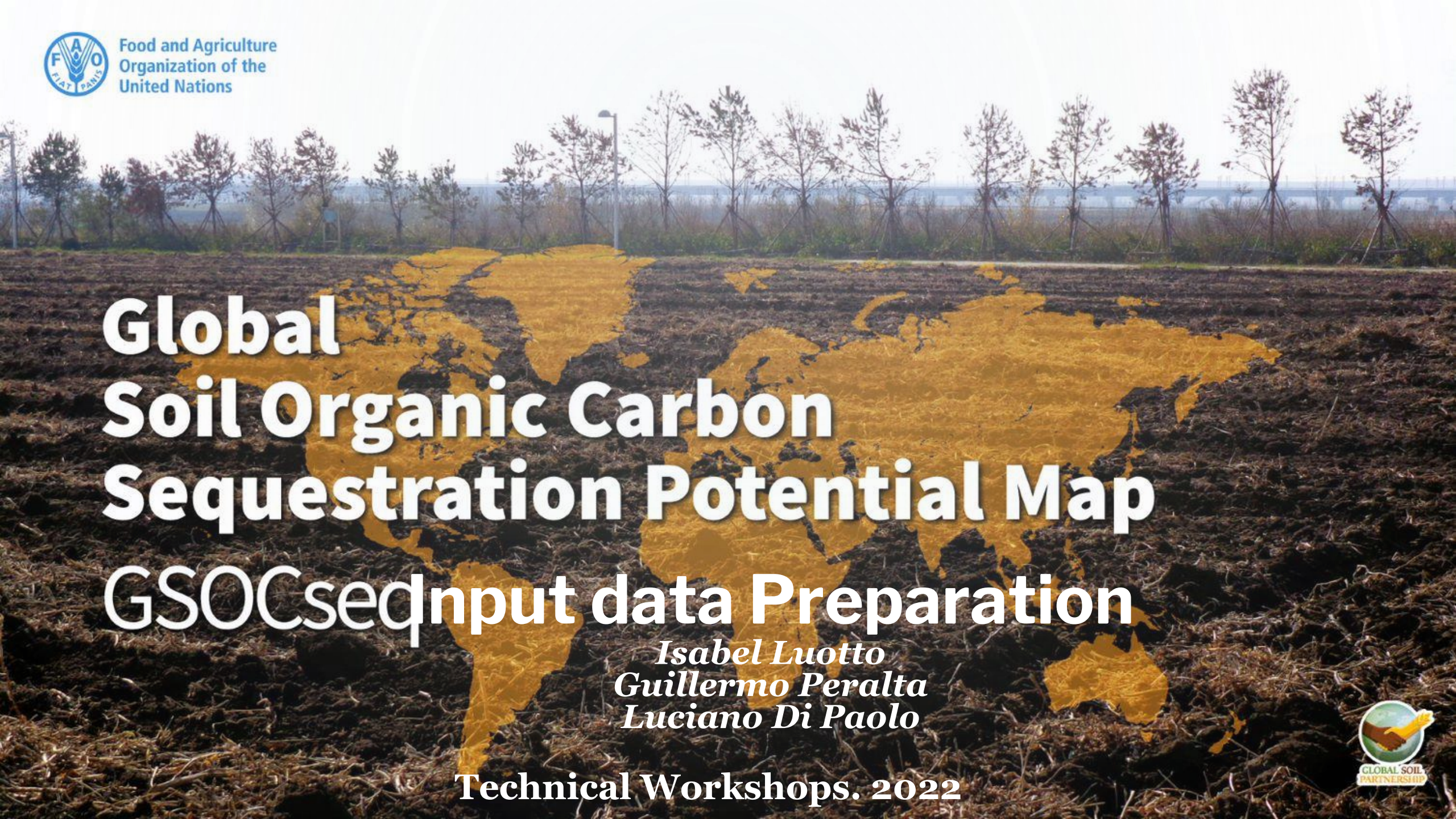
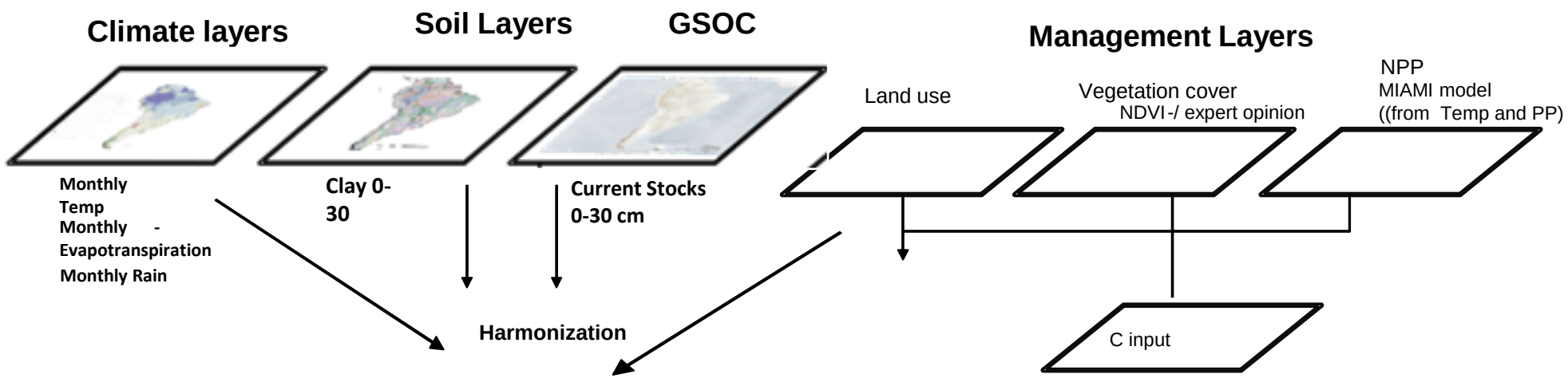

Food and Agriculture
Organization of the
United Nations
Global
Soil Organic Carbon
Sequestration Potential Map
GSOCseq Input data Preparation
Isabel Luotto
Guillermo Peralta
Luciano Di Paolo
Technical Workshops. 2022
GLOBAL SOIL
PARTNERSHIP

Roadmap

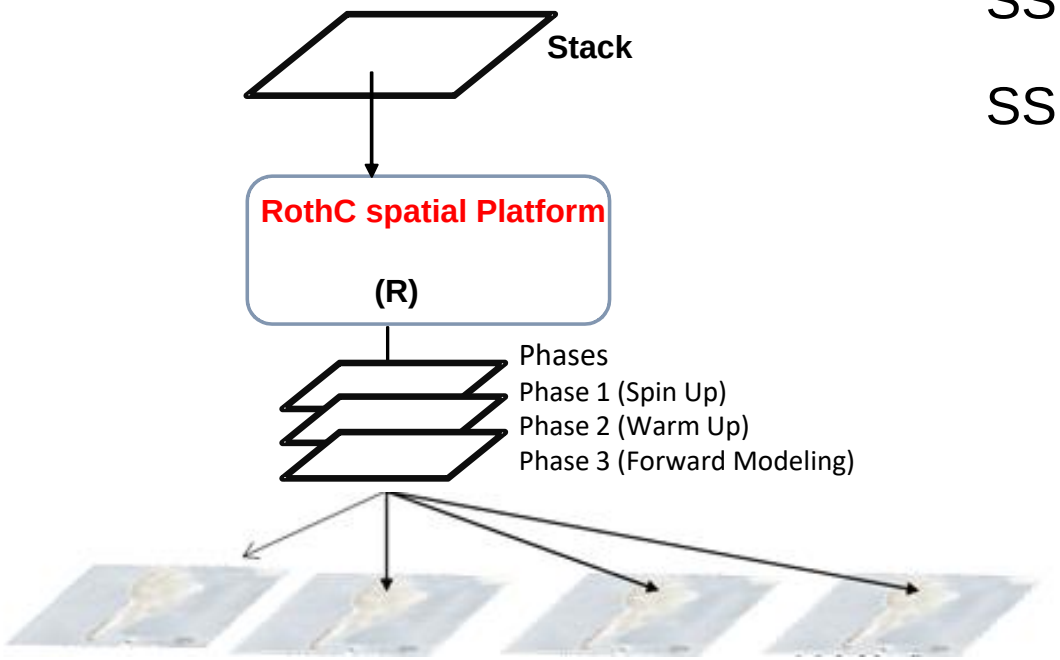
- Preparation of vegetation cover, soil, land use **layers**, climate*
- Preparation of **“Stacks”** to be used in the modelling phases.
- Preparation of “**target points**” where we will run the model.



SSM1 Scenario: + 5%

SSM2 Scenario: +10%

SSM3 Scenario: + 20%



SOC 20 years BAU

SOC 20 years Low Scenario

SOC 20 years MEdium Scenario

SOC 20 years High Scenario

Absolute and relative Sequestration rates
7 products
(29 intermediate products)

RothC Data requirements

Climate

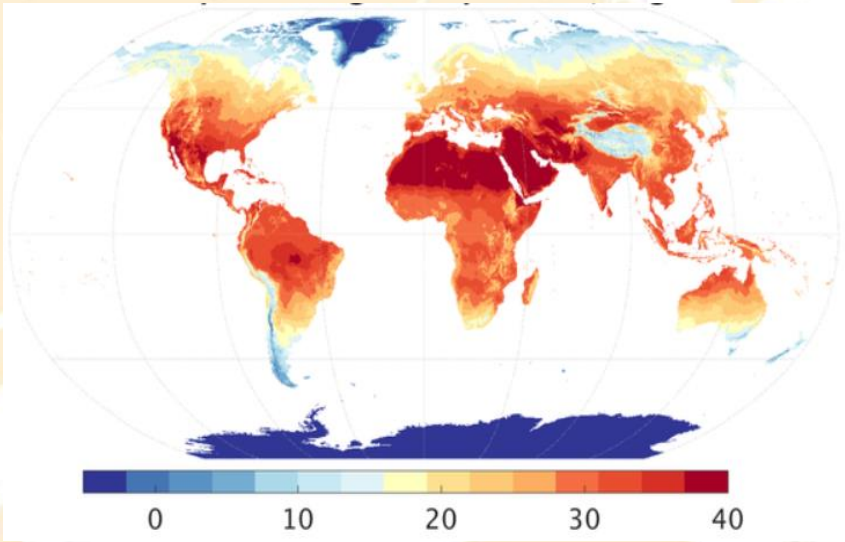
Soil

Management

Climate Data	Soil Data	Land Use- Management Data
1. Monthly rainfall(mm) 2. Average monthly mean air temperature (ºC) 3. Monthly open pan evaporation (mm)/evapotranspiration (mm) Penman-Monteith	1. Total initial 0-30cm SOC stocks (t C ha^{-1}) 2. Initial C stocks of the different pools (t C ha^{-1}): DPM, RPM, BIO, HUM, IOM 3. Clay content (%) at simulation depth.	1. Land cover/use 2. Vegetation cover (binary: bare vs. vegetated) 3. DPM/RPM ratio, an estimate of the decomposability of the incoming plant material 4. Irrigation (to be added to rainfall amounts)* 5. Monthly Carbon inputs from plant residues (aboveground + belowground), (t C ha-1)* 6. Monthly Carbon inputs from organic fertilizers and grazing animals' excretion (t C ha-1)*

Climatic data sources:

- TerraClimate is a dataset of monthly climate for global terrestrial surfaces from 1958-2020
- Monthly temporal resolution and a ~4-km
- GEE and R scripts to download and prepare the data are provided



Abatzoglou, J.T., S.Z. Dobrowski, S.A. Parks, K.C. Hegewisch, 2018, Terraclimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015, Scientific Data,

Climatic data sources:

- CHELSA-BIOCLIM+ is a dataset of monthly climate for global terrestrial surfaces from 1980 until 2018
- Monthly temporal resolution and a ~1-km
- Data can be downloaded here: https://envicloud.wsl.ch/#/?prefix=chelsa%2Fchelsa_V2%2FGLOBAL%2F

CHELSA

Climatologies at high resolution for the earth's land surface areas

CHELSA-BIOCLIM+ A novel set of global climate-related predictors at kilometre-resolution Philipp Brun, Niklaus E. Zimmermann, Chantal Hari, Loïc Pellissier, Dirk N. Karger https://doi.org/10.16904/envidat.332

Soil data: SOC and Clay

- National SOC stock grids can be downloaded from
  - the FAO's Global Soil Organic Carbon map GSOCmap v1.6 – Global layer already included in the training material folder
  - Soilgrids
  - National layers
- National Clay content [%] grids can be downloaded from
  - Soilgrids – Global layers already included in the training material folder
  - National layers

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  - National layers
- National Clay content [%] grids can be downloaded from
  - Soilgrids – Global layers already included in the training material folder
  - National layers

Land use

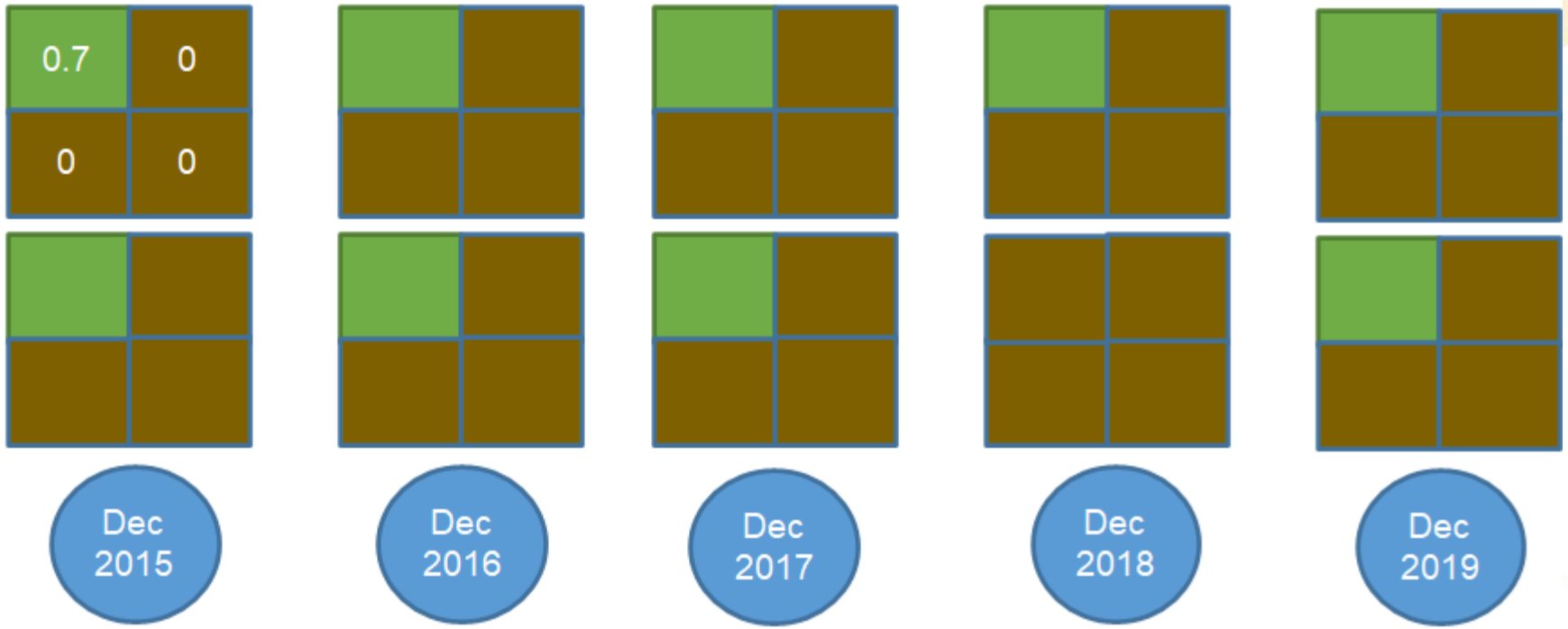
- Global land cover maps at 300 m spatial resolution, on an annual basis from 2016 to 2020, consistent with the series of global annual LC maps from 1992 to 2015 produced by the European Space Agency (ESA) Climate Change Initiative (CCI)
  - Raw 300 m layers for select countries already included in the training material
  - Raw global data here: https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-land-cover?tab=form
- New high resolution (10 m) yearly landcover product available on GEE: https://www.nature.com/articles/s41597-022-01307-4

Vegetation cover from Google Earth Engine

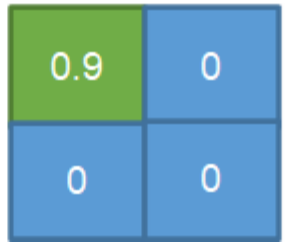
MOD13A2 v006
MODIS/Terra Vegetation Indices 16-Day L3 Global 1 km SIN Grid

365/16 ≈ 22 Layers per year
22/12 ≈ 2 Layers per month

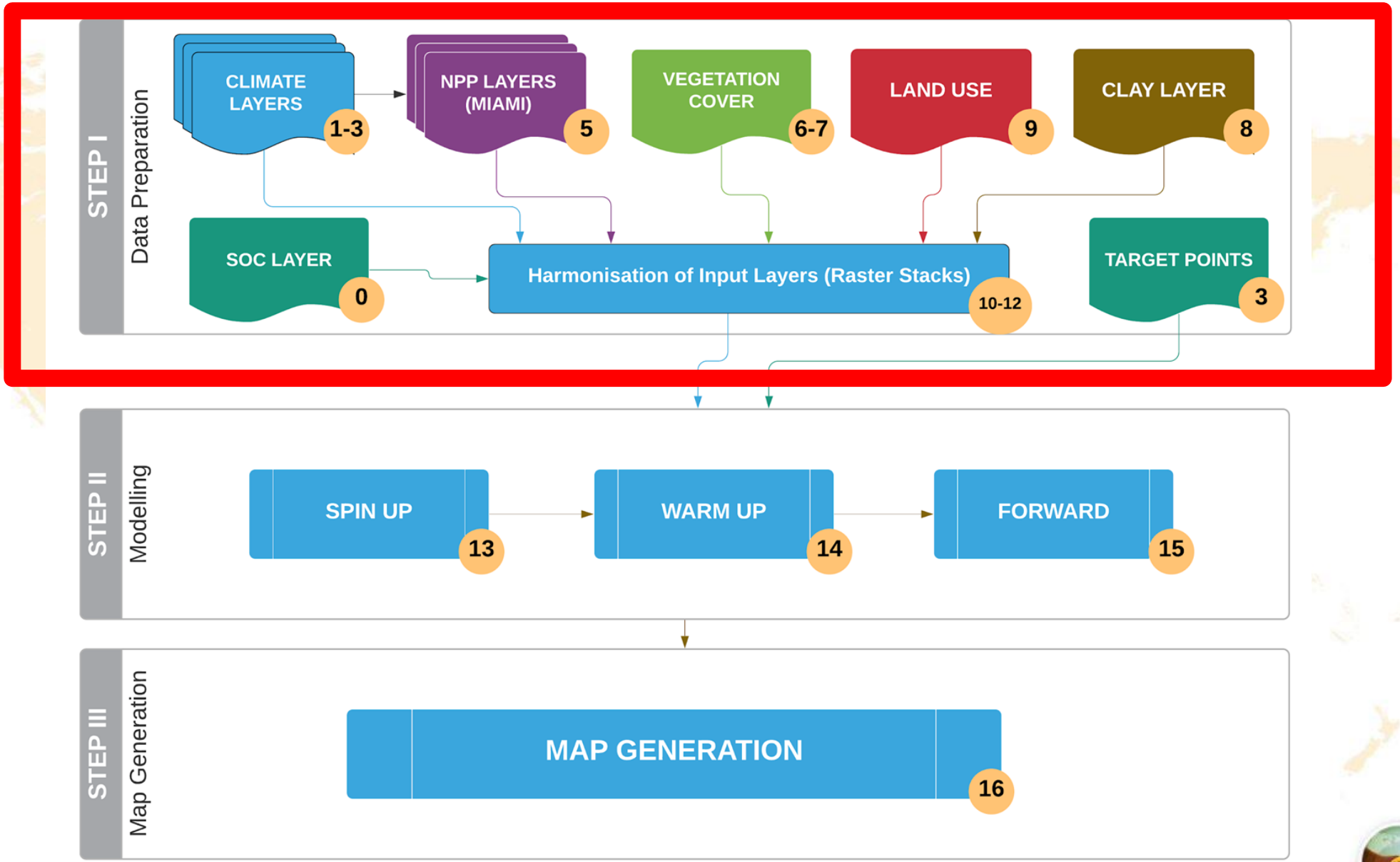
Total images = ~2 Layers per month x years of interest



$$P_{veg} = \frac{Number\ of\ images\ NDVI > 0.6}{Total\ images}$$



Global Soil Organic Carbon Sequestration Potential Map GSOCseq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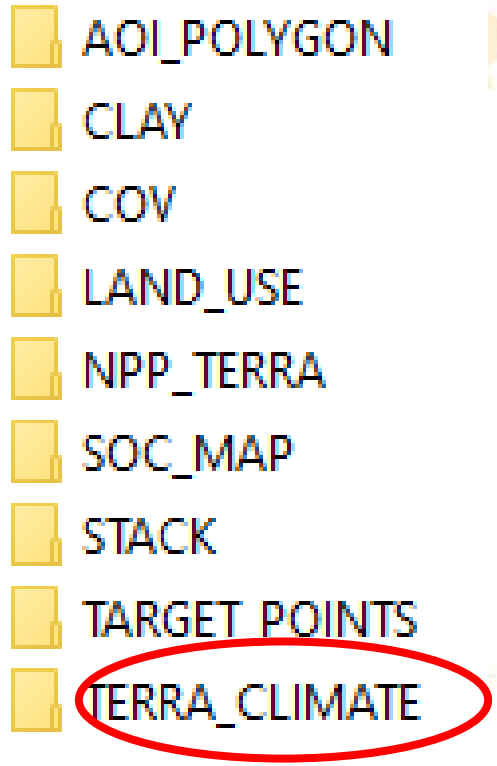
Harmonization of climate layers

- 00_1_TERRACLIMATE_DOWNLOAD_GEE_SPIN_UP.txt
- 00_2_TERRACLIMATE_DOWNLOAD_GEE_WUP_FORWARD.txt
- 1_1_TERRACLIMATE_variables_SPIN_UP.R
- 2_1_TERRACLIMATE_variables_FORWARD.R

Climate Layers

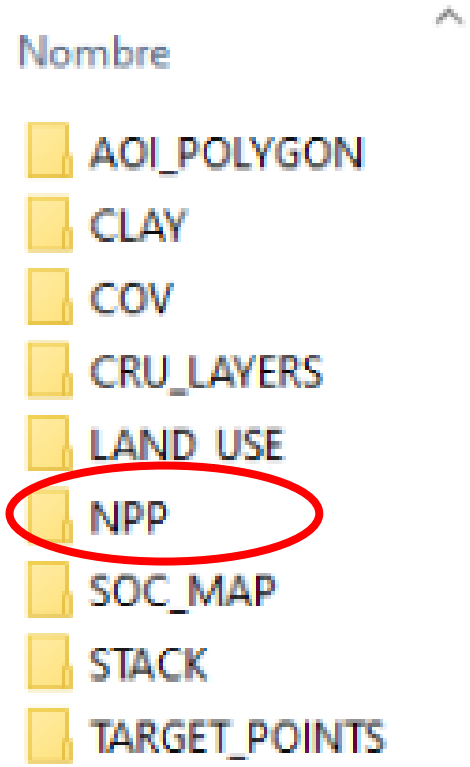
- Proposed climate layers TerraClimate
- Spatial resolution : 4 km x 4 km / pixel
- One layer per month per year :::: 20 years = 240 layers/climate variable
- Three climate variables :
  - Precipitation (mm/month)
  - Temperature (average °C/ month)
  - Potential Evapotranspiration (mm/month)



Net Primary Production Layers (MIAMI MODEL)

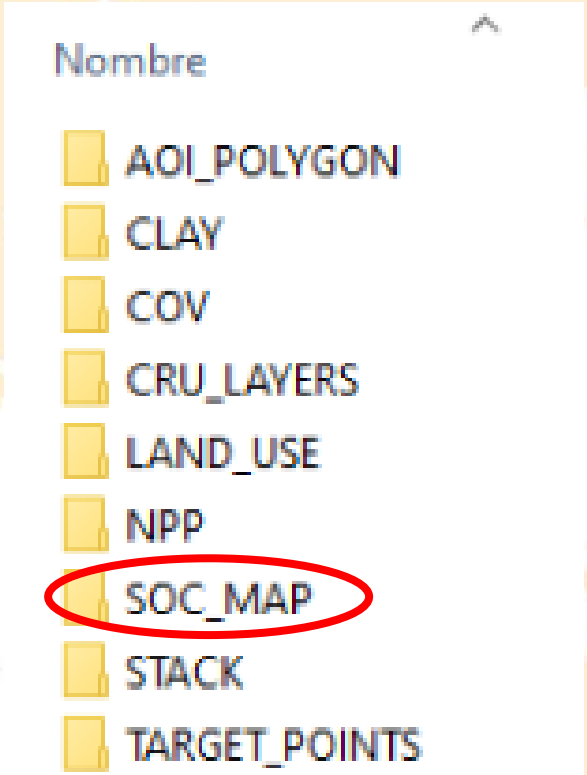
- MIAMI_MODEL_NPP_MIAMI_MEAN_81-00.R

- This script generates three input layers for WARM UP phase



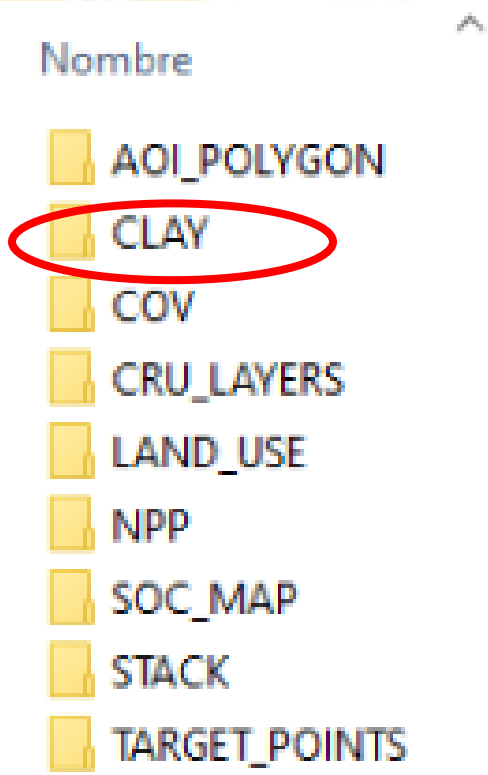
Script number “0” - Soil organic Carbon

- SOC FAO
- Master Layer
- spatial resolution : 1 km x 1km / pixel



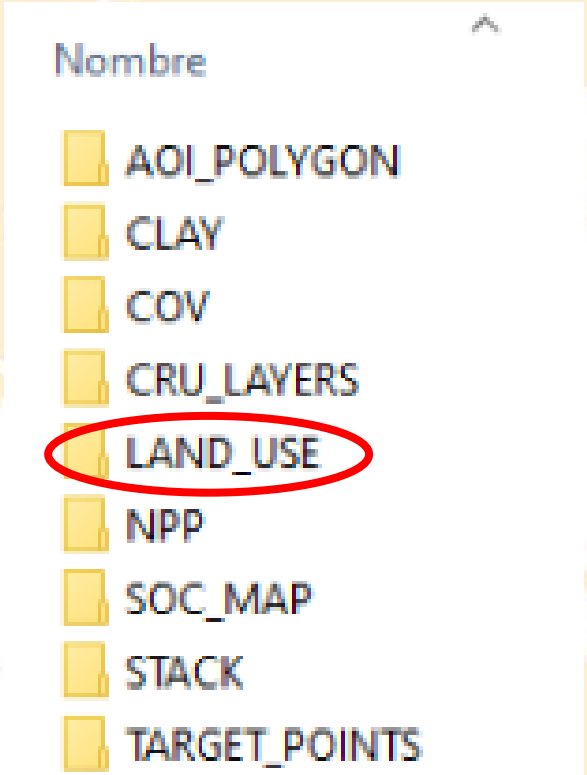
5_Script_CLAY_from_ISRIC
Clay Layer

- We need a clay layer in the first 30 cm
- Unit : %
- Proposed source . ISRIC
- We will use four layers and we will generate a weighted average



6_Land_Use_ESA_to_FAO_classes
Land Use

- Proposed land use/cover source : ESA
- We can use different yearlyland use layers to simulate the land use change
- All the classes must match those of FAO land use classes

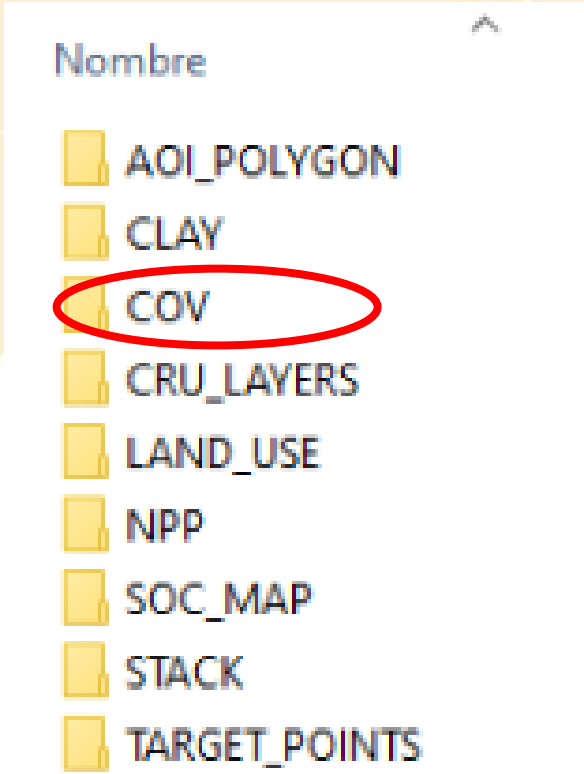


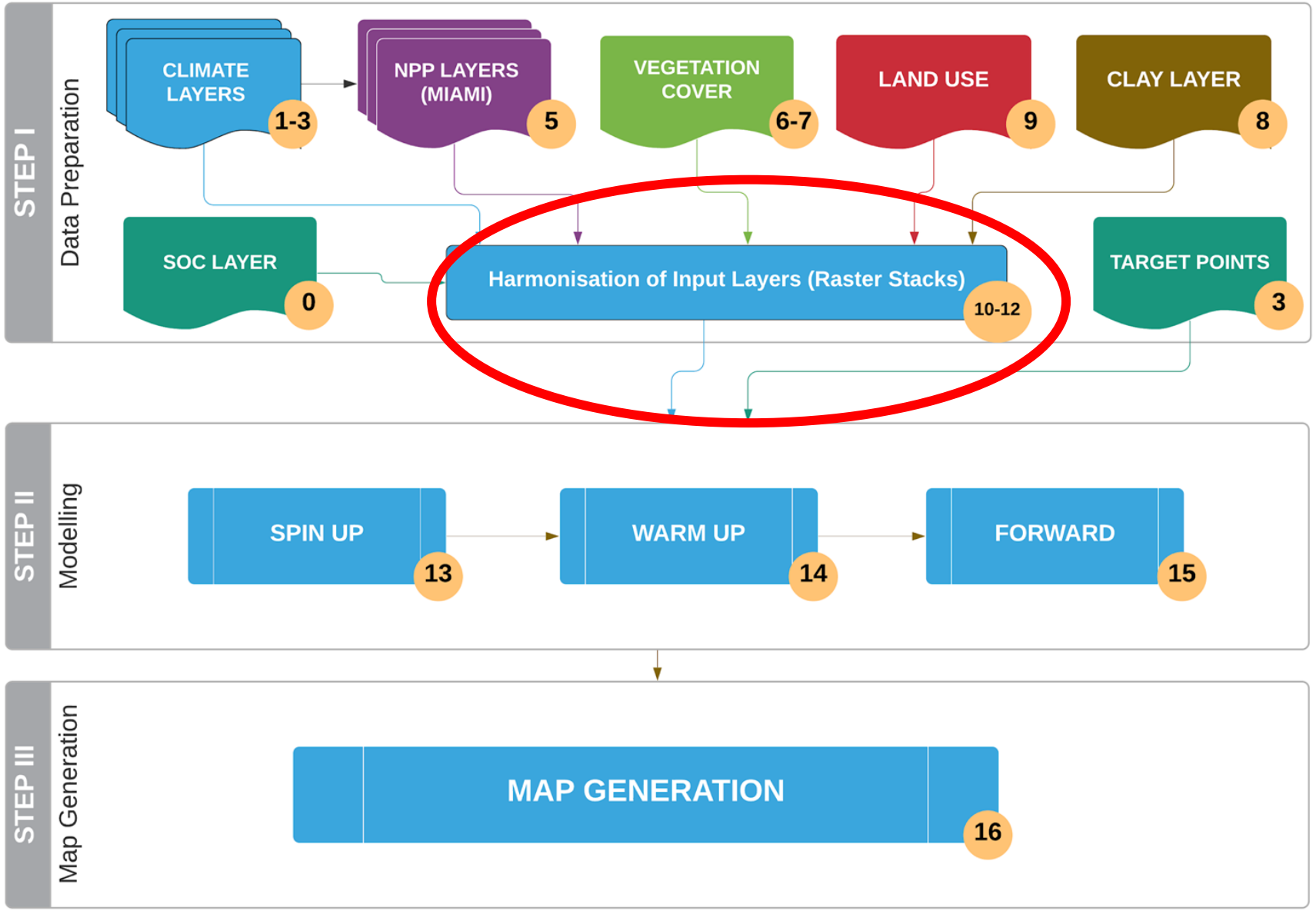
- # 0 No Data
- # 1 Artificial
- # 2 Croplands
- # 3 Grassland
- # 4 Tree Covered
- # 5 Shrubs Covered
- # 6 Herbaceous vegetation flooded
- # 7 Mangroves
- # 8 Sparse Vegetation
- # 9 Baresoil
- # 10 Snow and Glaciers
- # 11 Waterbodies
- # 12 Treecrops
- # 13 Paddy Fields

Vegetation cover from Google Earth Engine

- Google earth engine account
- Copy the script and paste it in the code editor
  - https://code.earthengine.google.com/

- Loop (one for each month)
- Save them to a google drive account
- Download them

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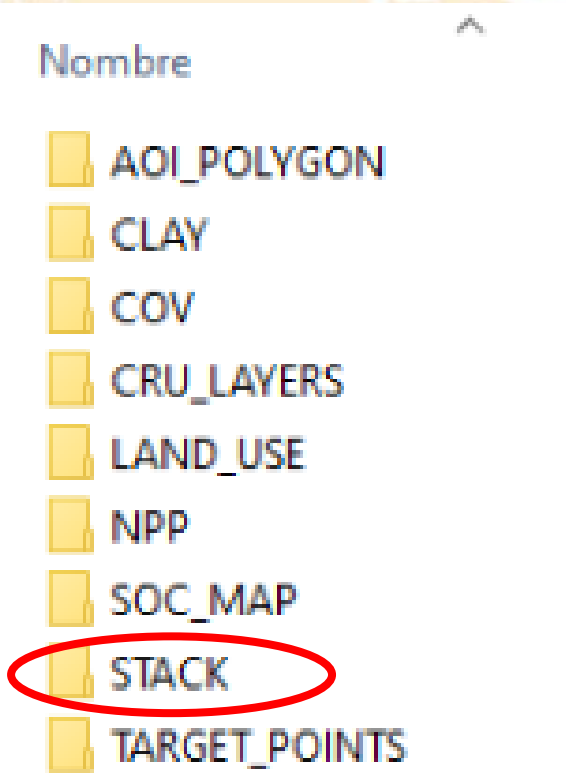
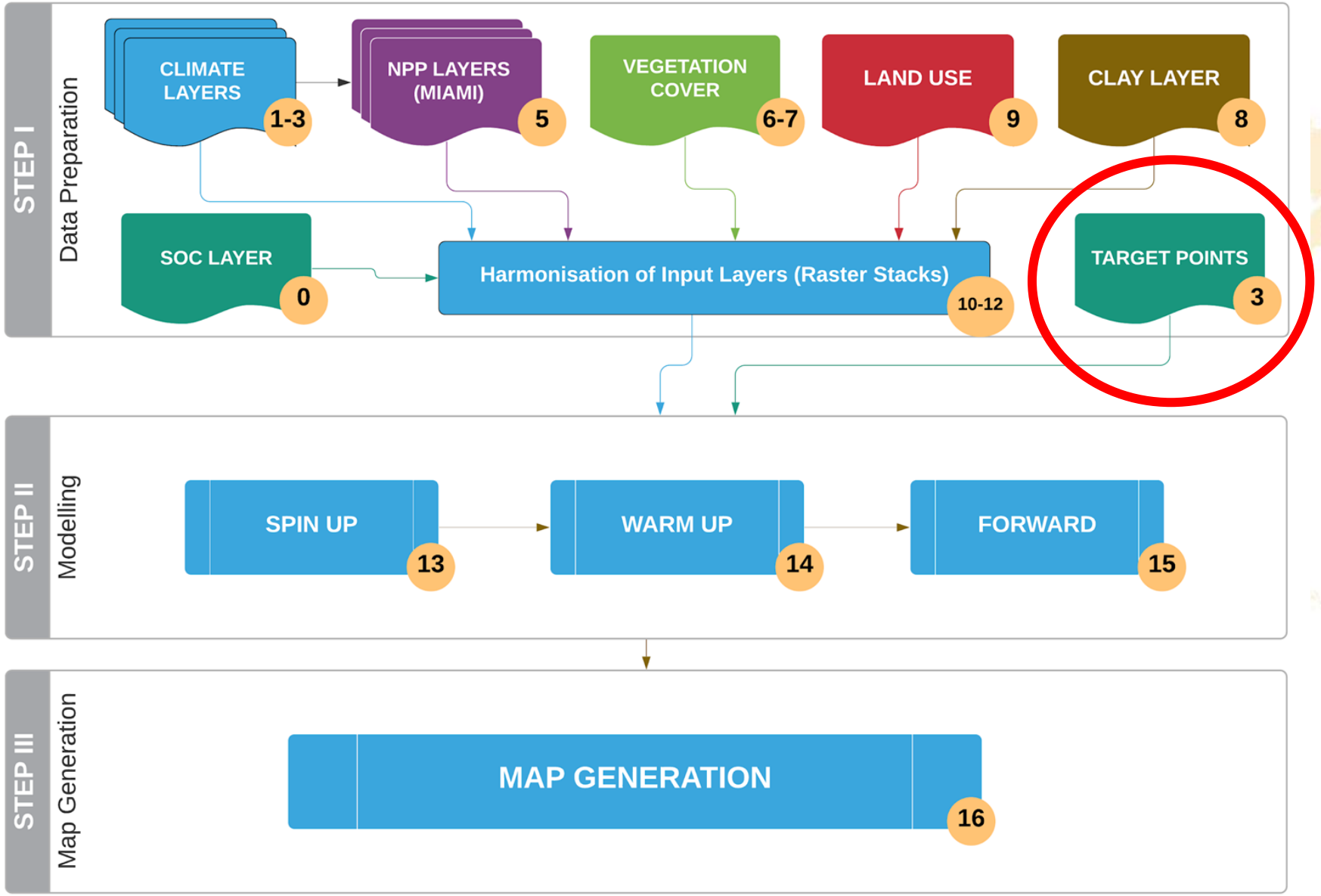
Harmonization of layers. Raster stacks creation

- All data needed for each process will be stacked to a single multiband raster file.
- SPIN_UP_STACK_V2.R
- WARM_UP_STACK_V3.R
- FOWARD_STACK.R

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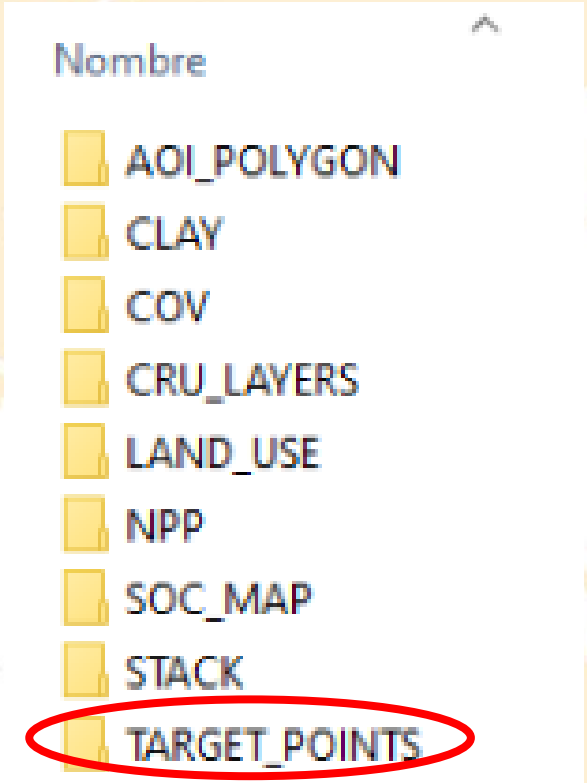
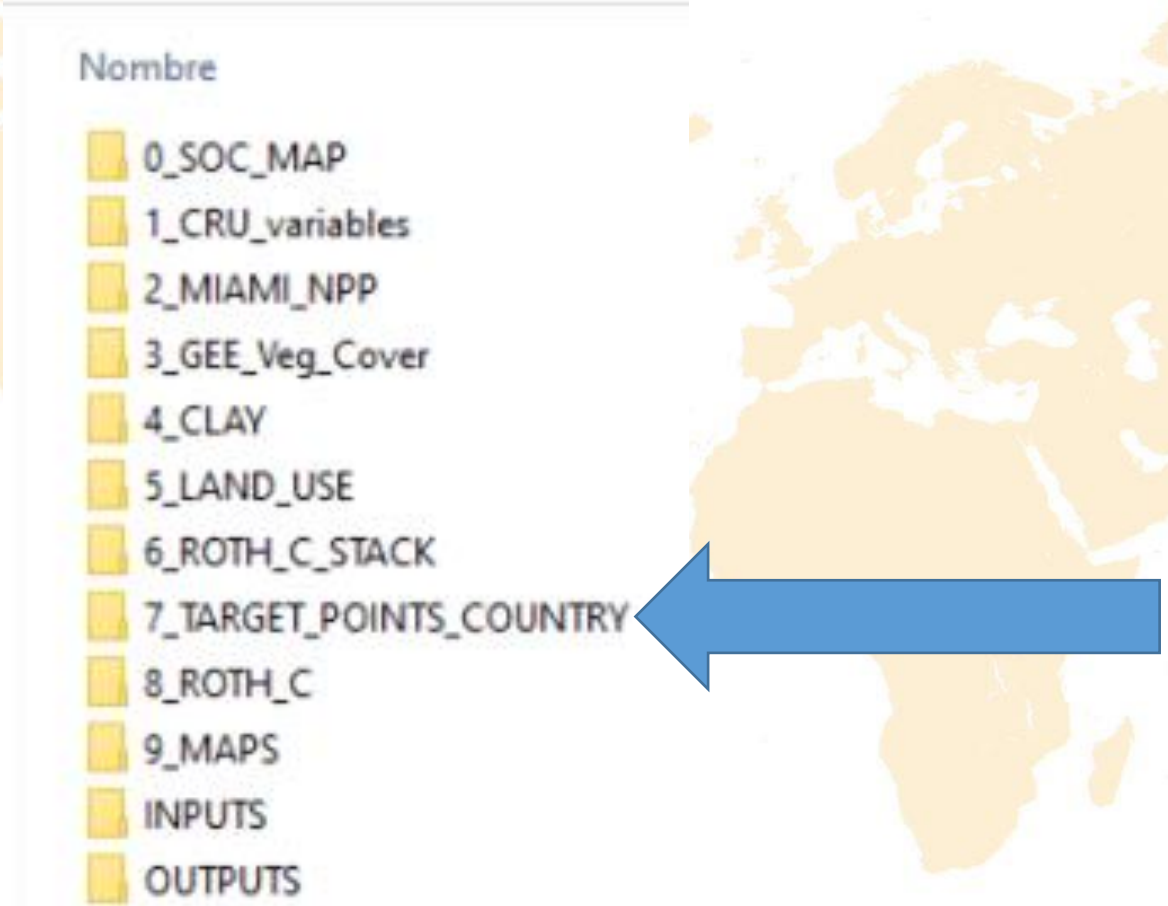
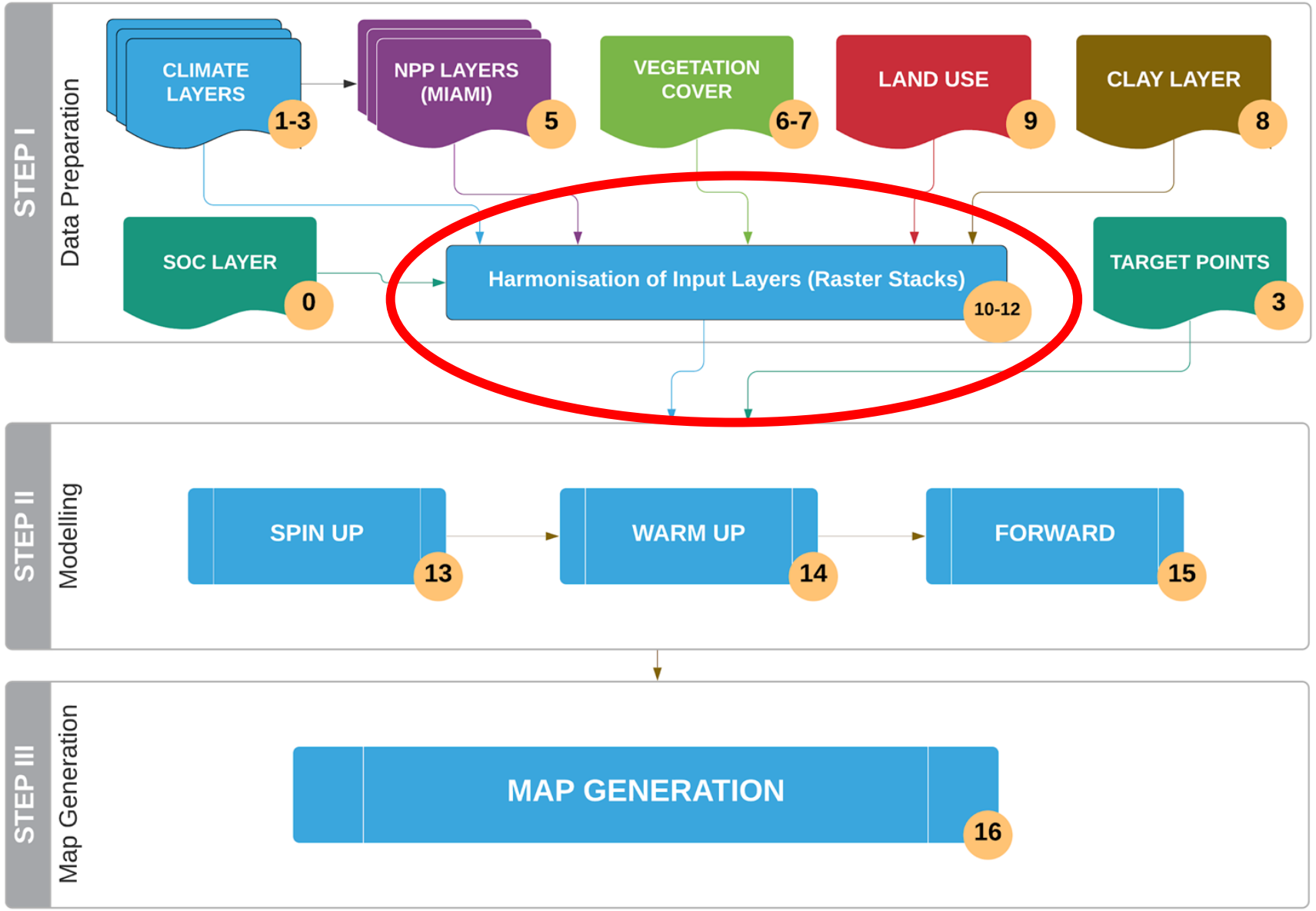
Target Points creation

- Scrip 10





Global Soil Organic Carbon Sequestration Potential Map GSOCseq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