LD Check identifies there are no errors associated with the LD data. By following the steps highlighted in the Step 1 – Mapping Land Disturbances section of the GIS_PPC users can avoid these errors and quickly move on to any of the other two analyses.

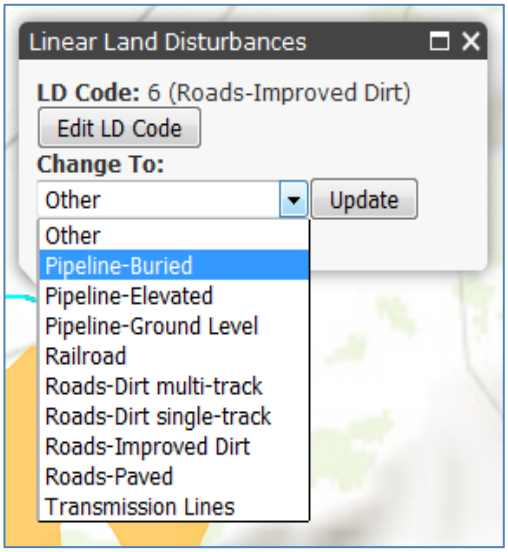

Figure 4 Expanded attribute dialog for changing LD attributes.

Avoidance Analysis

The *Avoidance Analysis* tool (Figure 5) provides users with relative cost comparisons of each of the planned LDs. The user must first check the LDs using the previous tool described. If this has been done,

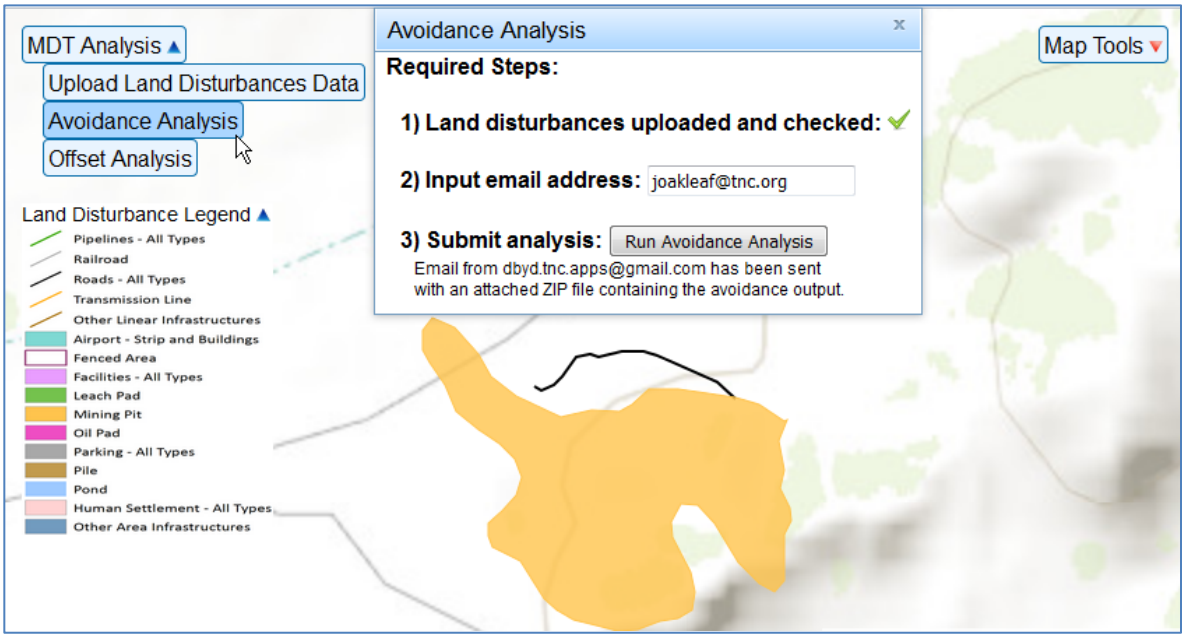

Figure 5 Avoidance Analysis tool.

a green check mark will appear after Step 1. Then by inputting their email address the user can proceed to running this analysis by clicking on the *Run Avoidance Analysis* button. Messages will be displayed at the bottom of the dialog indicating the analysis is running. Once completed, a final message will indicate an email has been sent to the user with the analysis output.

An email sent from dbyd.tnc.apps@gmail.com with the subject line MDT Avoidance Results will be sent to the inputted email address and have an attached zip file (i.e. mdt_avoid.data.zip) containing a text file (i.e. total_summary.txt) identifying the cumulative offset factor for the entire planned development and a polygon shapefile (i.e. ld_avoid.shp) representing the impact areas for all the LDs. Each polygon will have the original attributes from the both LD datasets and ten new fields*: buff_dist, LinkID, mdt_avgCat, mdt_avgCOF, mdt_Rank, mdt_sumCOF, mdt_PAs, mdt_FAs, mdt_HAs,* and *mdt_RAs*. Table 1 describes how each field is created. The *mdt_avgCat, mdt_avgCOF, mdt_Rank,* and *mdt_sumCOF* fields provide a method to relatively compare the LDs among each other based on either average or total COF value. This COF value provides guidance to those when comparing different potential LD scenarios and does not indicate the actual final offset costs since this will be determined by the overall project impact area and magnitude categories (i.e. high, medium, low). It can be assumed however that lowering either the average or total COF values will also lower the final offset costs thus these values are beneficial in the planning stages of locating LDs. For more information regarding the definition and methodology for calculating values found in each field and the cumulative offset factor, see Avoidance Analysis section of the GIS_PPC. ***Warning: If you do not receive emails make sure the emails from dbyd.tnc.apps@gmail.com are not getting directed to your junk e-mail folder.***

Table 1. Output fields for *Land Disturbances - Locational Offset Cost and Restrictions Assessment* tool. Field names with listing of potential values and description of how each field value are calculated.

Field Name	*Values*	*Description*
buff_dist	Variable	Distance used for calculating buffer distance and equal to the assigned max impact distance associated with the LD.
LinkID	Variable text	Identifies the disturbance feature the buffer area is derived from, for example P_0 would indicated this impact area was derived from the first area disturbance where as L_0 indicates that feature was derived from the first linear disturbance.
mdt_avgCat	High – mdt_avg > 8.3 Medium – mdt_avg > 4.5 and mdt_avg <=8.3 Low – mdt_avg < =4.5	Categorical description based on the average offset score within the LD buffered feature. Derived by categorizing the calculated mdt_avg field.
mdt_avg	12 (highest) - 0.08 (lowest)	The average, cumulative offset factor values created by calculating the average of all cell values within the LD buffered feature.
mdt_TCRank	ordinal rank 1 (lease with highest total cost)	The ordinal ranking of the calculated mdt_sum field.
mdt_sum	Variable	The total, cumulative offset factor value created by calculating the sum of all cell values within the LD buffered feature.
mdt_PAs	0- No national or local special protected	Indicates LD buffer overlaps either a national

	areas within buffered LD 1- Local special protected areas found within buffered LD 2- National protected areas found within buffered LD 3-Both local and national protected area found within buffered LD	protected areas or a local special protected area .
mdt_FAs	0- No forested areas located within impact. 1-Forested areas located within impact.	Indicates LD buffer overlaps with forested areas.
mdt_HAs	0- No headwater areas located within impact. 1-Headwater areas located within impact.	Indicates LD buffer overlaps with headwater areas.
mdt_RAs	0- No riparian or wet areas located within impact. 1- Riparian or wet areas located within impact.	Indicates LD buffer overlaps with riparian or wet areas.

Offset Analysis

The *Offset Analysis* tool (Figure 6) produces all data and the report necessary to comply with the MOR. The user must first check the LDs using the *Upload and Check Land Disturbance Data* tool described above. If this has been done, a green check mark will appear after Step 1. The user must then select one of the three pre-defined project life categories associated with their development. Finally to complete the dialog, the user must input a project name and their email address. When these three items have been identified, the user can click on the Run Offset Analysis button to start the process. Messages will be displayed at the bottom of the dialog indicating the analysis is running. Once completed, a final message will indicate an email has been sent to the user with the analysis output.

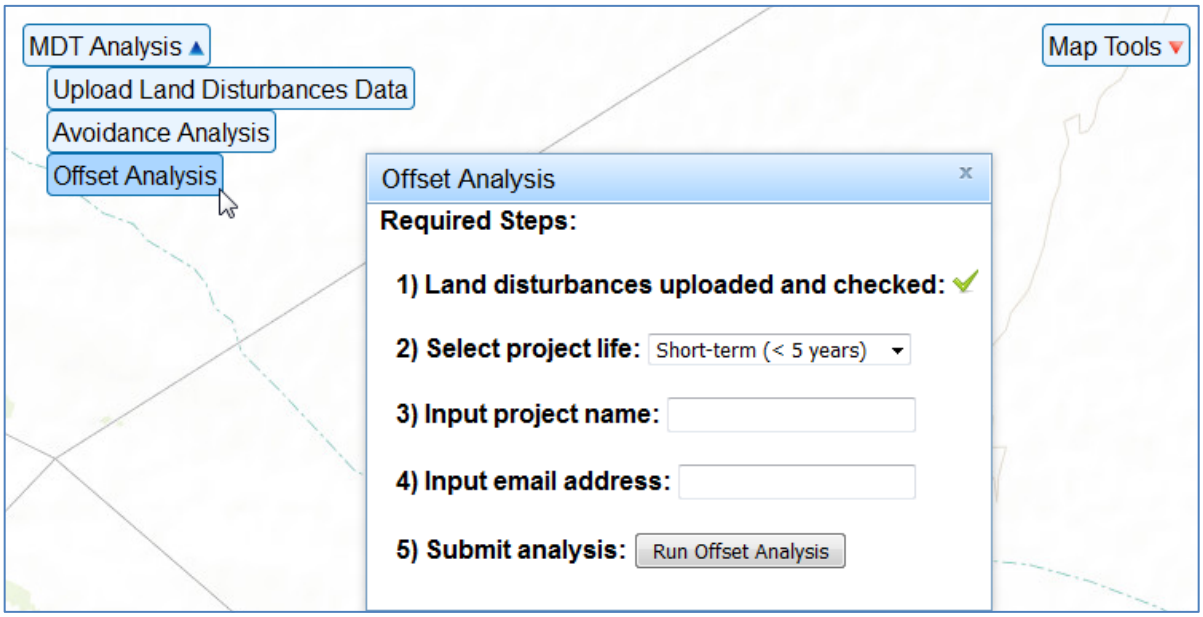

Figure 5 Offset Analysis tool.

An email sent from dbyd.tnc.apps@gmail.com with the subject line MDT Offset Results will be sent to the inputted email address with an attached zip file (i.e. mdt_offset_data.zip) containing all necessary information to comply with the MOR. Within this zip file will be a copy of the users LDs used in the analysis (i.e. ld_lines.shp & ld_area.shp), a cumulative project impact raster dataset (i.e. impact.img), the MDT offset cost report (i.e. mdt_offset_cost.html), an offset informational text file (i.e. offset_info.txt), and shapefiles identify the potential offset sites, if available for the ERA, Aimag, and Soum. Again all of these outputs are described in full detail within the GIS_PPC document and can be found within the Step 2 – Calculate Project Impact Area and Magnitude and Step3 – Calculate Offset Compensation and Potential Locations sections of that report. Below is a brief description of the output.

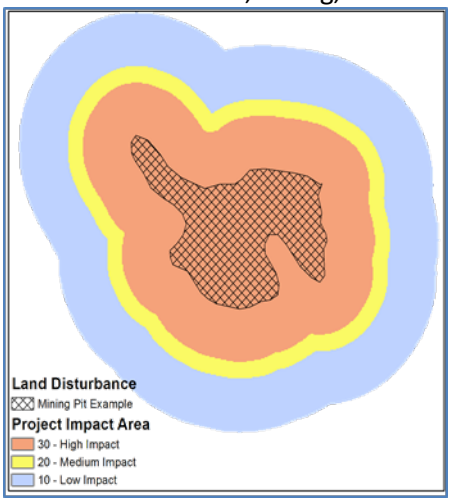

Figure 6 Project impact example

Cumulative Project Impact Raster Dataset: The cumulative project impact for all land disturbances with cell values were assigned to one of three impact magnitude zones: high-30, medium-20, and low-10 (Figure 7).

MDT Offset Cost Report: An HTML formatted report with two main headings; Offset Costs and Land Disturbance Impacts (Figures 8 – 10). The user can jump to each category by clicking on the headings under the title of report. The Offset Cost section identifies the total offset costs required by following the MOR and breaks these costs down according to offset factor (Figures 8 – 9). The *Disturbance Impacts* section (Figure 10) of the MDT Cost Report identifies the impact area dataset used for the report and the cumulative hectares for each impact category. Additionally this section identifies what percentage of the impacts occurs within each Soum and ERA and identifies the actual ecosystems impacted within each Soum.

The *Offset Costs* section of the MDT report (Figures. 8 - 9) totals the offset units required for the impacted area, lists the rate per unit for the offset, and totals the final per year offset costs. Additionally it details how the total offset units are derived by providing tables for each offset factor used in the calculation (i.e. ecosystem type, habitat category, landscape position, site condition, and project duration). Each offset factor table identifies the impact category on the left and the offset factor category at the top. In parenthesis is the associated ratio required for each impact and factor category. For each possible combination of impact and offset factor category (e.g. High/Unique, High/Rare, High/Common), the amount of actual hectares is calculated and placed in the column *Actual (ha)*. An offset unit value is then calculated based on the ratios associated for each combination and the actual hectares. This offset unit value is then placed in the column *Offset Units*. For example using Figure 8, the combination category of High/Unique under the Ecosystem Category table has identified 562.07 hectares. To obtain the offset units required for this combination, 539.36 hectares would be multiplied by 1 since that is the *High* category for the Impact Area and then by 3 since this is the *Unique* category for the Ecosystem Category thus equaling 1,618 offset units (i.e. 1*3*539.36 = 1618.08, rounded to 1,618 offset units). The offset units for all nine possible combinations are summed together and totaled at the bottom of each factor table. Since the user pre-selects one of the three possible project duration factors, the Project Duration table (bottom of Figure 9) has only three possible combinations for which

the offsets units are summed. The total offset units are then calculated by summing the totals for each of the five offset factors. This total offset unit value is multiplied by the offset unit cost (i.e. $5/offset unit) to derive the final yearly offset cost total. For more information on the procedures behind calculating the offset cost report see the Offset Compensation section of the GIS_PPC.

MDT Offset Report for Oakleaf Mine

Quick Page Links: Offset Costs Land Disturbance Impacts

Offset Costs

Total offset units required based on ratios = 16,805
Offset cost rate = $5/unit
Total offset costs per year for land disturbances = $84,025

Cost Details

Ecosytem Category

	Ecosytem Category					
	Unique (3)		Rare (1.5)		Common (0.2)	
Impact Category	Actual (ha)	Offset Units	Actual (ha)	Offset Units	Actual (ha)	Offset Units
High (1)	539.36	1,618	644.24	966	517.55	104
Medium (0.66)	9.36	19	50.58	50	47.18	6
Low (0.33)	100.56	100	594.29	294	587.08	39
Total offset units = 3,196						

Habitat Type

	Habitat Type					
	Critical (3)		Natural (1.5)		Modified (0.2)	
Impact Category	Actual (ha)	Offset Units	Actual (ha)	Offset Units	Actual (ha)	Offset Units
High (1)	0	0	1,701.15	2,552	0	0
Medium (0.66)	0	0	107.12	106	0	0
Low (0.33)	0	0	1,281.93	635	0	0
Total offset units = 3,293						

Figure 8 MDT Offset Cost Report Example – Offset Cost section

MDT Offset Report for Oakleaf Mine

Quick Page Links: Offset Costs Land Disturbance Impacts

Landscape Condition

	Landscape Condition					
	Good (3)		Moderate (1.5)		Poor (0.2)	
Impact Category	Actual (ha)	Offset Units	Actual (ha)	Offset Units	Actual (ha)	Offset Units
High (1)	1,701.15	5,103	0	0	0	0
Medium (0.66)	107.12	212	0	0	0	0
Low (0.33)	1,281.93	1,269	0	0	0	0
Total offset units = 6,584						

Landscape Priority

	Landscape Priority					
	High (3)		Medium (1.5)		Low (0.2)	
Impact Category	Actual (ha)	Offset Units	Actual (ha)	Offset Units	Actual (ha)	Offset Units
High (1)	0	0	0	0	1,701.15	340
Medium (0.66)	0	0	0	0	107.12	14
Low (0.33)	0	0	0	0	1,281.93	85
Total offset units = 439						

Project Duration

	Project Duration	
	Medium (1.5)	
Impact Category	Actual (ha)	Offset Units
High (1)	1,701.15	2,552
Medium (0.66)	107.12	106
Low (0.33)	1,281.93	635
Total offset units = 3,293		

Figure 9 MDT Offset Cost Report Example – Offset Cost section (continued)

MDT Offset Report for Oakleaf Mine

Quick Page Links: Offset Costs Land Disturbance Impacts

Land Disturbance Impacts

Data associated with impacted area: *XSoumsFencedDisturb*
File location: *D:\Data\Applications\JRO_Tools\MDT\app_old_versions\Old_Data\final_tests\impacts_output.gdb\XSoumsFencedDisturb*

- 100% of impacts within the Gobi ERA
- 33.65% of impacts found within Ulaanbadrax Soum in Dornogovi Aimag.
- 66.35% of impacts found within Xo'vsgol Soum in Dornogovi Aimag.

Impact Area

Impact Category	Hectares
High	1,701.15
Medium	107.12
Low	1,281.93
Total impacted: 3,090.2 ha	

Gobi Ecosystems (ES) Impacted within Ulaanbadrax Soum

ES Code	ES Category	Hectares Impacted
51	wet depressions, small basins 100-1,000 km2	192.45
92	riparian dense vegetation	102.1
95	sand massives	745.36

Gobi Ecosystems (ES) Impacted within Xo'vsgol Soum

ES Code	ES Category	Hectares Impacted
40	desert steppe	817.4
50	dry steppe	327.31
51	wet depressions, small basins 100-1,000 km2	344.29
92	riparian dense vegetation	12.2
95	sand massives	549.09

Figure 10 MDT Offset Cost Report Example – Land Disturbance Impacts section

Offset Informational Text File: Text file listing out information about selected offsets (i.e. offset_info.tx). It identifies the number of offset sites selected and the file name used to represent these data (e.g. OffSites_In_East_ERA.shp). In cases where no offsets were available for a particular level (i.e. ERA, Aimag, Soum), this text file will identify these omissions.

Potential Offset Sites: The application uses the project impact area raster to identify potential offset sites at three levels; ERA, Aimag, and Soum. These potential offset sites are a subset of all national or proposed nationally protected areas (i.e. ERA portfolio sites). The application will first identify those offset sites within the ERA being impacted which contain the same ecosystems types being impacted by the development and have at least the same or greater hectares of these impacted ecosystems. The application does the same process at both the Aimag and Soum level. For these processes, however the impacted ecosystems are first calculated only for those impacts which occur within the Aimag or Soum. Then the application uses only those portions of the ERA offset sites which fall within either the Aimag or Soum to compare with the impacted ecosystems occurring within the Aimag or Soum. These shapefiles follow the naming convention of *OffSites_In_<ERA Name>_ERA*, *OffSites_In_<Aimag Name>_Aimag_in<ERA Name>,* and *OffSites_In_<Soum Name>_Soum_in<ERA Name>.* If there are no matching offset sites found within any of these levels, this will be recorded within the offset_into.txt file discussed previously.

Each potential offset dataset will have protection status of the offset site in the Category field with values indicating whether the offset site is a national protected area (i.e. National Protected Area) or a proposed protected area (i.e. Proposed NPA) and a Type filed indicating the type of protected area (e.g. National Conservation Park, Strictly Protected Area) or proposed area (e.g. Expert site, portfolio). Additionally each dataset will have the name of the offset site (i.e. Name field) and the shortest straight-line distance from portfolio site boundary to impacted area boundary area (i.e. dist_away field). Finally for the Aimag and Soum potential offset sites, the NAME field will identify the name of the Aimag or Soum. This tool is mainly to support those decision makers who will be identifying where to direct funds which are collected by the MOR and is therefore not required by companies following the MOR. For more information on the procedures behind calculating the potential offset sites see the Potential Offset Locations section of the GIS_PPC.

Map Tools

The map tools (Figure 11) can be displayed or hidden by clicking on the red arrow to the right of the *Map Tools* text. To select a tool the user clicks on that tool image. Some of the tools will automatically change the display when the tool is clicked while others require the user to interact with the map display. Full Extent sets the map to display back to the map extent shown when the viewer was opened. Zoom In allows the user to zoom the map display into a specific area by clicking on the tool and then maneuvering the mouse pointer to the area they would like to zoom into. This is accomplished by holding the left mouse button down and dragging the mouse across the map until they have drawn a rectangle encompassing their area of interest and then releasing the button. Zoom Out interacts similarly but zooms the map display out based on the ratio of the box to the current display so the smaller the box the greater factor the map will be zoomed out. Pan allows the user to move the display of the map without changing the scale of the map. The user must hold down the left mouse button and drag the pointer to move the map and release the button to end the panning. Next and Previous tools allow the user to scroll back and forth thru all the displays viewed in a web session.

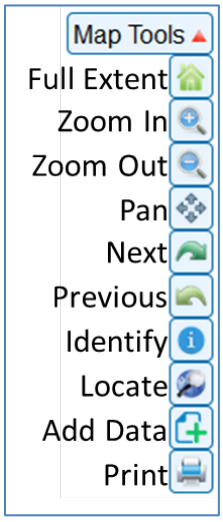

Figure 11 Map tools

The Identify tool allows the user to display information associated with a map which is visible (i.e. checked within the Map Resources panel, see Map Resources section of this document) on the map. In order to use the tool it must first be selected and then the user needs to click on a feature displayed by in the map. A window will be displayed listing all the information found for that location associated with any of the visible features (Figure 12). If multiple layers are visible and the user clicks on a location with features from these layers, the window will display an arrow with the layer name. The user can click on the arrow to see all attribute information for the feature clicked on. To close the window, click the X upper right-hand corner of the box.

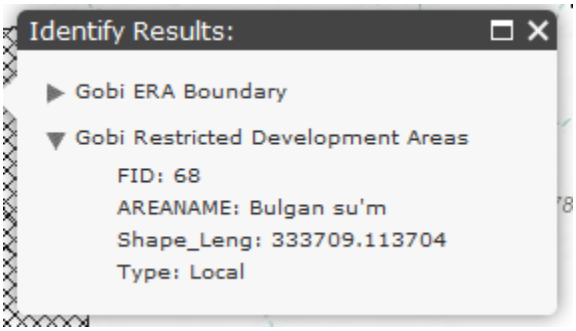

Figure 12 Identify window

The Locate tool gives user the ability to zoom to a location using geographic (i.e. Latitude and Longitude) or UTM (i.e. Northing and Easting). The user must input either of these coordinate pairs into the Loacate dialog (Figure 13) and click on the Zoom To button. A red "**X**" will indicate the location with the map display zooming in and centering on this position. For inputting UTM coordinates, the user must first select a UTM zone. Each new position inputted by the user will clear the previous one. To clear the last located position, the user can click on the Clear button which will remove the red "X" and clear the location input boxes.

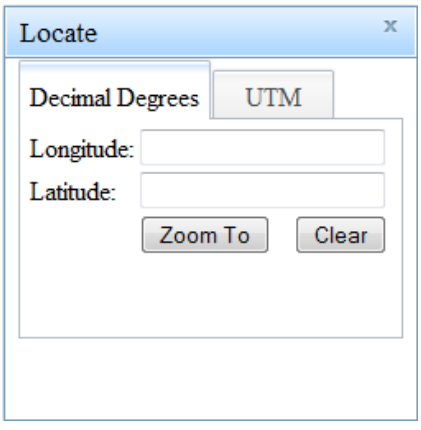

Figure 13 Locate dialog

The Add Data tool gives users the ability to display their own information within the map display. The user must first click on the Browse… button in the Add Zipped Shapefile dialog (Figure 14) and then select a local zipped file containing an ESRI shapefile. At minimum, this zip file must contain the

following files: .shp, .shx, .dbf and .prj). One the user selects the zip file the application will extract the spatial data from the zip file and display it on the map. Additionally the map display will zoom to the extent of these data. Uploaded data is not saved anywhere and is only displayed during the user web session. All features within the shapefile are displayed as a graphic and will have associated attributes of the shapefile available when clicking on the feature. The user can clear the most recently added dataset by hitting the Clear Shapefile button.

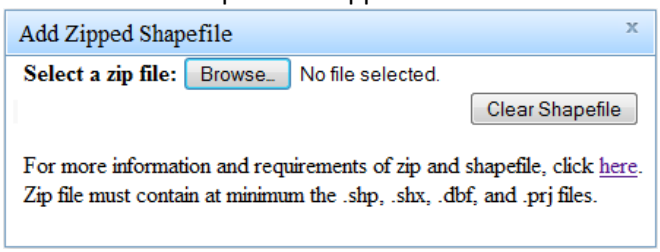

Figure 14 Add data dialog

The Print tool provides users with the ability to create a map which can be saved or printed by the user. By clicking on this tool, the Map Properties dialog (Figure 15) is displayed. Through this dialog, the user can set both the title and author of the map by inputting the appropriate text. A legend for the map will automatically be created if the box is checked. The user can select a variety of page sizes (i.e. letter, tabloid, A3, A4) and orientation (i.e. portrait or landscape). Finally the map produced can be created in a PDF, PNG, or JPG file format. Once the user has set all the parameters, they can click on the Create Map button which will start the process of creating the defined map. Once the process has been completed a hyperlink displaying Click Here for Map will be produced which allows for the user to access the map. The user must close the dialog by clicking on the X in the upper right portion of the dialog to return to the interactive mapping application. **Note:** Due to limits with regards to map spacing, layers with long legends or lengthy item descriptions may not be produced even when legend property is checked.

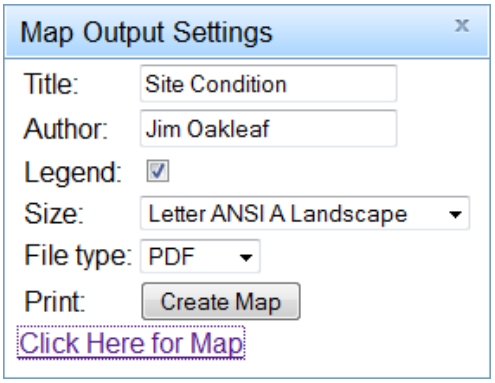

Figure 15 Map properties dialog

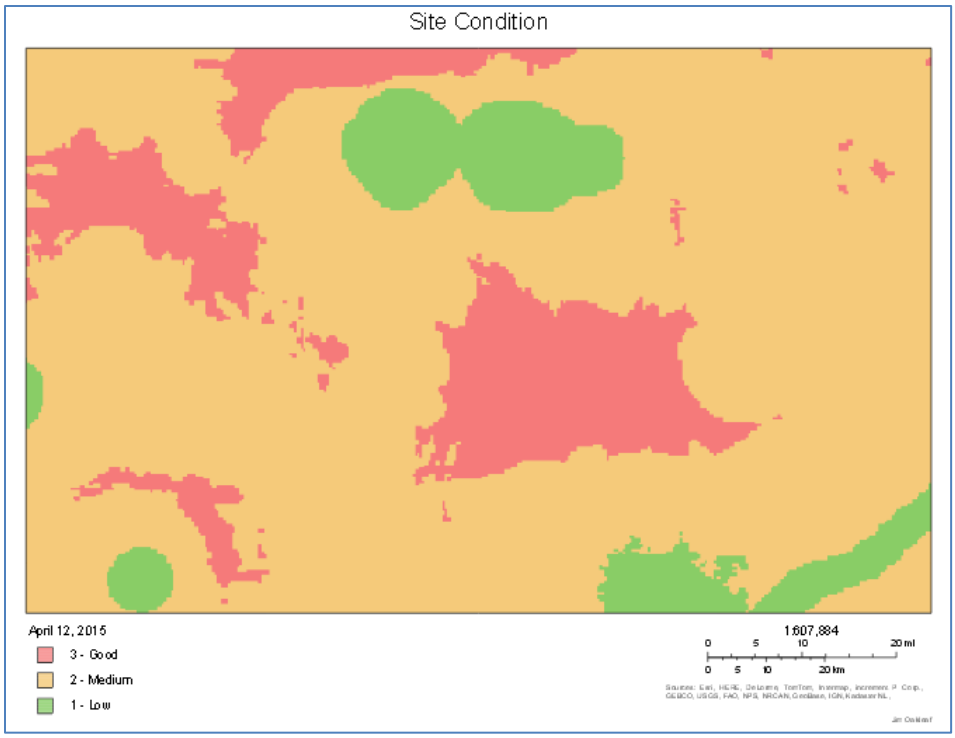

Figure 16 Example of map output

Map Resources Panel

The Map Resources Panel (Figure 17) gives users the ability to modify and display maps within the viewer. There are four major grouping of maps; *Offset Factor Maps, Input Data Maps,* and *Background Maps*. Additionally there is an *Additional Map Resources* group allowing the user to view reference maps, change the transparency of the displayed maps, and view the legend of the currently displayed maps. All groupings can be expanded or contracted by clicking on the heading name. To turn on a map within any group (except *Background Maps)*, the user clicks the check box in front of the layer name. To change the background map, the user clicks on one of the thumbnail images listed under this heading. To obtain more information on any of the maps, the user can click on the ⓘ icon to the right of the map name. This will open a dialog containing brief information regarding the map.

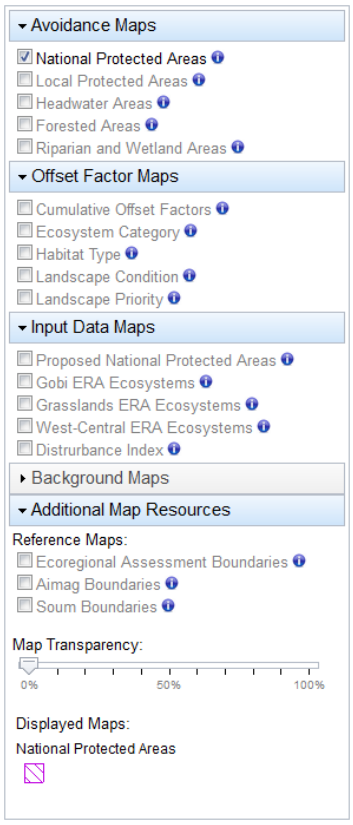

Figure 17 Maps resource panel

Technical Description of Application

The web application was developed using HTML, CSS and JavaScript with mapping functionality built using the ArcGIS API for JavaScript. Maps being displayed and all analysis routines are built using ESRI ArcGIS Server technology. This application has been developed and tested for use in the most recent versions of Firefox and Internet Explorer. It has also been tested successfully to run in Google Chrome and should run in other compatible Internet browsers.