

Geospatial Guidance Note I

Introduction to Geographic Information Systems and using MapX in the environmental sensitivity module

Who is this Guidance Document useful for?

In humanitarian work the real power of maps is as a means of communicating and sharing the complex information that is a crucial resource in emergency response. These geospatial guidance notes are useful for humanitarian workers who would like to understand the importance of geospatial data in humanitarian operations, and to use geospatial data during the NEAT+ environmental sensitivity assessment process. The guidance focuses on tried and tested technologies, readily deployable by any organization assuming access to a computer.

Geospatial data can be used to integrate environmental considerations into humanitarian response and represents a broad data source for the NEAT+. **Geographic (or Geospatial) Information Systems (GIS)**, can be used to obtain information to aid the user in completing the NEAT+, such as:

- Remote sensing imagery to get an idea of land cover and land use types
- Environmental aspects of humanitarian action, such as forest cover, location of watercourses and types of terrain
- Understanding the availability and scarcity of natural resources, including mining and extraction activities
- Providing information for the construction of new settlements at a distance from potential environmental threats
- Knowing where protected areas and ecologically critical areas (as well as habitat and species) are located to minimize impact on these areas.

This note is intended for beginners who have not yet worked with MapX. MapX is an open source web mapping platform that can help NEAT+ users answer questions for the process of assessing the environmental sensitivity of a specific site. It is particularly useful for answering questions about the natural environment of the area of interest. The second guidance note focuses on collecting spatial data using Google Earth Pro.

Introduction to Geographic Information Systems and using MapX in the environmental sensitivity module	1
Who is this Guidance Document useful for?	1
Introduction: What is GIS?	3
How to Use MapX to Answer Questions in the NEAT+	4
Access dedicated MapX project space	4
Create user account/log-in to MapX	5
Optional: add the boundaries of your area of interest to the map	5
a) Click and drag a GeoJSON file into MapX	5
b) Draw your area of interest	7
MapX Key Functions	8
a) Exploring the data: activating views	8
b) Adjusting the view and menus	9
c) Filtering and searching for data	10
d) Re-ordering the views	10
e) Sharing a view	11
f) What do the colors of the buttons for the data mean?	12
g) Consulting and interacting with the attributes of the spatial data	14
Examples: NEAT+ Environmental Sensitivity Questions which can be answered in MapX	16
How to Create Maps using MapX	20
Annex A: NEAT+ Environmental Sensitivity Questions and Useful Datasets	23
Annex B: Additional learning resources	29

Introduction: What is GIS?

GIS stands for **Geographic (or Geospatial) Information System**, a computer-based tool for gathering, managing and analyzing data with a spatial component. GIS assists in analyzing location to provide insight into spatial patterns, relationships and situations. GIS merges computer database technology with geo-referenced and cartographic information, resulting in digital maps and databases with fundamental applications in areas such as natural resource management, ecosystem conservation, environmental studies, utility management, infrastructures and transportation planning, town and regional planning, municipal government and commercial applications. GIS and geospatial data are an incredibly powerful resource for disaster response and preparedness and are often underutilized by humanitarian practitioners.

High-quality spatial data is often open and widely available, and can be sourced from reputable organizations such as the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), which maintains the [Humanitarian Data Exchange](#) (HDX) platform. Users can download or create geospatial data and use GIS software to gain actionable insights through visualizations, analyses and planning purposes. GIS software can also give users the option to view and interact with spatial data on online mapping platforms, interactive story maps and dashboards. The combination of remote sensing, which is the science of measuring the earth using sensors such as satellites, and GIS technology offers unparalleled opportunities to map and monitor the environment in near-real time.

In humanitarian settings, geospatial data can be used in a number of different ways:

- For preparedness activities to help identify and understand potential risks that are driven by geography,
- To forecast by modeling specific scenarios to determine risk and vulnerability based on various pathways
- To perform rapid assessments of the extent of damage from disasters
- To assess damage by comparing before and after satellite imagery and data
- To enable situational awareness and support aid operations in response efforts and decision making
- Displaying layers of socioeconomic data at a district or regional level to better understand the social climate of the area of interest

To learn more about GIS in humanitarian response, please visit: <https://ehaconnect.org/themes/geographic-information-system-gis/>

For an extensive list of GIS and data platforms, [click here](#).

How to Use MapX to Answer Questions in the NEAT+

MapX contains a dedicated spatial data project space to help users find answers for the environmental sensitivity assessment at the site they are assessing using the NEAT+. In addition, contextual data which may be useful to the planning process is included in this project. While **MapX is not necessary to answer the NEAT+ or to replace the data collection process**, it can be used as an additional tool to fill in missing environmental data into the analysis, or help users to create a map to go alongside their assessment report, or understand the environmental context of their site. [Annex A](#) of this document contains the questions in the environmental sensitivity analysis and datasets which may help the user to answer questions about the NEAT+.

If you would like to use MapX as an additional tool to answer geospatial questions about your area of interest for the NEAT+, follow the steps below. These steps are a quick start tailored for NEAT+ users and do not provide a comprehensive guide to the complete utilities of MapX. For more guidance documents about using MapX, including how to interact with different types of data, story maps, and the project workspace, please [click here](#).

Access dedicated MapX project space

MapX is organized based on thematic spatial data projects, which are tailored spaces purpose-fit for applications. The “NEAT+ Global” project can be [accessed here](#). MapX is optimized for Google Chrome and Internet Explorer. Once you click on the link, you should be directed to the “NEAT+ Global” project resembling the screenshot below. You can change the language (English, French, and Spanish are fully available) and explore different datasets by opening the categories and clicking on the buttons beside the dataset name.



*In the MapX web application, the project name is displayed in the top left corner of the view panel (**green box**), which can be clicked to navigate through other projects. MapX is available in English, French and Spanish (**red box**). The categories of views can be collapsed or expanded (**blue box**) according to the user's needs.*

Create user account/log-in to MapX

By setting up a MapX account, you get better access to data and analysis features, such as downloading data. In order to see all the data available in the “NEAT+ Global” project, it is necessary to create a user account. **However, you do not need to request membership for the NEAT+ Global project.** Registering for MapX is simple:

1. Click on the log-in button located in the top toolbar.
2. Enter your email address. A one-time use password will be sent to you by email. The MapX platform does not rely on user passwords that are vulnerable to hacking. Instead, unique passwords will be generated and sent to your email each time you login. If you are using the same computer, the login may be automatic, depending on your settings, without having to request a new password each time.
3. Keep the MapX window open while you check your email in another browser. Copy and paste the one-time use code into the MapX window. The password is valid for 20 minutes.



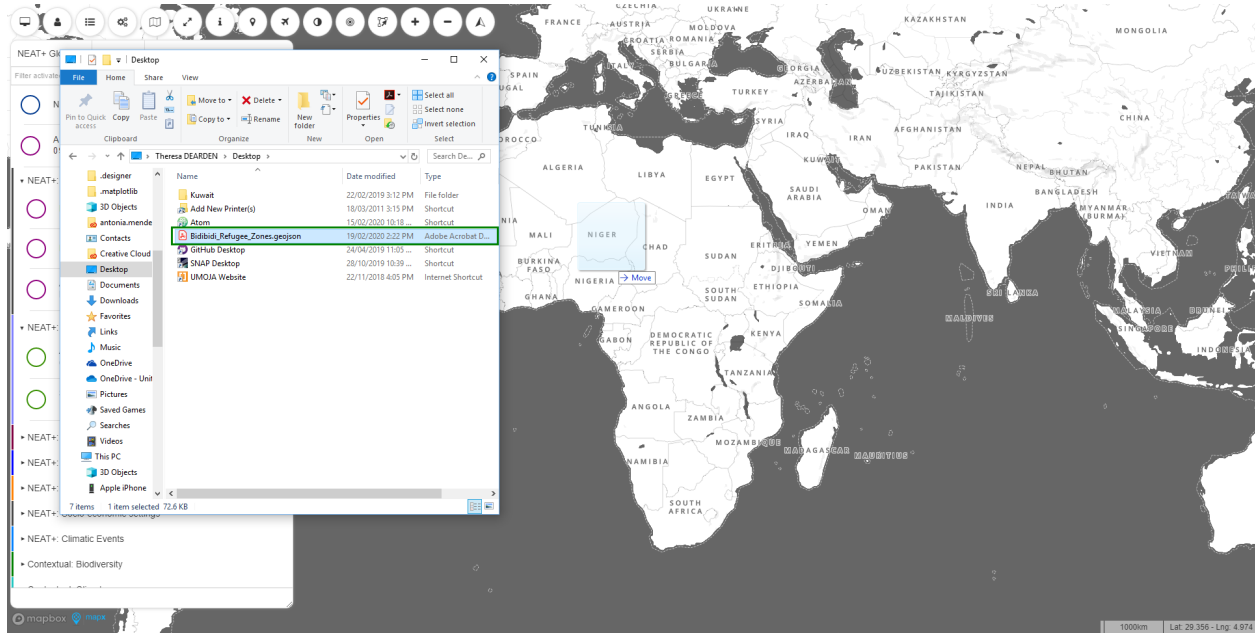
*After clicking on the log-in button (**yellow box**), a dialogue will appear where you can enter your email. A one-time use password will be emailed to you for entry in this dialogue. You can click the log-in button at any time to confirm you are logged in and to see your user status in the current project.*

Optional: add the boundaries of your area of interest to the map

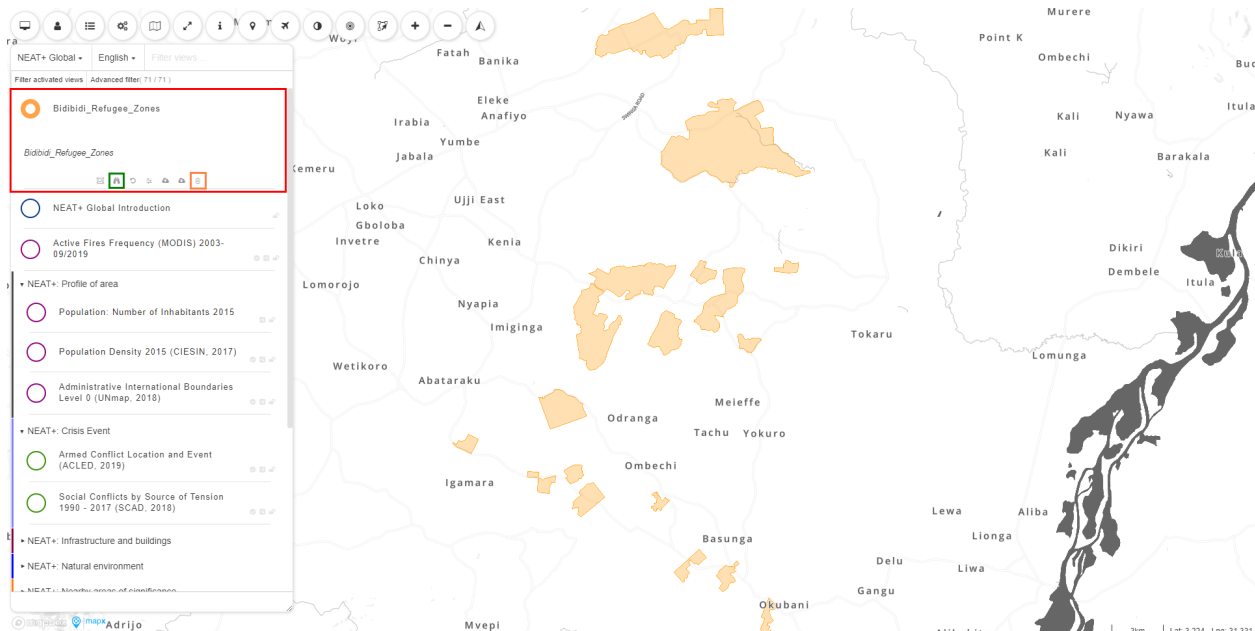
If you can easily recognize your area of interest by zooming into the region, you may not need to add any more spatial information to MapX. However, if you would like to specify your area of interest for the purpose of making maps or to compare the environmental data more precisely, you have two options available. Both options involve creating a temporary file which will be stored on your browser and cannot be viewed by other users.

a) Click and drag a GeoJSON file into MapX

If you already have the boundaries of your area of interest in a [.geojson format](#), a widely used geospatial JSON based format, you can simply click and drag it into the browser to temporarily visualize it in MapX. To convert a vector file ([such as .shp, .kml or .gpx](#)) or spreadsheet with coordinates to a .geojson, you can use an offline GIS software or a free online conversion tool such as [mapshaper](#). Note that the coordinate system must be in WGS84. The file will upload to your browser and will have an orange button next to it, denoting it as a temporary file. **Please delete the temporary file when you are finished.**



Clicking and dragging the .geojson file into the MapX web application.



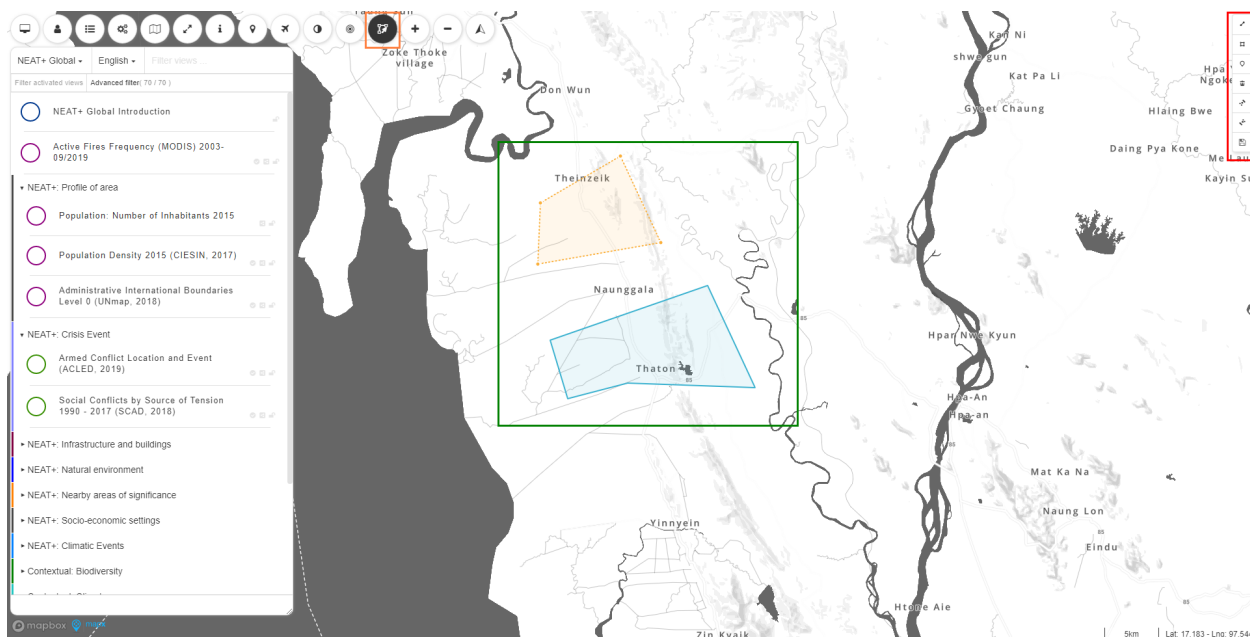
The temporary file has been uploaded, denoted by the title of the file and orange button (**red box**). Use the “Zoom on displayed features” button (**green box**) to zoom into the temporary file. After you have finished your operation, delete the file by clicking the trash can button (**orange box**).

b) Draw your area of interest

MapX has a “draw” tool that allows all users to create new point, line and polygon features. While this is not as precise as uploading the exact boundaries of your area of interest, it can be useful for exploring contextual data, collecting data and making maps.

To create new point, line polygon features using the “vector draw” toolbar, follow these steps:







1. Click on the “Vector draw tools” button in the top toolbar to activate the editing box which will appear on the right-hand side of the screen.
2. Select the type of feature you would like to create. The functions of each button are described in Table 1 below. A polygon should be selected for the purpose of drawing boundaries. Begin by drawing your feature on the map.
3. Finish each feature by double-clicking.



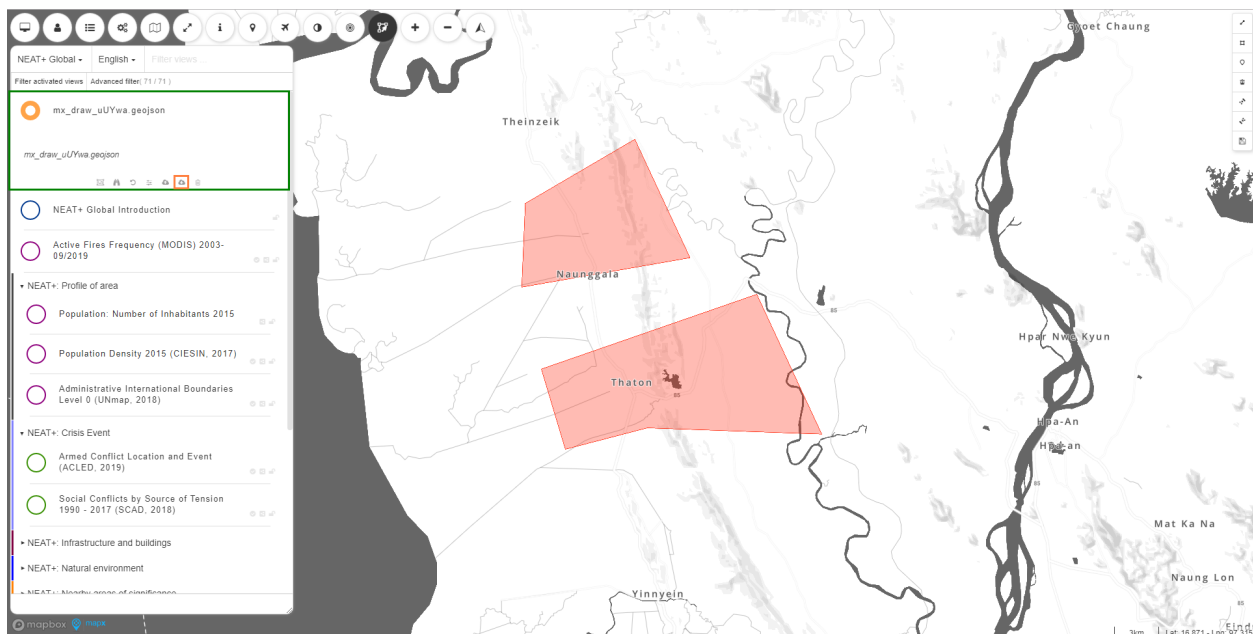
The “draw new geometries” button (**orange box**) will activate the editing options on the right hand side of the screen (**red box**). Select the type of feature you wish to draw and begin by clicking on the map (**green box**), editing where necessary. You can draw multiple features of the same type in one file.

Table 1. Draw new features toolbar

Button	Purpose
	Draw line feature

	Draw polygon feature
	Draw point feature
	Delete
	Combine
	Uncombine
	Save

Once you click on the “save” button in the “draw new features” toolbar, the new dataset will be stored as a temporary view in the views panel, i.e. it is available only in your browser. It can be downloaded in GeoJSON format for future use in an offline GIS software, and should be deleted after you have finished your operation.



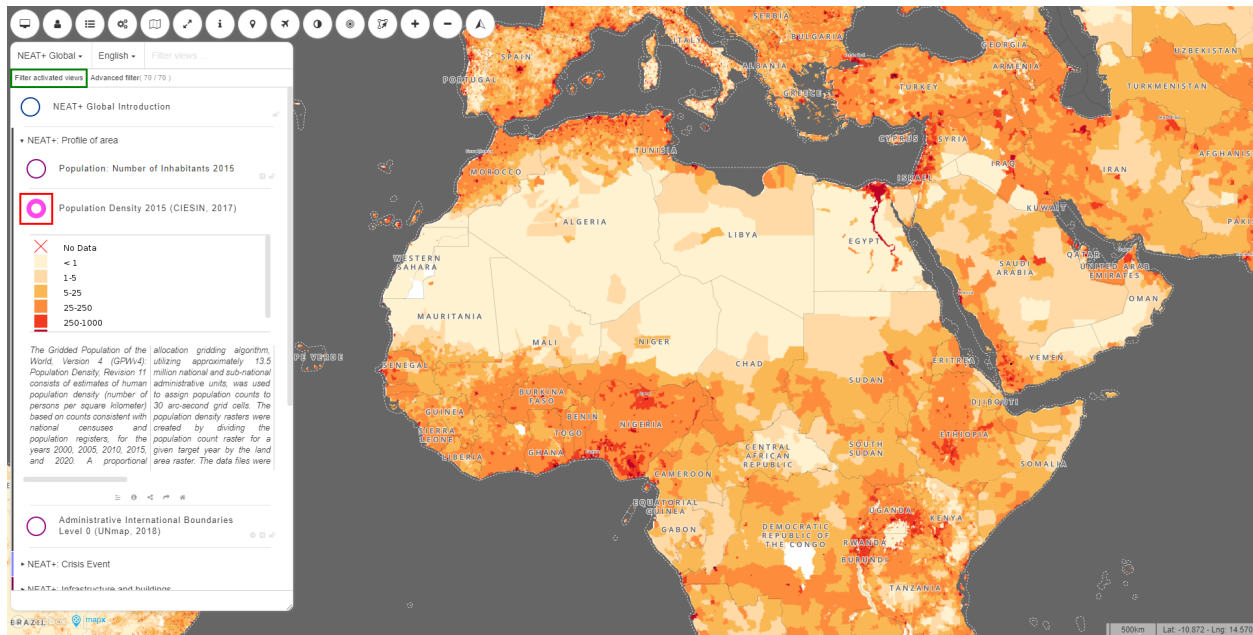
The drawn feature will be saved as a temporary file (**green box**) on your browser. To download the feature as a .geojson file, click on the “download” button (**red box**).

MapX Key Functions

a) Exploring the data: activating views

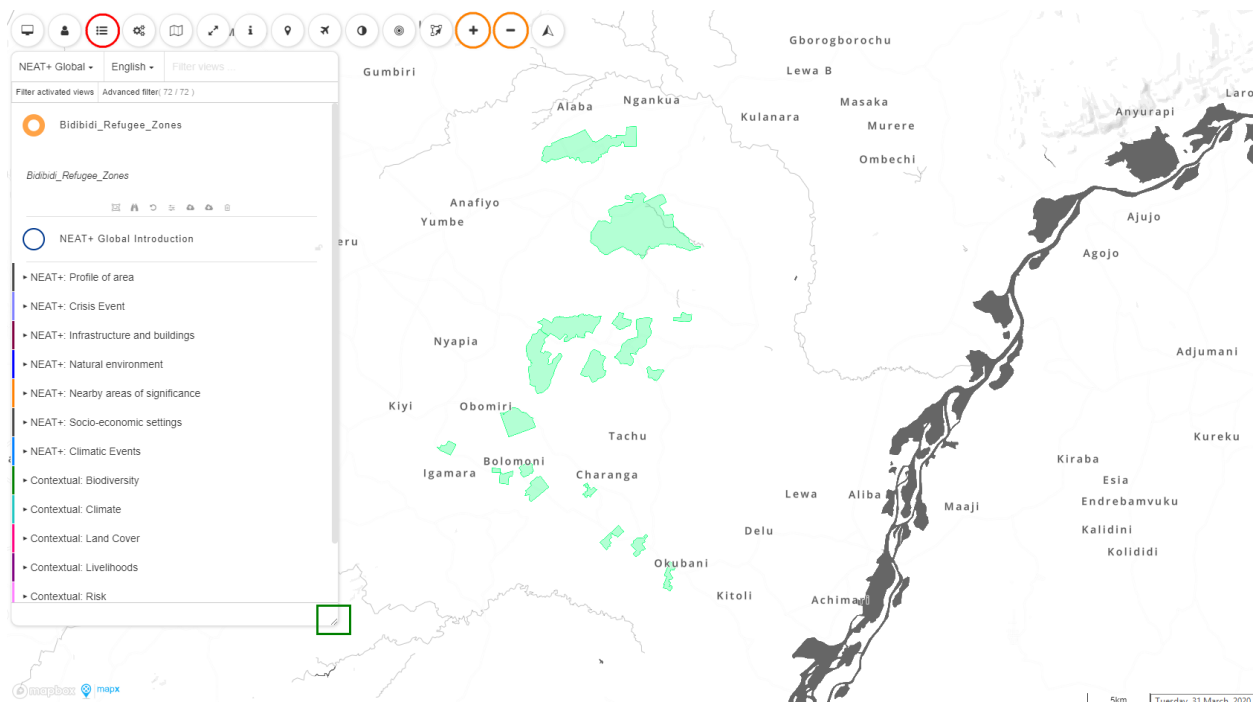
When you access the “NEAT+ Global” project, you will see all relevant data listed in the panel on the left. Each title is what we call a “view”, created from a source spatial data layer and visualizes one spatial attribute of a dataset. The data can be visualized by clicking on the circle

button next to the view (red box). Selecting the “Filter Activated Views” button will remove all the views from the panel except for the ones you have selected (green box).

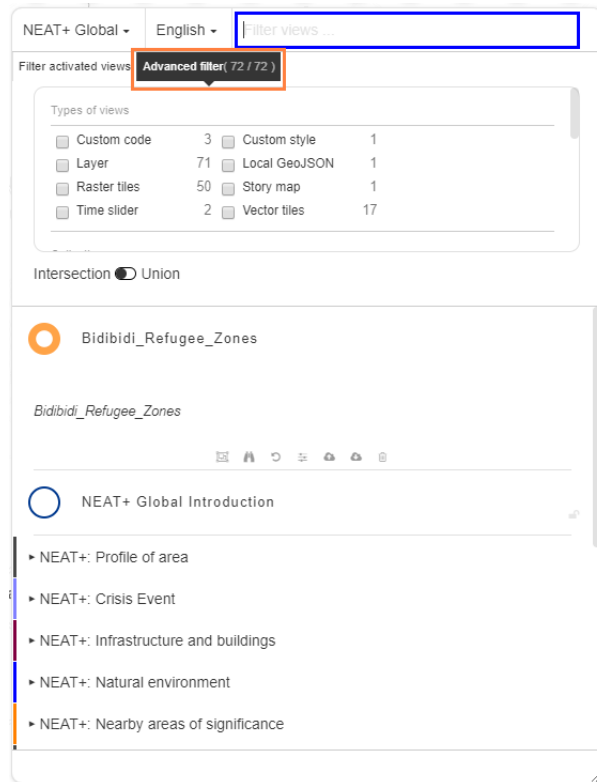


b) Adjusting the view and menus

Explore the map by clicking and dragging with your mouse, or using your keyboard arrow keys. Zoom in and out on the map using the mouse scroll, or the +/- buttons on the frame (orange circles). Increase or reduce the size of the list of views within the panel by dragging the arrow in the bottom right corner of the legend (green box). Experiment with collapsing and expanding the left sidebar so that the map is full screen (red circle).



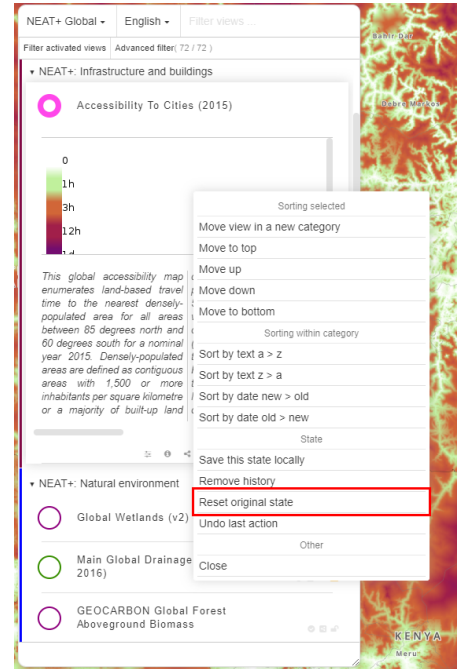
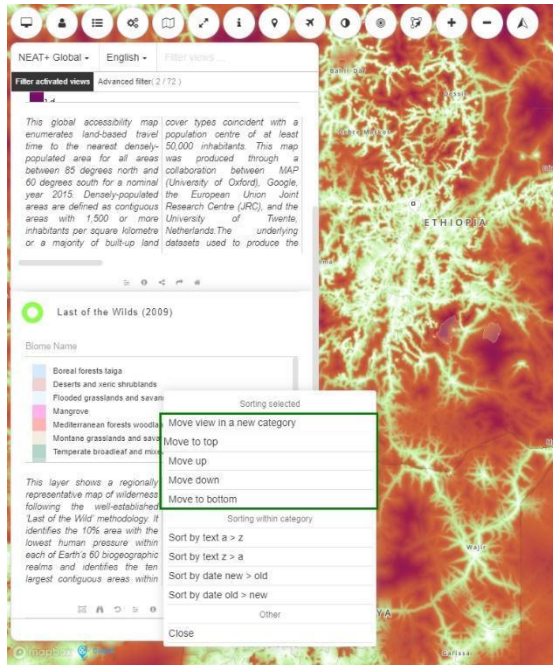
c) Filtering and searching for data



Users can filter available data by entering keywords (blue box) in the view panel, or by selecting the “Advanced filter” option (red box) which allows the user to filter by two categories: types of views (raster tile, story map, vector tiles, etc) or collections (group of views that are related to a common subtopic, such as NEAT+). Multiple selections can be managed in two different ways depending on the user’s choice at the bottom of the module: “Intersection” (by default) or “Union”. The first option displays views that satisfy all selected parameters, while the second results in a larger list of views that satisfy one or more selected parameters.

d) Re-ordering the views

If your views are not in the correct order, i.e. if you would like to modify the order in which the data appears on the map, you can change the order of the views by *clicking and dragging* the view you would like to be layered at the top to the top of the list, or by using the dialogue that appears when you right click on the view and click “Move to top” (green box).

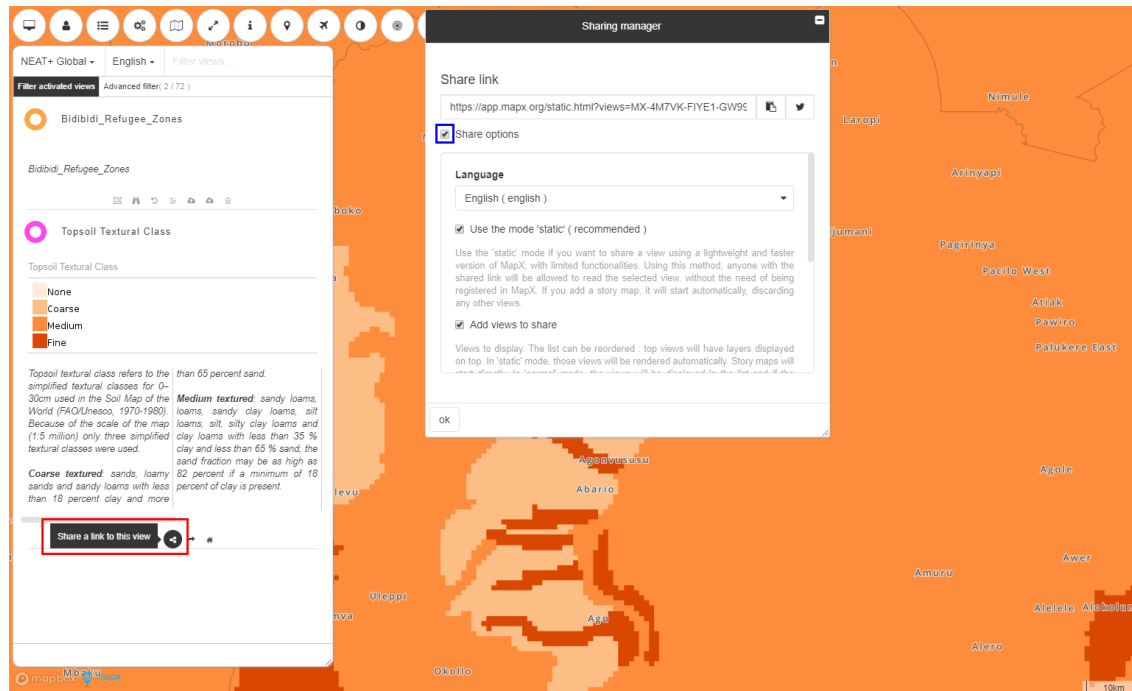


To reset the order of the views to their original state, right click within the view panel and click "Reset original state" (red box). Note that this will only work if you do not have "Filter activated views" turned on. You can also refresh the browser to reset the views.

e) Sharing a view

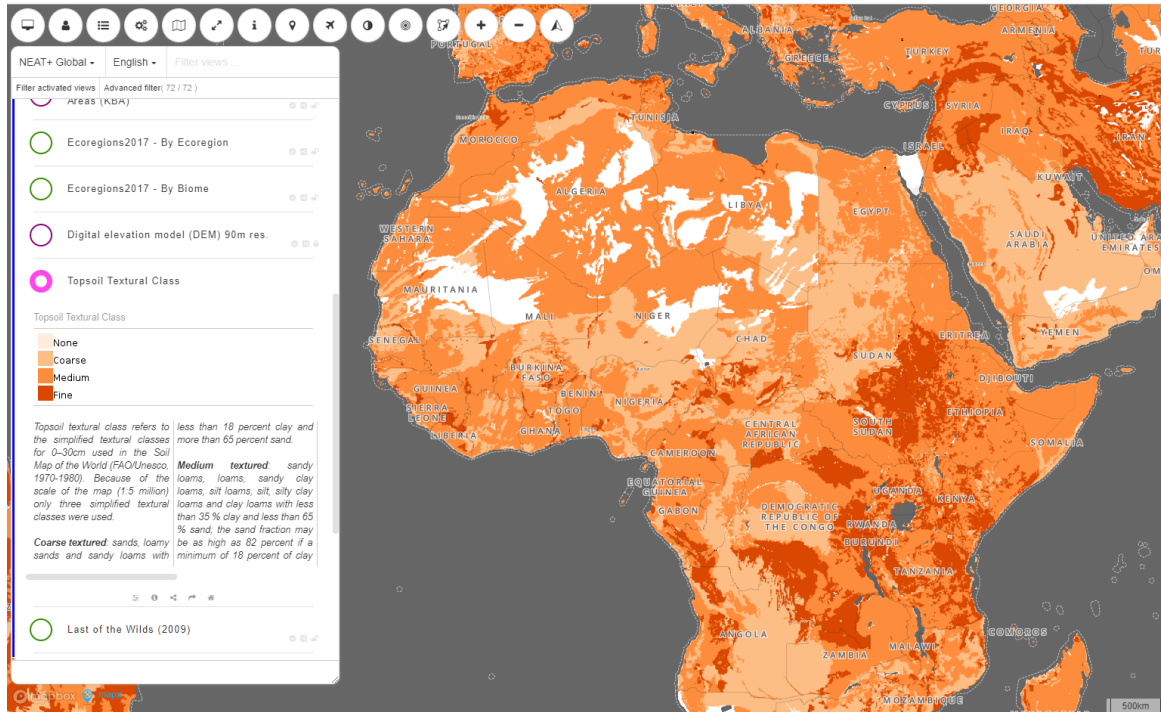
By clicking the "Share a link to this view" (red box) button, located in the view toolbar, you will receive a customized link to share that view, or you can tweet it directly. If you click the "Share options" (blue box) button, more customization options will appear:

- By enabling the "static" mode, the view will be auto played, i.e. even if it is set to "private", the viewer will be able to see it with limited interaction. . If the static mode for story maps is enabled, a story map will also be auto played (the user does not need to click the play button and the presentation starts on the first slide).
- You can select several views to share with one link. If you leave the "Add views to share" link blank, the entire project will be shared.
- You can set which view will be activated when the user clicks the link. If this is empty, no views will be activated but will be available in the view panel.
- Setting the collection will share all views associated with that collection within the project.
- You can set the map position in a specific area you would like to highlight.
- You can also receive the link as an html code for an iframe (for a website or a blog). An iframe essentially inserts a frame into your online platform that contains the view, so it can be viewed without leaving your website.

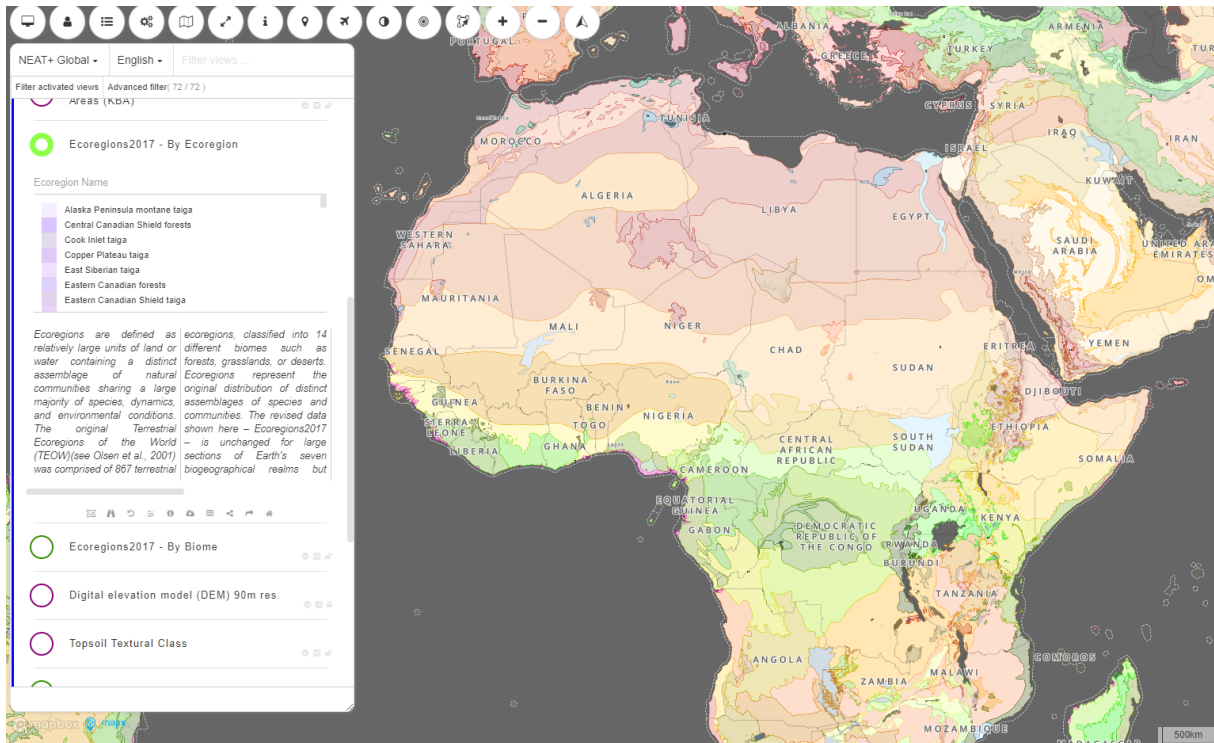


f) What do the colors of the buttons for the data mean?

The color of the button indicates the type of data that created the view: purple for raster data and green for vector data. Vector and raster data are two fundamentally different ways of representing spatial data. Raster data is generally understood to be data that represents things that exist on a range of values across space, such as a map of temperature, land cover, population density, or the percentage of canopy closure in a forest. In the below example, the [“Topsoil Textural Class”](#) dataset is a raster view in which each pixel has a continuous value. The attribute of raster data is a value within a pixel (or grid cell) and can represent categorical values (such as a land cover classification) or continuous values such as elevation.



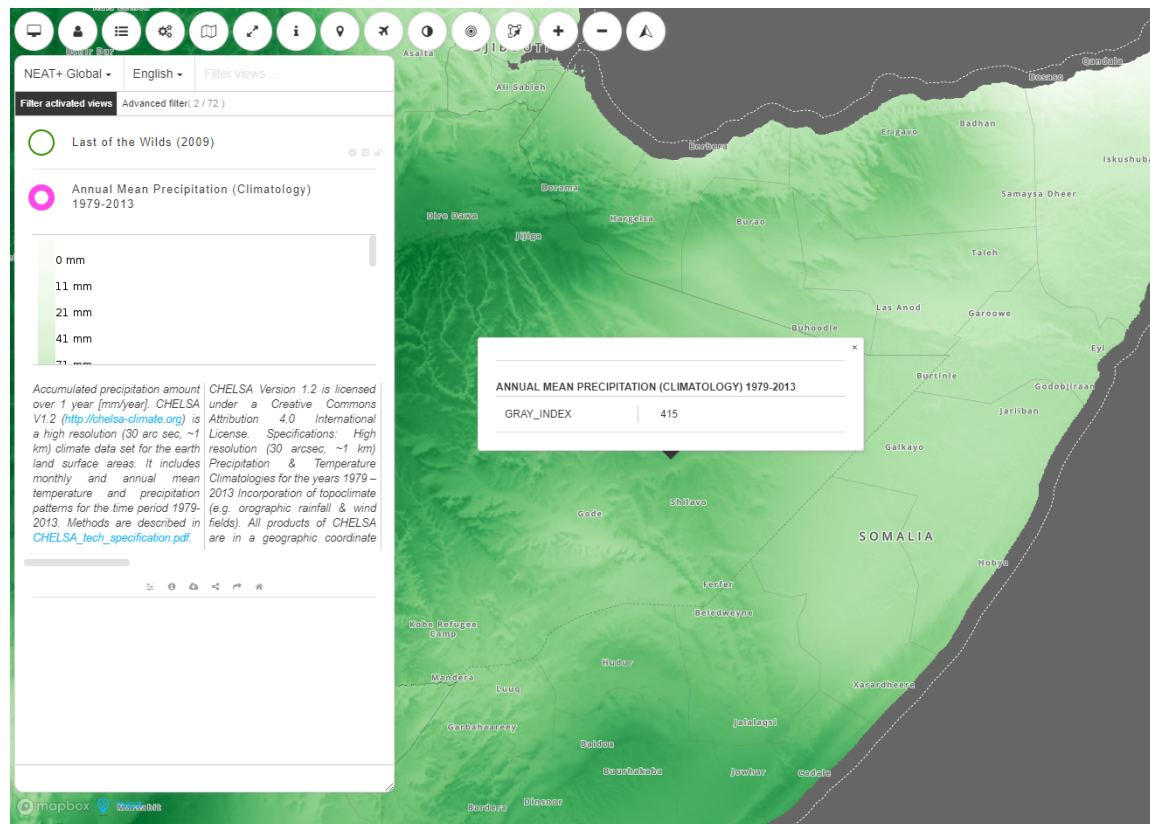
Conversely, vector data is data that represents linear or area features on a map, such as highways (lines), cities (points), or species zone maps (polygons). Vector data will normally contain not just a feature on a map, but will also have other data associated with it called attribute data. Attributes can be many things, such as place names, the area of a feature, or other calculated or derived data associated with a feature. In this example, for each feature in the [“Ecoregions2017”](#) dataset there is an attribute for that feature’s Ecoregion (a finer scale land classification), as well as its Biome (a more generalised land classification). The below example shows the Ecoregion attribute. Try comparing two datasets, one with a purple button and one with a green button.



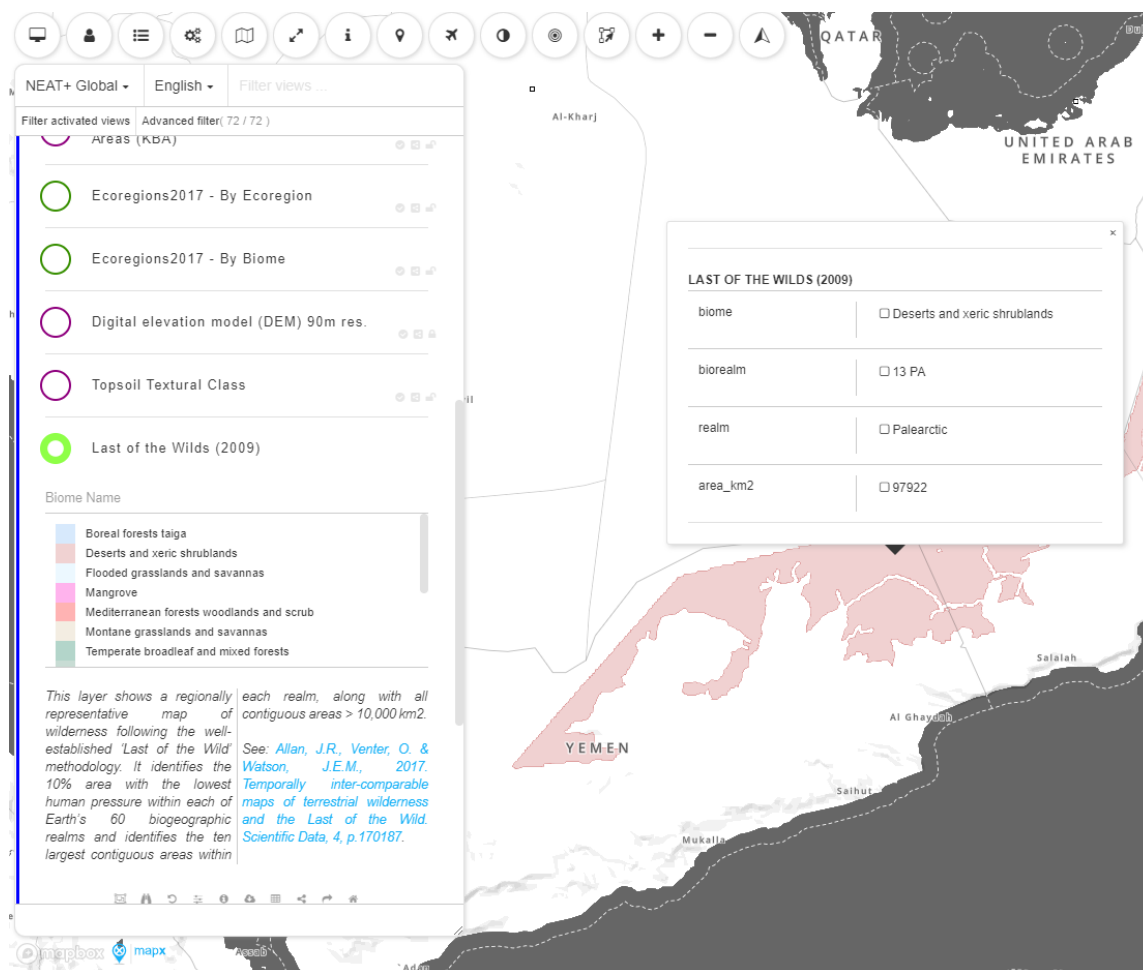
Finally, there are red buttons which denote a geospatial dataset that is stored in external repositories and directly streamed into MapX, such as the [World Database on Protected Areas \(WDPA\)](#). The WDPA is the largest database of legally defined protected areas on the planet. This data is updated every month.

g) Consulting and interacting with the attributes of the spatial data

To retrieve information from the activated datasets, simply click on the location you are interested in. For example, try to search for “precipitation” and to activate the “[Annual Mean Precipitation \(Climatology\) 1979 – 2013](#)” dataset. When you click on a location, the value returned in the pop-up window is the annual mean precipitation in mm for the grid you selected. Raster datasets will only return one value. As some rasters are hosted by external data providers and live-streamed into MapX, not all will return values due to data streaming restrictions (the pop-up window will likely display “NO VALUE”).



Vector datasets return multiple attributes associated with the source data layer. For example, search for and activate “[Last of the Wilds \(2009\)](#)”. If you click on one of the polygons, several attributes of the feature are returned, including the biome, the realm, and the area in km2



Examples: NEAT+ Environmental Sensitivity Questions which can be answered in MapX

The data in the project were curated to enable users of the NEAT+ to better understand the environmental context of their area of interest. The MapX project space was organized according to relevant environmental datasets that are pertinent to each category within the NEAT+ environmental sensitivity module. It is not designed to answer questions in the thematic modules. A list of these datasets is available in Annex A. **MapX is particularly useful for answering questions about the natural environment of the surrounding area.** It should be kept in mind that the spatial datasets may not have been updated in the time since the crisis event began, so information such as population numbers and land use may not be accurate in their present state.

a) **Natural environment: What is the main vegetation cover of the area being assessed?**

Natural environment	
What is the climate of the local area?	
What is the main vegetation cover of the area being assessed?	
What is the secondary vegetation cover of the area being assessed?	Tropical Rainforest
What is the density of the vegetation cover of the area being assessed?	Temperate Forest
What is the distance between the area being assessed and natural ecosystems such as forests, shrubland, water bodies, etc. ?	Desert
What is the local topography and terrain?	Grassland
What is the type of ground and topsoil?	Savanna
	Coastal
	Wetland
	Shrubland

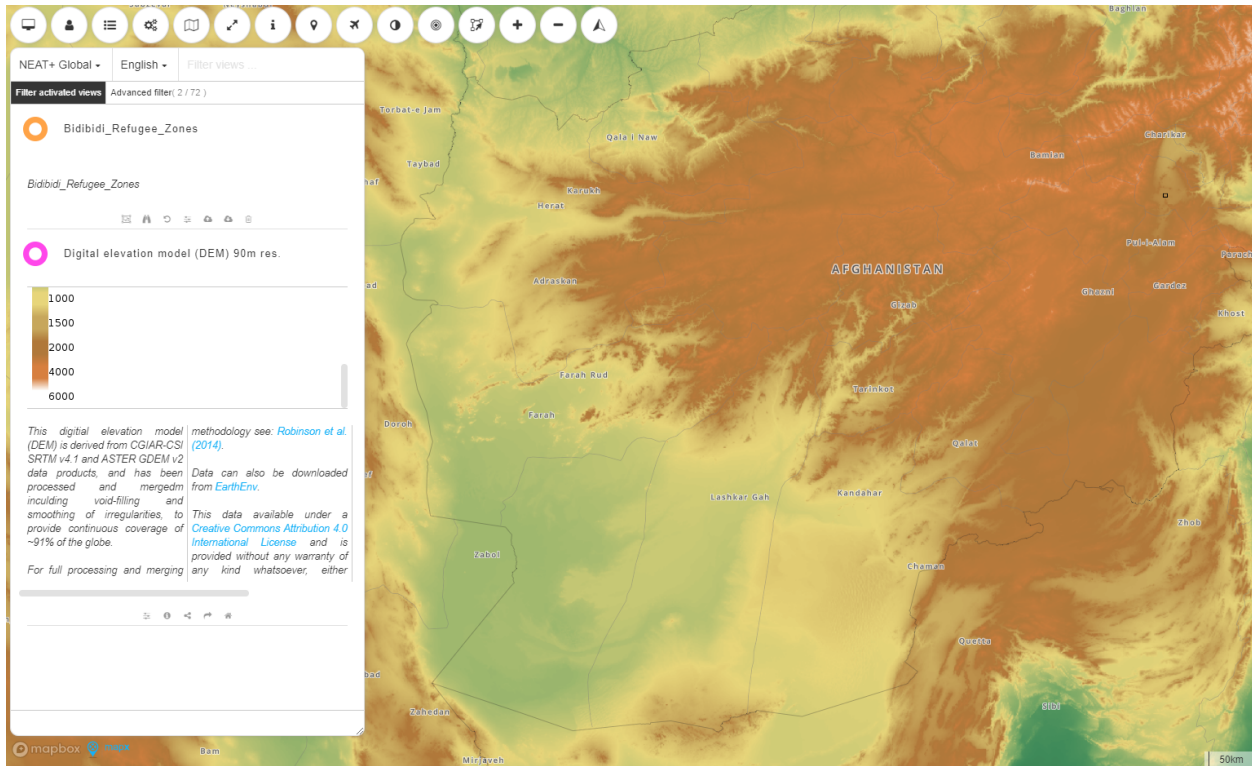
The categories given are a reference to terrestrial biomes. The “[Ecoregions2017](#)” dataset describes global ecoregions, or distinct ecological communities, of the world, and is located under the “NEAT+: Natural Environment” category within the MapX project. Activate it and click on the relevant feature around the area of interest. The “Biome Name” attribute describes the generalized assemblage of natural communities located within that polygon and can help answer this question. In the example below, the area of interest is within the “Tropical & Subtropical Grasslands, Savannas & Shrublands” biome.

b) Natural environment: What is the local topography and terrain?

What is the local topography and terrain?	Mountains
What is the type of ground and topsoil?	Mountains
What is the average gradient of the area?	Hills and Valleys
	Flatlands
	Coastal

The dataset “[Digital elevation model \(DEM\) 90m res](#)” can help the user to obtain a visual representation of the topography surrounding the area of interest. When activated, areas which appear in green shades represent low elevation areas, and orange shades progressive higher elevation above sea level. Areas of undulating orange and green shades represent hills and

valleys, whereas the light brown and white represent high mountain areas. In the below example, southeastern Afghanistan is shown, with elevation rising from the flatlands in the southeast to the mountains in central Afghanistan.



c) Nearby areas of significance: What is the distance to stationary surface water bodies?

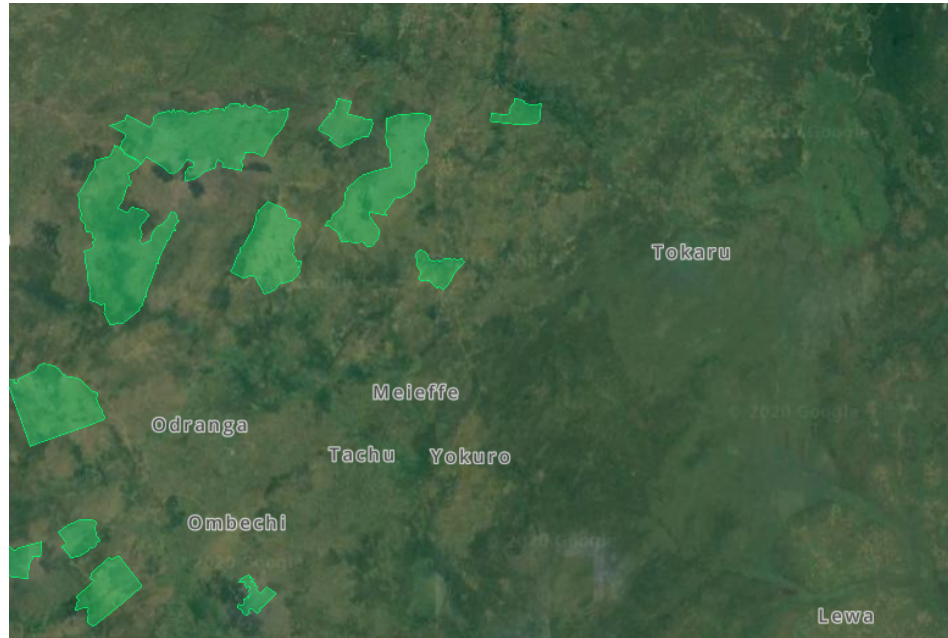
Nearby areas of significance	
What is the distance to stationary surface water bodies?	
What is the distance of running surface water bodies?	< 500m
Are there significant historical or cultural sites nearby?	500m-5km
Are there protected environmental areas or zones nearby?	> 5km

Under the NEAT+: Nearby areas of significance category, there are several views that can help the user to answer the question of the distance to nearby water bodies, including “[Lake](#)” and “[River](#)”. Satellite imagery, as described in the below section, can also be useful. Once activated, it is relatively simple to estimate the distance to nearby bodies of water (or other significant areas) by using the dynamic scale in the lower right corner of the MapX window (red box).



d) Using satellite imagery

At the bottom of the “NEAT+ Global” project’s view panel, you will find a category called “Satellite Imagery”. These datasets are streamed from open, well-known satellite imagery providers such as Google, Bing and Mapbox. Please note that these satellite images are open and are updated by the provider at their discretion, and may not reflect recent changes to the area of interest. The [Google Maps](#) layer, however, includes the year of the image capture on the tile. In the below example, the tiles distinctly say © 2020 Google, indicating that the imagery was collected in 2020. The exact date is still unclear, however.



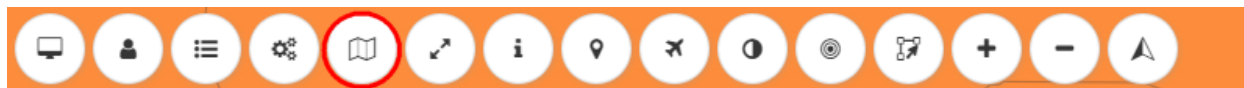
Satellite imagery has a wide range of applications, especially for planning and scoping in humanitarian situations. For the NEAT+, it can also be used to help answer density questions such as “What is the building density in the area being assessed?” or, “What is the density of vegetation cover of the area being assessed?”. In the below example, it can be noted that the boundaries may be outdated compared to the most current satellite image showing a settlement outside the boundary and that the average building density is low.



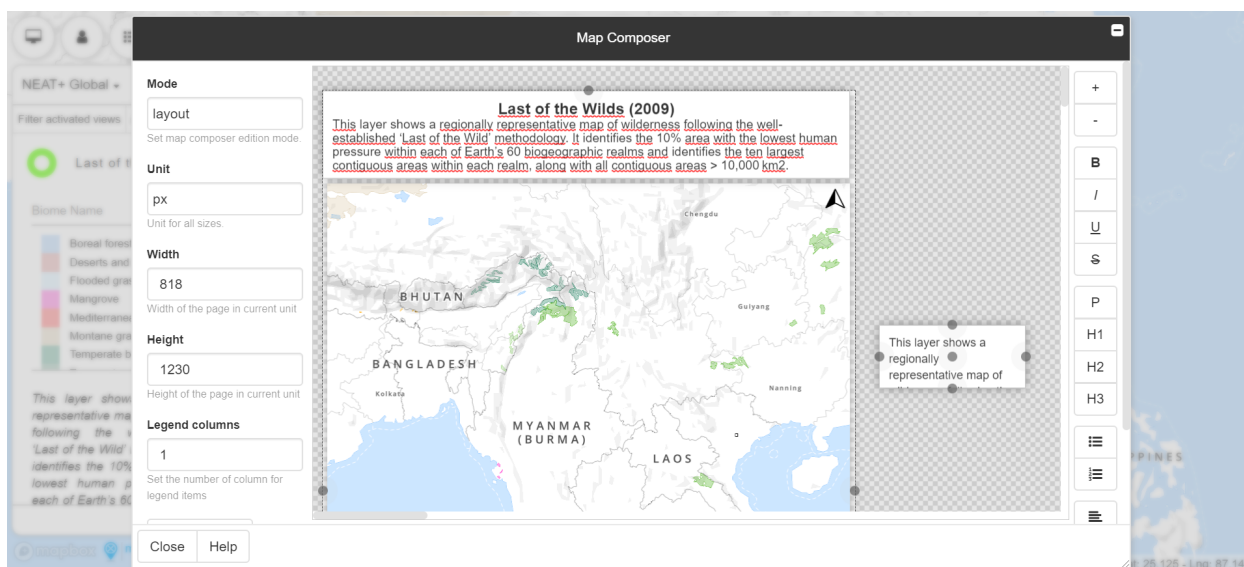
How to Create Maps using MapX

The map composer tool allows the user to generate exportable maps in a customized way, using the information related to the data selected and displayed on the map. You can import these maps into reports to supplement your NEAT+ assessment. Please note that the map composer is optimized for use in Google Chrome.

1. Activate the views you want to be present in the map. Click the map composer button located in the top toolbar (red circle).



2. In the map composer tool window, define the size of the area that will be exported by dragging the margins of the "page".

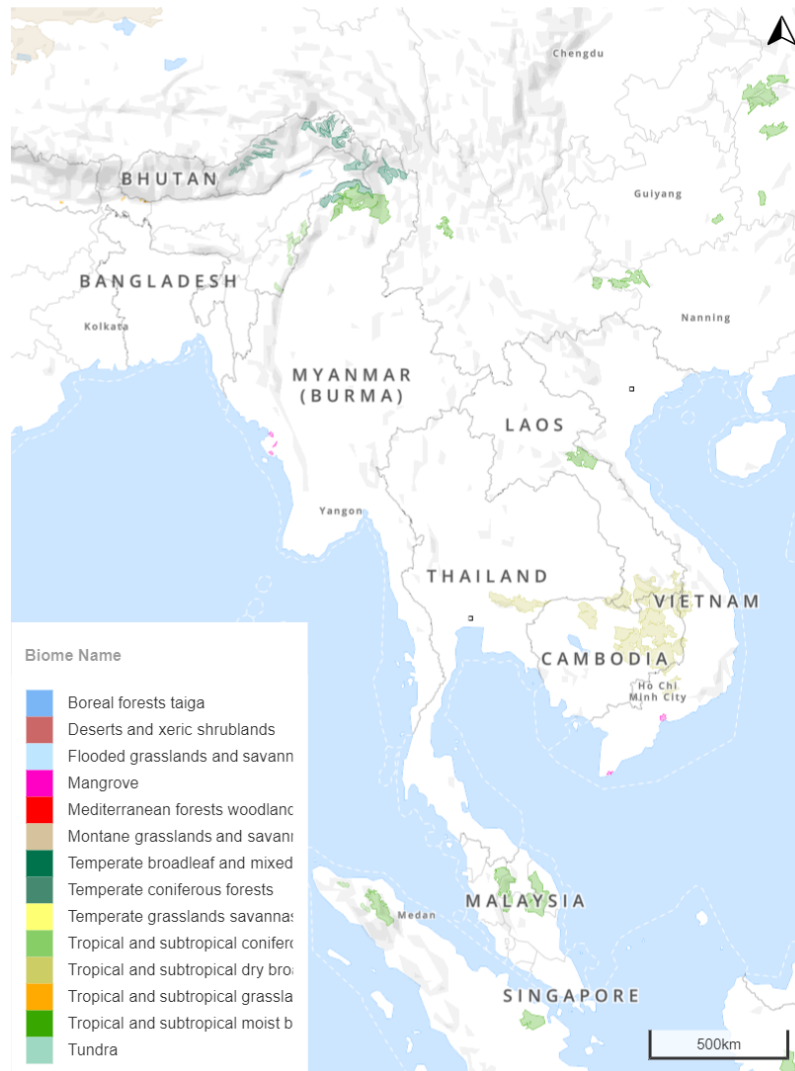


3. Move the objects to be exported in the page by dragging them from the central point of the box. Resize them by dragging their margins. You can place objects that you do not want to include in your map outside the page. Switch the view mode to "preview" to check how your map will look when you download it.
4. If necessary, change the map location and zoom out of the map by clicking in the map environment as you would normally do in MapX.
5. Text in text boxes can be edited. Simply click on it and start editing. You can, for instance, delete the abstract of one view and replace it with alternate text you want to appear in the exported map, or copy the title of the view into the legend box.
6. Legends with a large number of classes can be organized in multiple columns using the "Legend columns" button. For example, to have two columns, enter "2" in the box and press "Enter".
7. Use the right sidebar to change the layout, text size and font style within a selected text box.
8. To download your map in high resolution at certain width and height measures, switch the unit of measurement from "px" (pixels) to "mm" (millimetres) or "in" (inches) and define the resolution (in dpi) of the output.

- When you are ready to download, click on "Export image" and check your download directory for the downloaded map.

Last of the Wilds (2009)

This layer shows a regionally representative map of wilderness following the well-established 'Last of the Wild' methodology. It identifies the 10% area with the lowest human pressure within each of Earth's 60 biogeographic realms and identifies the ten largest contiguous areas within each realm, along with all contiguous areas > 10,000 km².



Annex A: NEAT+ Environmental Sensitivity Questions and Useful Datasets

Questions	Name of Dataset	Alternate Dataset	Notes
Profile of Area			
What is the population of the area being assessed?	Population: Number of Inhabitants 2015	Population Density 2015 (CIESEN, 2017)	Global census data from 2015. Number of inhabitants shows number at point clicked, while population density is aggregated to sub-national administrative units.
What best describes the type of settlement(s) in the area being assessed?			
Are there displaced people in the area being assessed?			
What is the distance to the nearest international border?	Administrative International Boundaries Level 0 (UNMap, 2018)		
Conditions of the camp or camp-type settlement			
How is the camp structured?			
How is the camp managed?			
What is the distance to the nearest host community settlement?			Population: Number of Inhabitants could be used as proxy (note the nearest community may not necessarily be host community)
Profile of displaced population			
What proportion of the population in the area			

being assessed are displaced people?			
What is the distance of the displaced people from their origin?			
Do the displaced people and host community share similar cultures?			
What is the certainty that the displaced people will remain in this location			
Crisis Event			
What best describes the crisis event?			In instances of conflict, UCPD data can be useful: https://ucdp.uu.se/country/483 worldwide.
How much time has passed since the crisis began?			
Infrastructure and buildings			
What type of area is the location being assessed?	Accessibility to Cities (2015)		Accessibility to Cities can be used as a proxy (i.e, if travel time is less than one hour, it is peri-urban, greater than one hour, it is rural)
What is the main building construction materials of host communities?			
What is the building density in the area being assessed?	Google Maps Digital Globe Aerial Imagery		Can be used as a proxy, date of satellite image is on tile.
What type of access is there to the area being assessed?			

Are there any access restrictions?			
Are there industrial (production, processing, storage) facilities nearby?			
Are there conflict damaged buildings or abandoned military equipment nearby?			
Natural Environment			
What is the climate of the local area?	Ecoregions2017 - By Biome (on MapX)		Biome name has climate in it
What is the main vegetation cover of the area being assessed?	Ecoregions2017 - By Biome (on MapX)		Biome attribute has vegetation type listed
What is the secondary vegetation cover of the area being assessed?	Ecoregions2017 - By Biome (on MapX)		Biome name has climate in it
What is the density of vegetation cover of the area being assessed?	Google Maps Digital Globe Aerial Imagery	Aboveground Biomass Density of Vegetation	
What is the distance between the area being assessed and natural ecosystems?	Key Biodiversity Areas, Global Wetlands, Mangroves, Last of the Wilds, Forest Biomass		
What is the local topography and terrain?	Digital elevation model (DEM) 90m res.		
What is the type of ground and topsoil?	Topsoil Textural Class		Does not have the exact parameters as NEAT+.
What is the average gradient of the area?			

Nearby Areas of Significance			
What is the distance to stationary surface water bodies?	Lake		
What is the distance to running surface water bodies?	River		
Are there significant historical or cultural sites nearby?	UNESCO World Heritage Sites		
Are there protected environmental areas or zones nearby?	Ramsar Sites, Terrestrial and Marine Protected Areas (WDPA)		
Basic Services			
Is there electricity supply in the area being assessed?			
What is the primary source of electricity?			
What was the main source of cooking and heating fuel of the local population pre-crisis?			
What is the current main source of cooking and heating fuel for the crisis-affected population?			
What was the main water source of the local population pre-crisis?			
What is the current main water source for the crisis-affected population?			

What is the most common form of household water management in the area being assessed?			
What is the most common form of household wastewater (grey water) management in the area being assessed?			
What is the most common form of household wastewater (black water) management in the area being assessed?			
What is the most common form of household solid waste management in the area being assessed?			
How accessible is healthcare?			
Socio-economic Settings			
What are the structures of community governance?			
What is the state of formal government structures?			
How accessible are markets?			
What is the main livelihood activities of the host community?			FEWS Livelihood Zones (only in Africa) can be used as proxy
What is the main livelihood activities of the crisis-affected community?			

How dependent is the crisis-affected population on aid assistance?			
What is the main agricultural activity in the area being assessed?			Global Land Cover 2015 can be used as a proxy
What is the main livestock activity in the area being assessed?			The “ Gridded Livestock of the World ” datasets can be used as a proxy
Natural Resources			
Are people collecting or extracting natural resources for commercial purposes?			
What percentage of people in the area are involved in natural resource extraction?			
Has any conflict-related natural resource extraction occurred in the area?			
Climatic Events			
Has the host community noticed a change in rainfall amounts?			Several datasets can help add context: climate anomalies, mortality risk, flood return but cannot exactly answer the question
Has the host community noticed a change in rainfall timings?			
Has the host community noticed more extreme flood or storm events?			
Has the host community noticed longer and more intense droughts?			

Annex B: Additional learning resources

GIS:

1. MapX Guidance Documents:
<https://owncloud.unepgrid.ch/index.php/s/Kb2YgpgOfjB70CV#pdfviewer>
2. Google Earth Outreach:
<http://earth.google.com/outreach/>
 - a) Showcase – View KMZ files produced by others
 - b) Tutorials – Watch video tutorials and find helpful tools and resources
 - c) Community – Connect with others using Google Earth tools
 - d) Grants – Available for non-profits and communities
3. Esri: ArcGIS Documentation
<https://doc.arcgis.com/en/>
4. Esri: Learn ArcGIS
<https://learn.arcgis.com/en/>
5. QGIS: Official Training Manual in English
https://docs.qgis.org/3.10/en/docs/training_manual/index.html
6. QGIS: A Gentle Introduction to GIS
https://docs.qgis.org/testing/en/docs/gentle_gis_introduction/
7. GIS & Data Platforms: An extensive list of GIS data sources
https://docs.google.com/spreadsheets/d/1b0N1xW_q8eGUjJVE6RgE3NJb_V-8WHd_ERQE-mQuBGo/edit?usp=sharing
8. PPGis.net: Open Forum on Participatory Geographic Information Systems and Technologies
<http://www.ppgis.net/>

Remote sensing:

1. Satellite Observations in Science Education: Principles in Remote Sensing.
https://www.ssec.wisc.edu/sose/pirs_activity.html