Steps to prepare qualitative/categorical raster maps for EO Lab based on polygon maps using ArcMap

Sharing of know-how based on EO Lab training experience held in Bogor, 22-24 August 2017, using time series of land cover maps provided by MOEF

Application link:
https://moef.ipb.ourecosystem.com/interface/#layers

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Version: Aug/31/2017

1. Overall workflow

There are 4 main steps to prepare qualitative/categorical raster maps for EO Lab based on polygon maps using ArcMap, comprising: (1) preparing TIFF for dataset layer; (2) preparing TIFF for display layer; (4) preparing colour palette for layer legend; and (4) preparing image for layer legend (**Fig 1**).

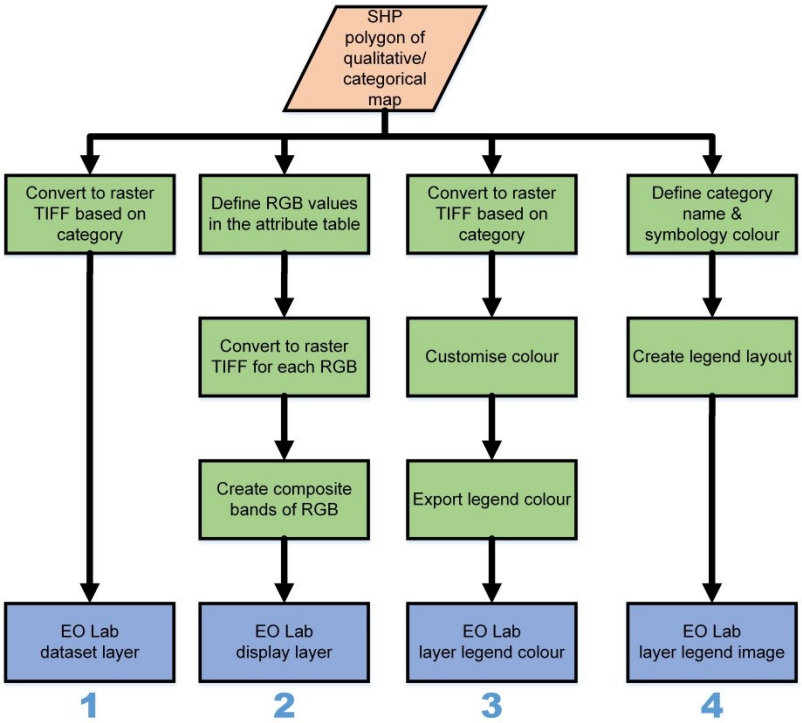

Fig. 1. Overall workflow.

2. Preparing TIFF for dataset layer

Basically, raster TIFF of qualitative/categorical maps for dataset layer in EO Lab platform should have the properties as listed in **Table 1**.

Table 1. Properties of raster TIFF of qualitative/categorical maps for dataset layer in EO Lab platform.

Property	Value
Number of bands	1
Pixel type	unsigned integer
Pixel depth	16 bit
NoData value	-9999*)
Compression	LZW
Spatial reference	GCS_WGS_1984
Statistics | Band_1	Statistics have not been calculated

*) Actually, NoData value does not always equal -9999. Other values which are not used within the value range of the fields to be converted into raster can also be used (e.g. -1e32 or +1e32). However, to be consistent, let's use -9999 for NoData value.

To prepare raster TIFF from polygon with the properties as listed in **Table 1** using ArcMap, please follow the following steps:

- open **ArcToolbox**, select **Conversion Tools | To Raster | Feature to Raster**;
- select the **Input features with qualitative/categorical values contained in the attribute tables** (*.SHP files) to be converted into raster TIFF (e.g. D:\ forests2020\ eolab\input\landcover.shp);
- select the **Field** to be converted into raster TIFF that should have integer value;
- define the **Output features** of the raster TIFF map, by typing [dot]tif after the file name (e.g. D:\ forests2020\ eolab\output\dataset01.tif);
- define the **Output cell size** (e.g. 0.00027º or 30 meter for land cover maps of MOEF);
- select **Environments...**;
- select **Output Coordinates** and set **Output Coordinate System** into **GCS_WGS_1984**;
- select **M Values**, and set **Output has M Values** into **Disabled**;
- select **Z Values**, and set **Output has Z Values** into **Disabled**; and
- select **Raster Storage**, **uncheck** **Build pyramids**, **uncheck** **Calculate statistics**, and set **Compression** into **LZW**.

When the raster TIFF file has been created, to change **NoData value** into **-9999**, please follow the following steps:

- open **ArcToolbox**, select **Database Management Tools | Raster | Raster Dataset | Copy Raster**;
- select the **Input Raster** (*.TIF files) to be copied into another raster TIFF (i.e. the TIF file that was just created using the previous steps);
- define the **Output Raster Dataset** of the output, by typing [dot]tif after the file name (e.g. D:\ forests2020\ eolab\output\datasetc.tif); and
- define **NoData Value** into **-9999**.

The final raster TIFF file created using the above steps should be ready to be uploaded as dataset layer into EO Lab platform. Please, refer to the steps provided by Jil Bournazel and Nina Moffat during the training on how to upload qualitative raster dataset into EO Lab platform.

AUTOMATION TIPS:

- When you have several fields to be converted into raster TIFFs for dataset layers of EO Lab, you can use **Batch** by right-clicking the **ArcToolbox** of **Conversion Tools | To Raster | Feature to Raster** as used in the above steps (**Fig. 2**). Please, make sure that the parameters within the **Environments...** of the batch are adjusted following above steps.
- Similarly, to adjust NoData values of several raster TIFFs can also be done quickly using **Batch** or using **ModelBuilder** (**Fig. 3**).

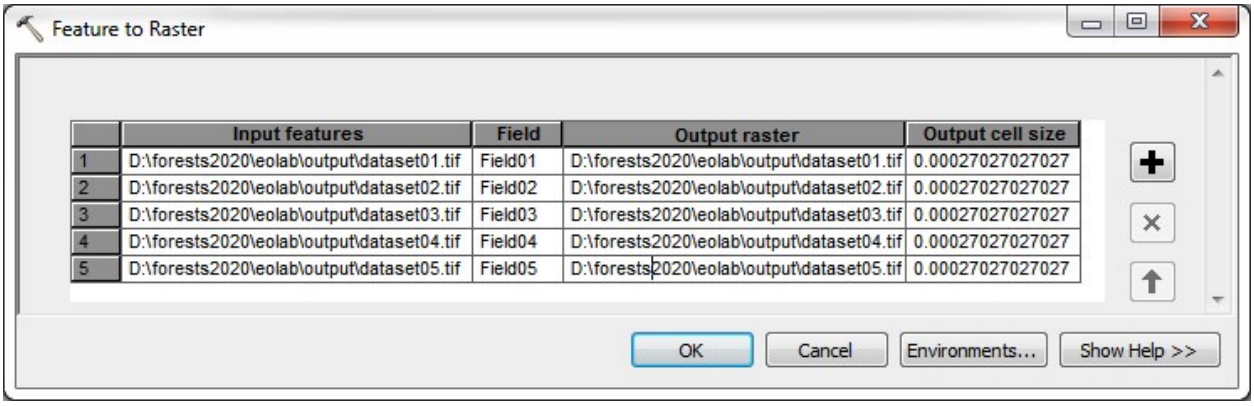

Fig. 2. Batch of converting feature to raster for several fields.

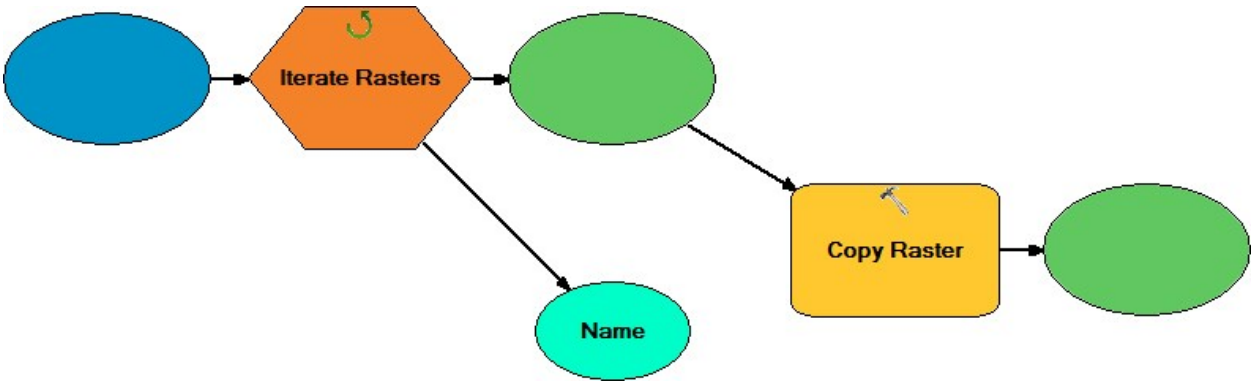

Fig. 3. General structure of ModelBuilder to copy several raster TIFFs into other raster TIFFs with different NoData values.

3. Preparing TIFF for display layer

Basically, raster TIFF of qualitative/categorical maps for display layer in EO Lab platform should have the properties as listed in **Table 2**.

Table 2. Properties of raster TIFF of qualitative/categorical maps for display layer in EO Lab platform.

Property	Value
Number of bands	3
Pixel type	unsigned integer
Pixel depth	8 bit
Compression	LZW
Spatial reference	WGS_1984_Web_Mercator_Auxiliary_Sphere
Statistics	Calculated for each of Band 1, Band 2, and Band 3

To prepare raster TIFF from polygon with the properties as listed in **Table 2** using ArcMap, please follow the following steps.

First of all, we should define RGB values within the attribute table of our qualitative/categorical SHP map. For instance, from MOEF land cover dataset we define the RGB values as listed in **Table 3**. **TIPS:** use **Joins and Relates** to rapidly define RGB based on lookup.

Table 3. RGB of MOEF land cover maps.

Id	Category	R	G	B
2001	Primary dryland forests	96	230	99
2002	Logged over secondary dryland forests	114	254	0
2005	Primary swamp forests	96	230	99
2006	Plantations	211	229	152
2007	Shrubs	218	254	198
2010	Forest plantations	211	229	152
2012	Settlements	255	0	0
2014	Bareland	244	202	126
5001	Water body	212	252	247
20041	Logged over secondary mangrove forests	193	167	0
20051	Logged over secondary swamp forests	114	254	0
20071	Swamp shrubs	218	254	198
20091	Dryland agriculture	246	254	167
20092	Complex dryland agriculture	237	245	0
20093	Ricefield	168	214	255
20094	Fish pond	124	244	244
20121	Airport/harbour	144	142	167
20122	Resettlement area	144	142	167
20141	Mining	167	4	0
50011	Swamp	152	229	229

Secondly, we have to convert SHP containing RGB values into raster IMG files:

- open **ArcToolbox**, select **Conversion Tools | To Raster | Feature to Raster**;
- select the **Input features with RGB values contained in the attribute tables** (*.SHP files) to be converted into raster IMG (e.g. D:\ forests2020\ eolab\input\landcover-rgb.shp);
- select the **Field** referring to R values to be converted into raster IMG that should have integer value;
- define the **Output features** of the raster IMG map containing R values, by typing [dot]tif after the file name (e.g. D:\ forests2020\ eolab\output\r.tif);
- define the **Output cell size** (e.g. 0.00027º or 30 meter for land cover maps of MOEF); and
- repeat the steps for each G and B values (**TIPS:** you can use **Batch** or **ModelBuilder** for automated interation).

Thirdly, we have to create composite of RGB raster IMGs, as follows:

- open **ArcToolbox**, select **Database Management Tools | Raster | Raster Processing | Composite Bands**;
- select the **Input Rasters** (*.TIF files) of R, G, and B values (i.e. the TIFFs that were just created using the previous steps);
- define the **Output raster** of the RGB composite raster TIFF, by typing [dot]tif after the file name (e.g. D:\ forests2020\ eolab\output\rgb.tif);
- define the **Output cell size** (e.g. 0.00027º or 30 meter for land cover maps of MOEF);
- select **Environments...**;
- select **Output Coordinates** and set **Output Coordinate System** into **WGS_1984_Web_Mercator_Auxiliary_Sphere**;
- select **M Values**, and set **Output has M Values** into **Disabled**;
- select **Z Values**, and set **Output has Z Values** into **Disabled**;
- select **Raster Storage**, **uncheck** **Build pyramids**, **check** **Calculate statistics**, and set **Compression** into **LZW**;
- double-click the resulted layer of composite RGB raster IMG available in the **Table Of Contents**;
- select **Symbology** tab; set **Display NoData as** black color; (later, you can easily parameterise **Transparent color** within **display layer** setting of EO Lab with RGB values of 0, 0, 0) – set **Type** of **Strecth** into **Minimum-Maximum**; and **uncheck** **Apply Gamma Stretch**;
- when it's done, the composite RGB raster IMG should preview the colour as desired with black colour for NoData values;
- now, right-click the layer; select **Data | Export Data...**, under **Output Raster**, **check** **Renderer** and **Force RGB** and set **NoData** into blank; define the output file location and file name with **Format TIFF** and **Compression Type** of **LZW**; and
- afterward, double-click the resulted layer of composite RGB raster TIFF available in the **Table Of Contents**; select **Symbology** tab; set **Display NoData as** black color; (later, you can easily parameterise **Transparent color** within **display layer** setting of EO Lab with RGB values of 0, 0, 0) – set **Type** of **Strecth** into **None**; and **uncheck** **Apply Gamma Stretch**.

Fourthly, we should project the composite RGB raster TIFF as resulted from the previous steps into **WGS_1984_Web_Mercator_Auxiliary_Sphere**, as follows:

- open **ArcToolbox**, select **Database Management Tools | Projections and Transformations | Raster | Project Raster**;

- select the **Input Raster** (*.TIF file) to be projected into **WGS_1984_Web_Mercator_Auxiliary_Sphere** (i.e. the TIFF that was just created using the previous steps); and
- define the **Output Raster Dataset** of the output, by typing [dot]tif after the file name (e.g. D:\ forests2020\ eolab\output\rgbweb.tif);
- afterward, similar to previous steps, double-click the resulted layer of composite RGB raster TIFF available in the **Table Of Contents**; select **Symbology** tab; set **Display NoData as** black color; (later, you can easily parameterise **Transparent color** within **display layer** setting of EO Lab with RGB values of 0, 0, 0) – set **Type** of **Strecth** into **None**; and **uncheck** **Apply Gamma Stretch**; and
- finally, double-click the resulted layer of composite RGB raster TIFF available in the **Table Of Contents**; select **Source** tab; and check if the **Statistics** have been calculated for each of Band 1, Band 2 and Band 3 – if the **Statistics** have not been calculated, go to **Catalog**, find the TIFF, right-click the file name, and select **Calculate Statistics**.

The final raster TIFF file created using the above steps should be ready to be uploaded as display layer into EO Lab platform. Please, refer to the steps provided by Jil Bournazel and Nina Moffat during the training on how to upload qualitative raster dataset into EO Lab platform.

AUTOMATION TIPS:

- use **Batch** or **ModelMaker** for the steps when you have several data to be processed for EO Lab display layer.

4. Preparing colour palette for legend layer

- **Add Data** from raster TIFF resulted by steps of **Part 2**;
- double click the layer from **Table Of Contents**;
- select **Symbology** tab, change into **Unique Values**, and define the colour values of each category according to your defined RGB values (e.g for MOEF land cover, we use RGB colours which refer to **Table 3**);
- select **Colormap | Export Colormap...**; and
- the resulted *.clr file should be ready to be uploaded as legend layer.

Please, refer to the steps provided by Jil Bournazel and Nina Moffat during the training on how to upload colour palette (*.clr) for layer legend into EO Lab platform.

5. Preparing image for legend layer

- **Add Data** from polygon SHP of your qualitative/categorical map containing category name in the **attribute table** (see **Table 3** as example);
- double click the layer from **Table Of Contents**;
- select **Symbology** tab, change into **Categories | Unique Values**, select Value Field referring to category name, and define the colour values of each category according to your defined RGB values (e.g for MOEF land cover, we use category name and RGB colours which refer to **Table 3**);
- select **View | Layout View**; then select **Insert | Legend**; and adjust the layout so you will have optimum size of the legend; and
- select **File | Export Map...**; choose the **Type** of the **Output File Name** into graphical formats such as **JPG**; and edit the resulted graphical legend using image editor (e.g. Adobe Photoshop); and

- the resulted *.jpg file should be ready to be uploaded as legend layer.

Please, refer to the steps provided by Jil Bournazel and Nina Moffat during the training on how to upload legend image for layer legend into EO Lab platform. **TIPS:** use **Joins and Relates** to rapidly define category name based on lookup.