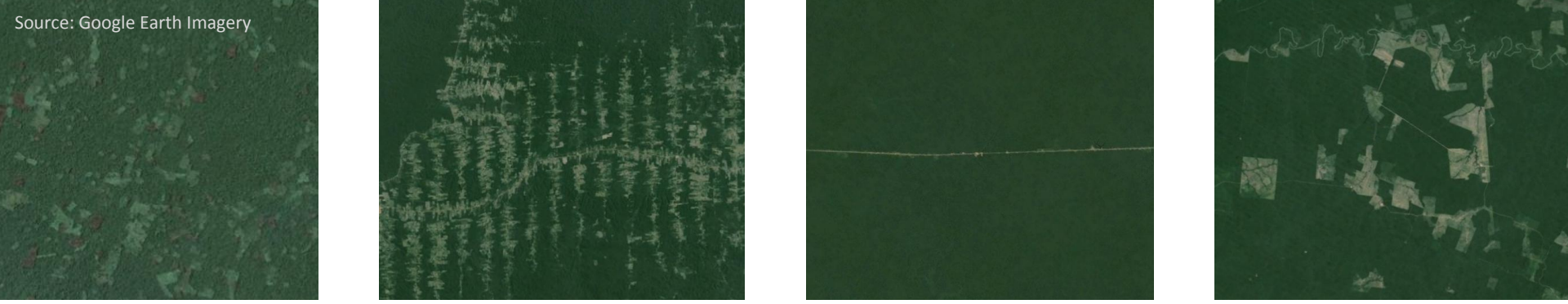

"Mapping spatial patterns of deforested areas monitored by Terra-i and GFC datasets" (Hands-on)

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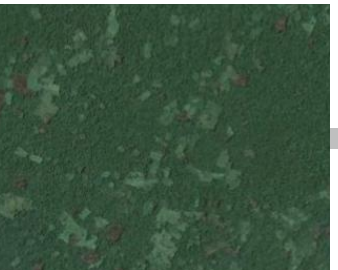
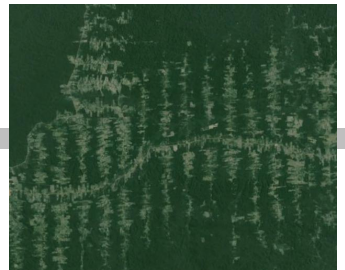
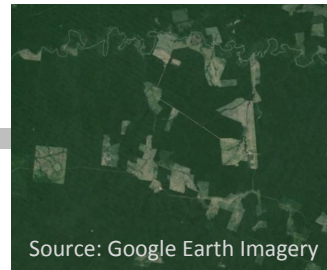
Hands-on content

- Software requirements
- Inputs
- Performing a spatial patterns mapping analysis
  a. Preprocessing input data and project settings
  b. Extract detection data using non-overlapping grid objects (fishnet)
  c. Extract FRAGSTAT-like metrics
  d. Create a training set
  e. Perform machine learning analyses
  f. Explore machine learning results
  g. Export and visualise machine learning results
- Results & Interpretations



Software

- **Software that must be installed.:**
  a. R version 3.2.2 (main programming language)
  b. FRAGSTAT version 4.2 (to extract landscape ecology metrics)
  c. Geospatial Modelling Environment (GME) (to generate non-overlapping grids or fishnet adjusted to detection raster). Version varies according to the ArcGIS version installed.
  d. ArcGIS v10.x
- **The following software are optional**:
  a. QGIS latest version (cartography and visualise results)
  b. RStudio (IDE for programming and running R scripts)

Inputs

- RASTER (geoTIFF format)
  a. Terra-i and GFC deforestation detection grids:
     - Annual detections (consolidated years);
     - Grid values must be reclassified as 4 (2004), 5 (2005), ……., 13 (2013);
     - For the aim of calculating areas-like metrics, projected projections must be applied (i.e. equal-area projections such as the Interrupted Goode Homolosine Projection or Lambert Azimuthal Equal Area)
- VECTOR (ESRI shape format)
  a. Target area
     - In projected projection as used by the deforestation grid
- FRAGSTAT (FCA file format)
  a. Metrics to extract (class and landscape level) must be selected.
  b. Distance-like metrics values must be defined according to the target area extent
  c. (OPTIONAL) If edge contrast and similarity index like metrics are extracted, their associated CSV files must be added in the fragstat settings file

Preprocessing Input Data

- BOUNDARY (STUDY AREA) VECTOR
  a. Project the target layer to a projected projection (e.g. IGH);
  b. Create a buffer (suggested to 50 km) from the target layer;
  c. Create a polygon based on the spatial extent of buffered target layer (in ArcGIS, Minimum Bounding Geometry (Data Management). Then select the "Envelope". Use the group option if there are multiple polygons to create a unique polygon).
- DETECTION GRIDS (For the aim to compare Terra-i and GFC datasets, a relation of 1 Terra-i = 8 GFC pixels can be assumed reprojecting and adjusting their spatial resolution to 240 m and 30 m, respectively)
  a. Crop detection grids
     - Reproject the boundary layer created in the previous step to WGS84
     - Using only the files with WGS84 projection, crop the reclassified Terra-i and GFC datasets using the boundary vector (*ArcGIS* > *Extract by Mask* function selecting the snap option to avoid pixels displacement)
  b. Project to the same projected projection used for the boundary vector:
     - The Terra-i dataset using a cell size of 240m
     - The GFC dataset using a cell size of 30m but aligning pixels to Terra-i projected raster (use snap option).

Preprocessing Input Data

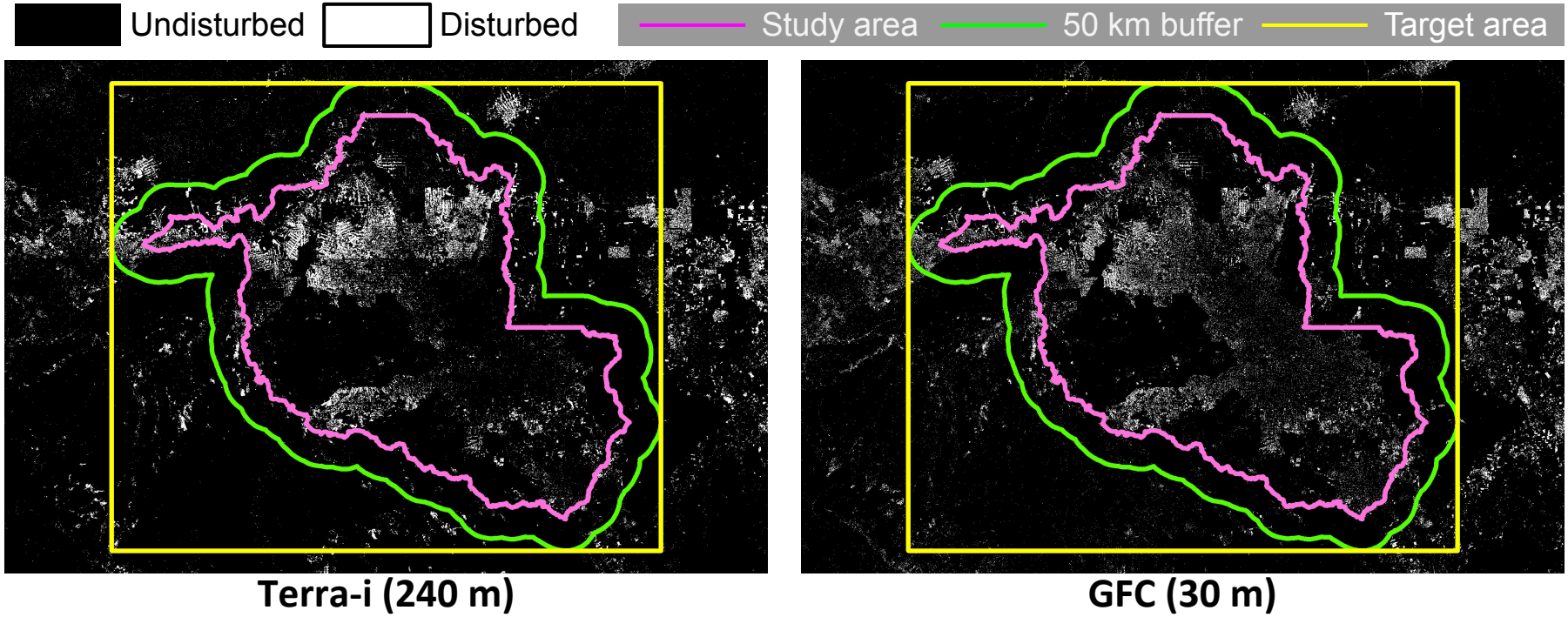


Fig 1. Example of definition of a target area to create fishnet vector layers for pattern analysis

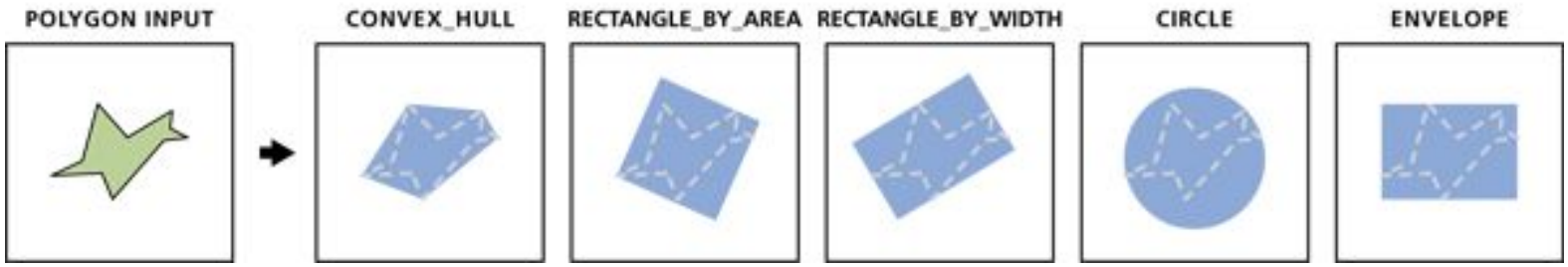
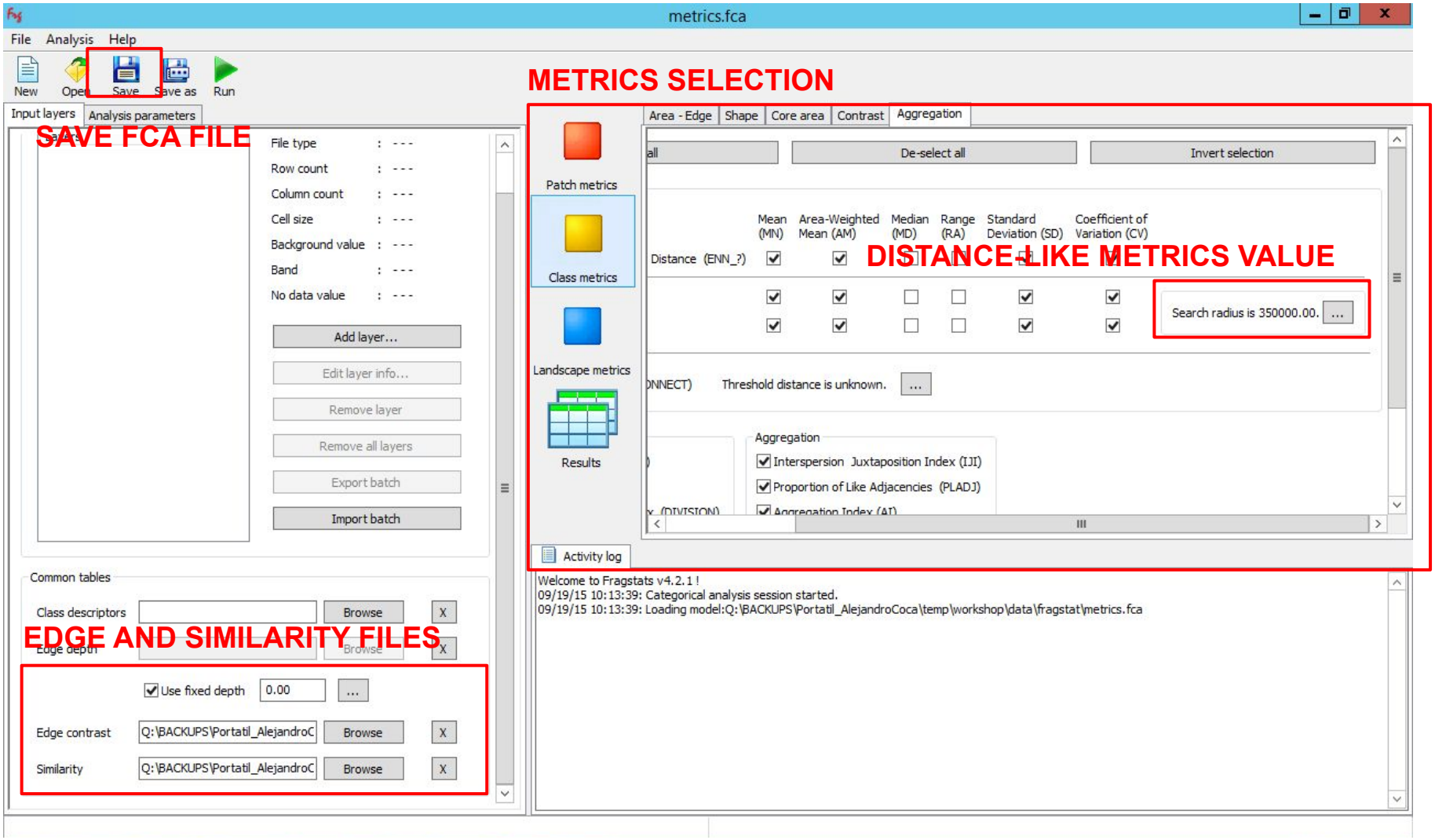


Fig 2. Arc's Minimum Bounding Geometry (Data Management) output geometric types

Settings: Create/Edit a FRAGSTAT file



Settings: Project folder and config file

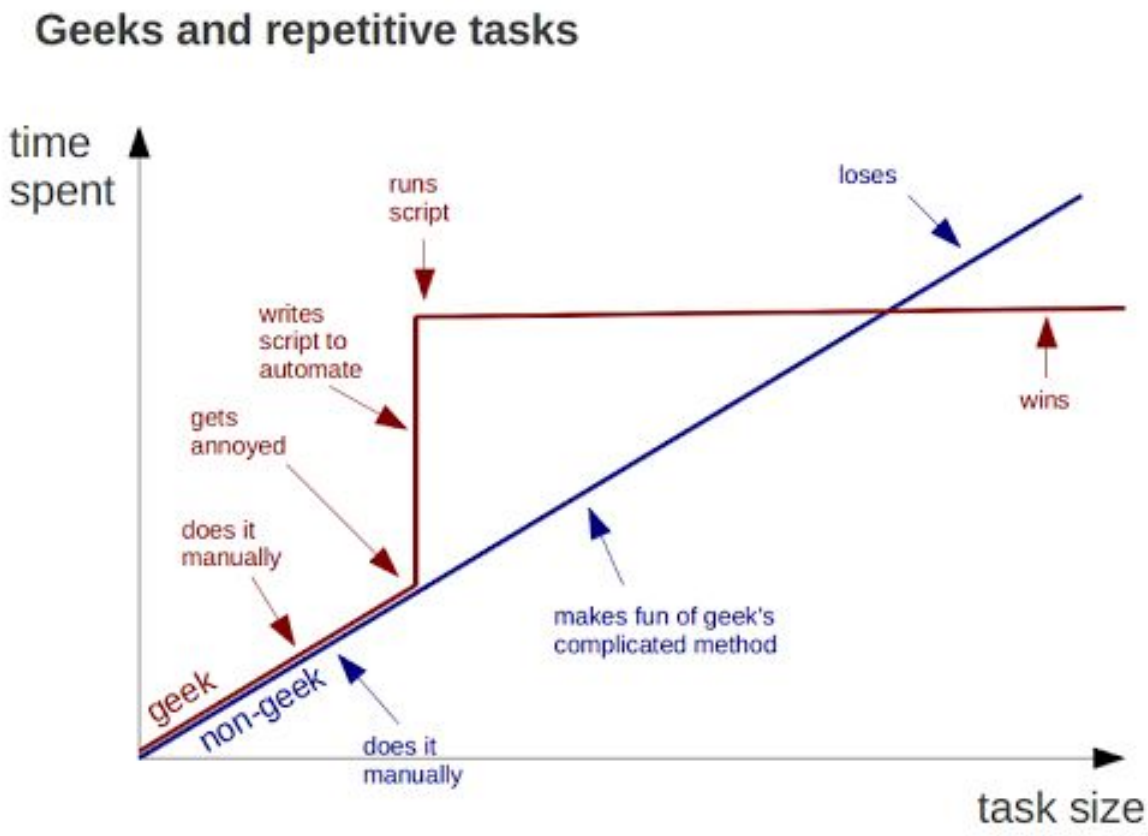
1) Create the project folder and copy the conf folder containing the conf.file
2) Edit the conf.file

conf.txt - Notepad

File Edit Format View Help

```
Bogota; September 2015
########################

########################
Paths
########################
path = E:/terra-i/data/temp/test

########################
Analysis period
########################
det.ini = 4
det.end = 13

########################
Geodata projection
########################
proj.acronym = IGH
proj.CRS = +proj=goode +lon_0=0 +x_0=0 +y_0=0 +ellps=WGS84 +units=m +no_def

########################
Fishnet
########################
fishnet.sizes = 15360;30720;61440

########################
Fragstat
########################
fragstat.exe = C:/Fragstats4/frg.exe
fragstat.fca.file =  Q:/BACKUPS/Portatil_AlejandroCoca/temp/workshop/data/fragstat/metrics.fca
class.metrics = CA;PLAND;PD;ED;AREA_MN;AREA_CV;AREA_SD;LSI;SHAPE_MN;SHAPE_AM;FRAC_MN;FRAC_AM;PARA_MN
land.metrics = NA

########################
DM models using k-fold CV
########################
CV.n.repeats = 10
CV.n.resampling = 10
################################################
```

Proof-of-concept “Pattern Analysis” tool



Source: “Why writing code saves you time with repetitive tasks”, by Bruno Oliveira

- using R programming language
- tool consists of **code snippets (modules and functions)** that are inserted and called in a **master code** file
- Step-by-Step approach
- Tasks are performed by individual grid file generated using the fishnet which allows parallel processing

“Pattern Analysis” tool

1) Run first lines up to Part 1
   a) Register the path containing R scripts
   b) Register the full path to the config.file
   c) Install and load R-libraries

2) Run by step (part) and verify outputs