How does MoFuSS work?

A Ghilardi, J-F Mas, U Olivares

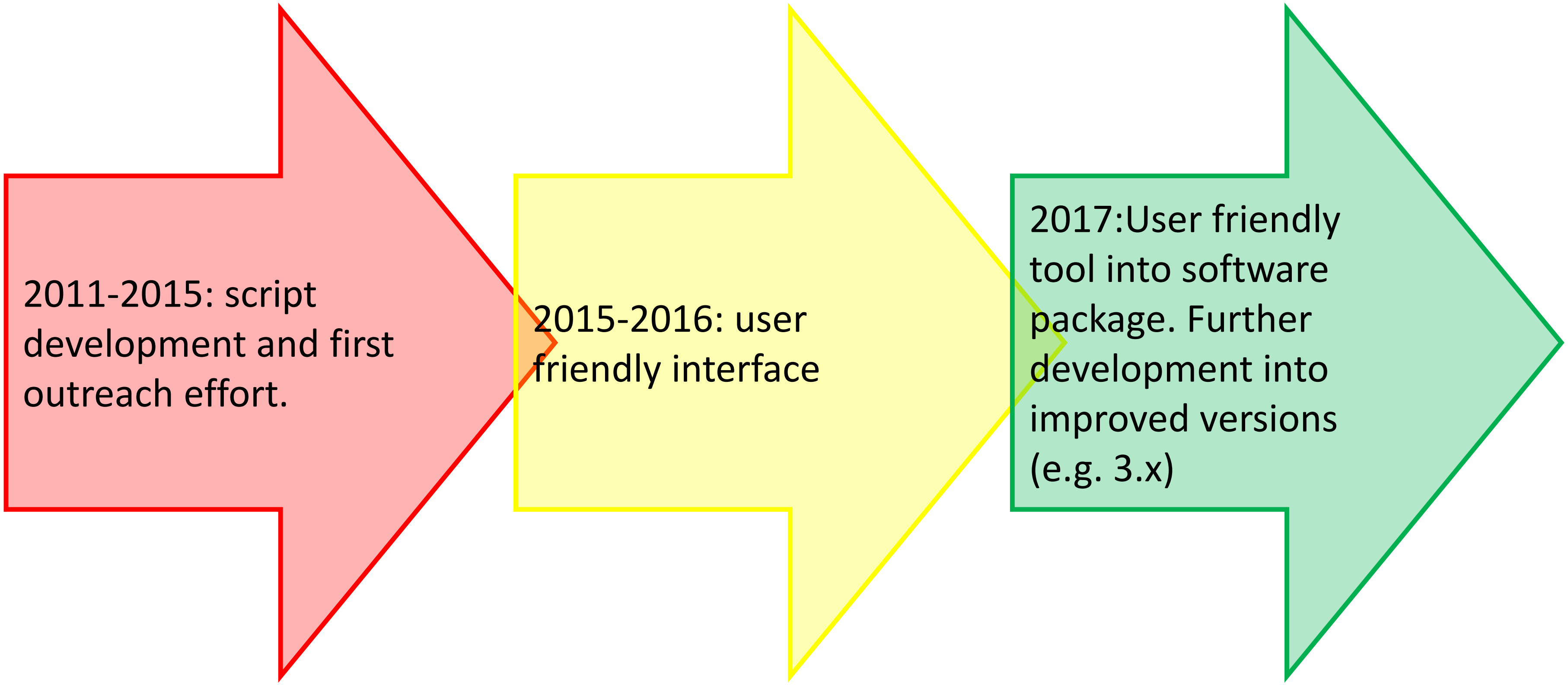
MoFuSS v1.0 Training Course 2016

El Jadida, Morocco September 3-4

www.mofuss.unam.mx/course-2016/

Is MoFuSS a software?

- Not yet a software, but a bunch of scripts willing to be a software.



Freeware "code interpreters"

Environment for Geoprocessing Objects

DINAMICA Project

R

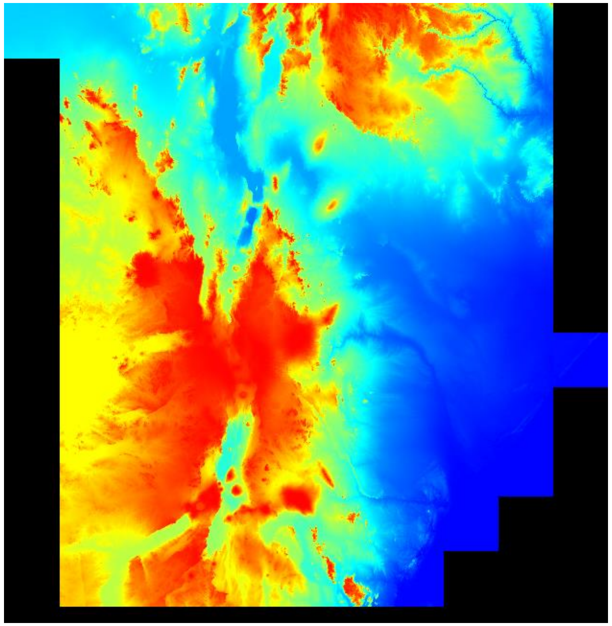
The LaTeX Project

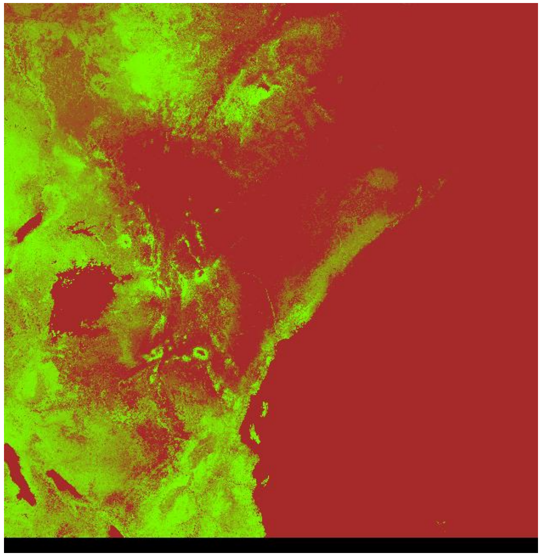
FFmpeg

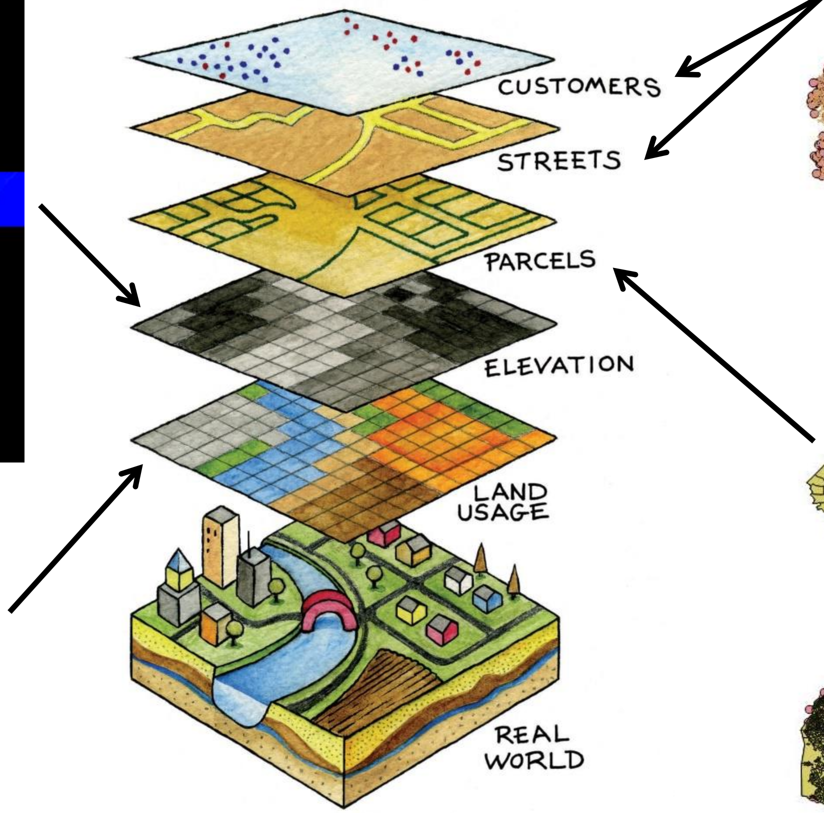
MoFuSS allows six levels of interaction with the user:

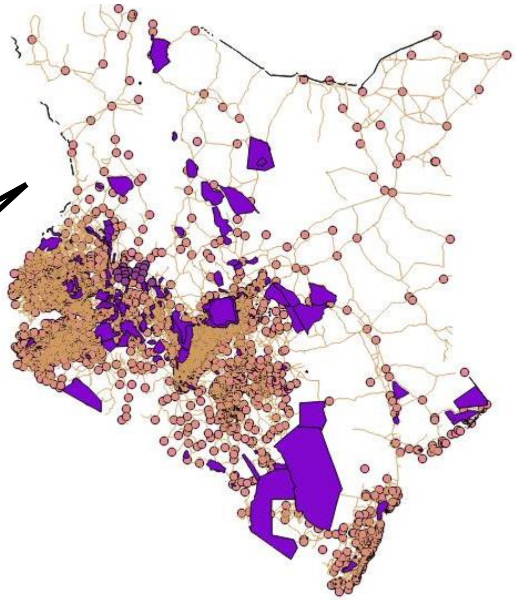
- LEVEL 1: Query global Tier 1 estimates using a web-based map: http://redd.ciga.unam.mx/webtool/
- LEVEL 2: Run MoFuSS in fully default mode for a user-defined study area.
- LEVEL 3: Users can alter a small set of input parameters related to woodfuel demand in Business as Usual and Intervention scenarios.
- LEVEL 4: Users can tune most built-in model parameters using locally available data
- LEVEL 5: Add alternative maps (i.e. GIS layers) available for the study area
- LEVEL 6: Modify and/or add inner geoprocessing operations to account for site-specific processes

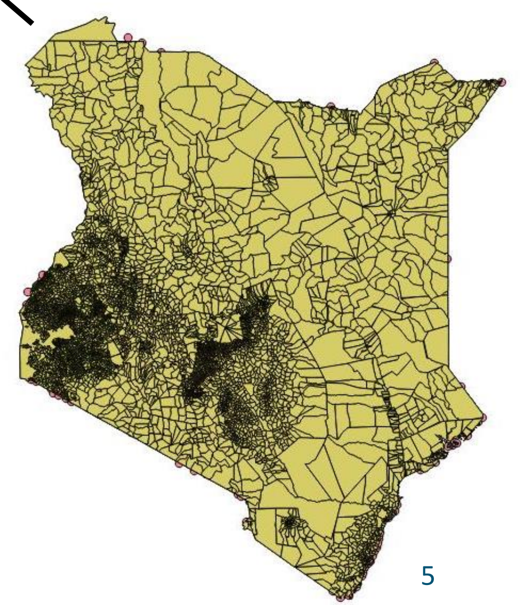
Step 1: Harmonizes all vector and raster input data: *projects, resamples, rasterizes, crops, etc., etc.*











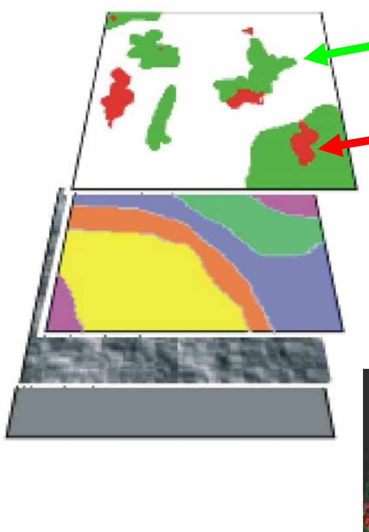
Using **multiple cores** to speed up calculations

Parallel computing

- MoFuSS frequently takes advatage of multi-core processing.
- And sometimes of *multi-computer* processing.

Remainder: Go to processor monitor

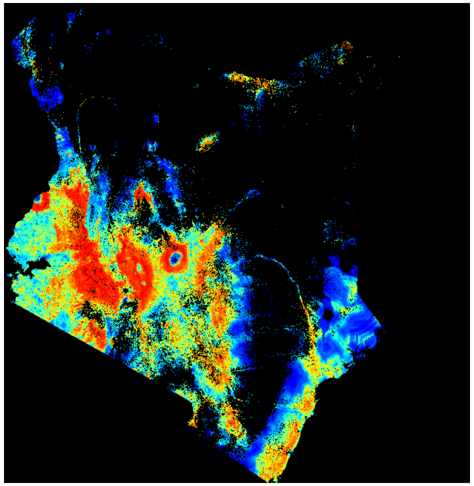
Step 2: Simulates future events of forests *loss* and *gain*, based on past observations and spatial relationships.

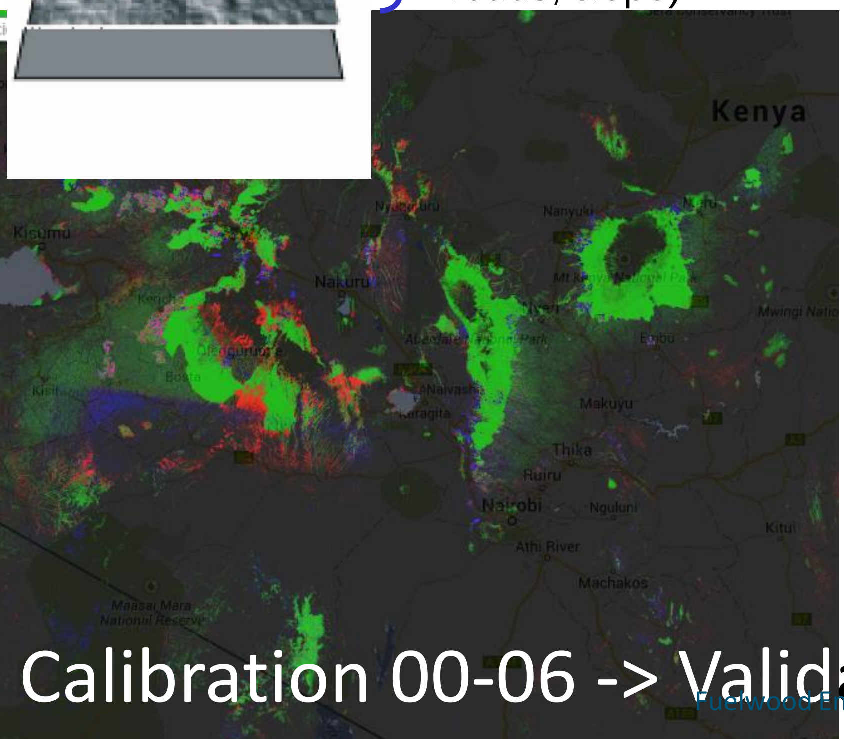


Forest

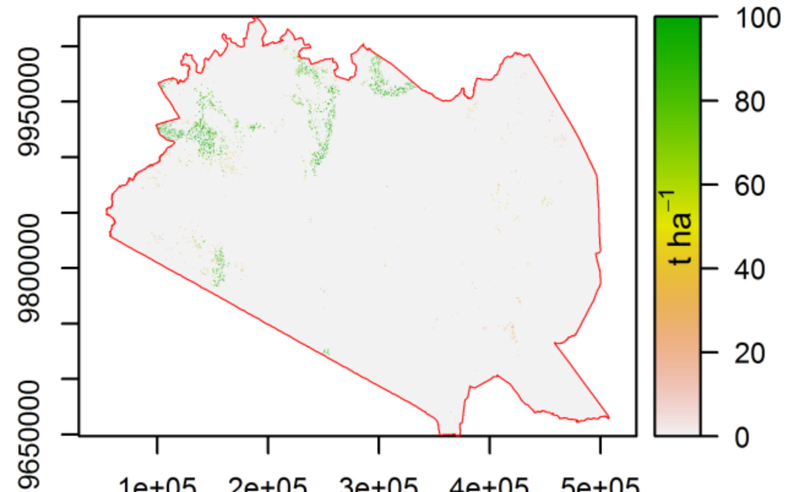
Forest loss event

Spatial relation between events and "explicative" variables (e.g. distance to roads, slope)



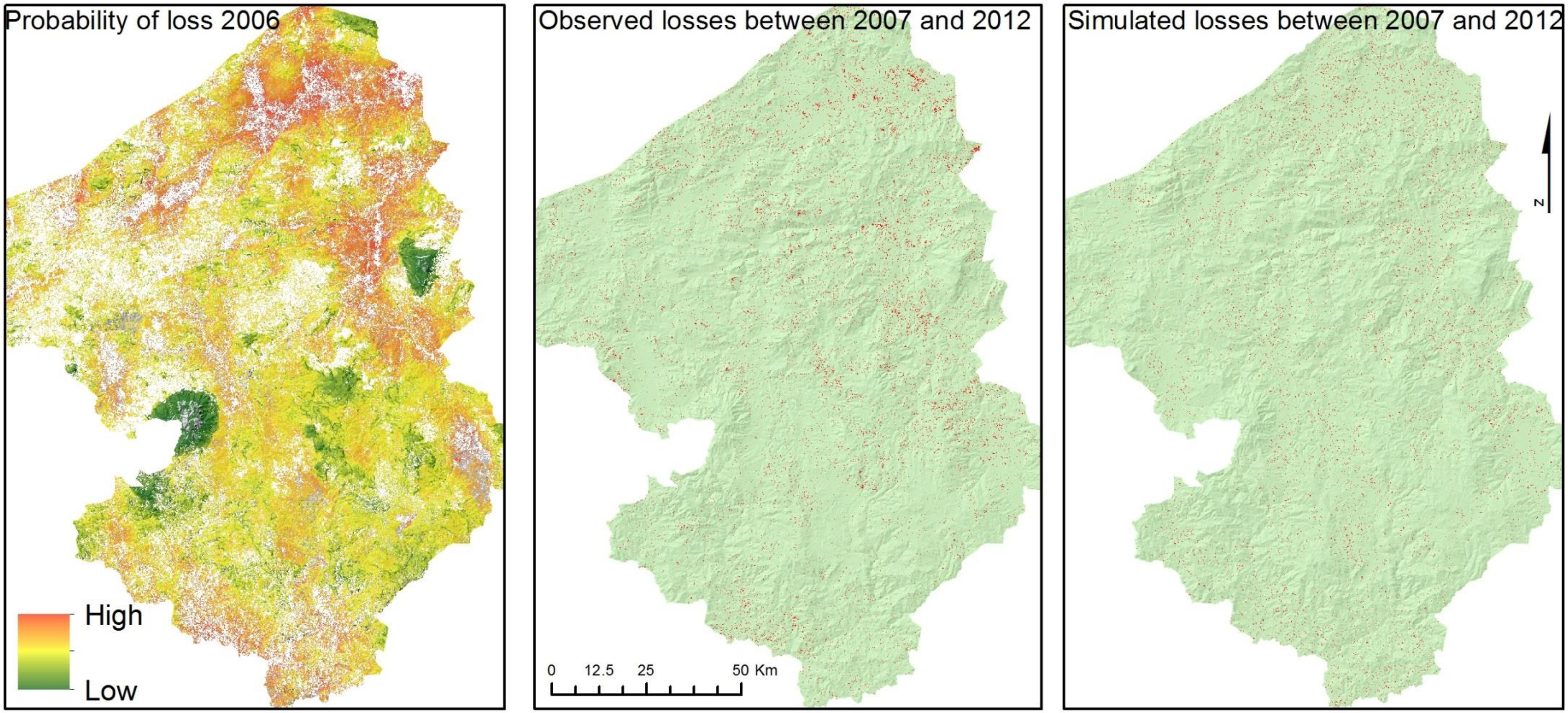


Fuelwood from deforestation: period 2000 to 2030



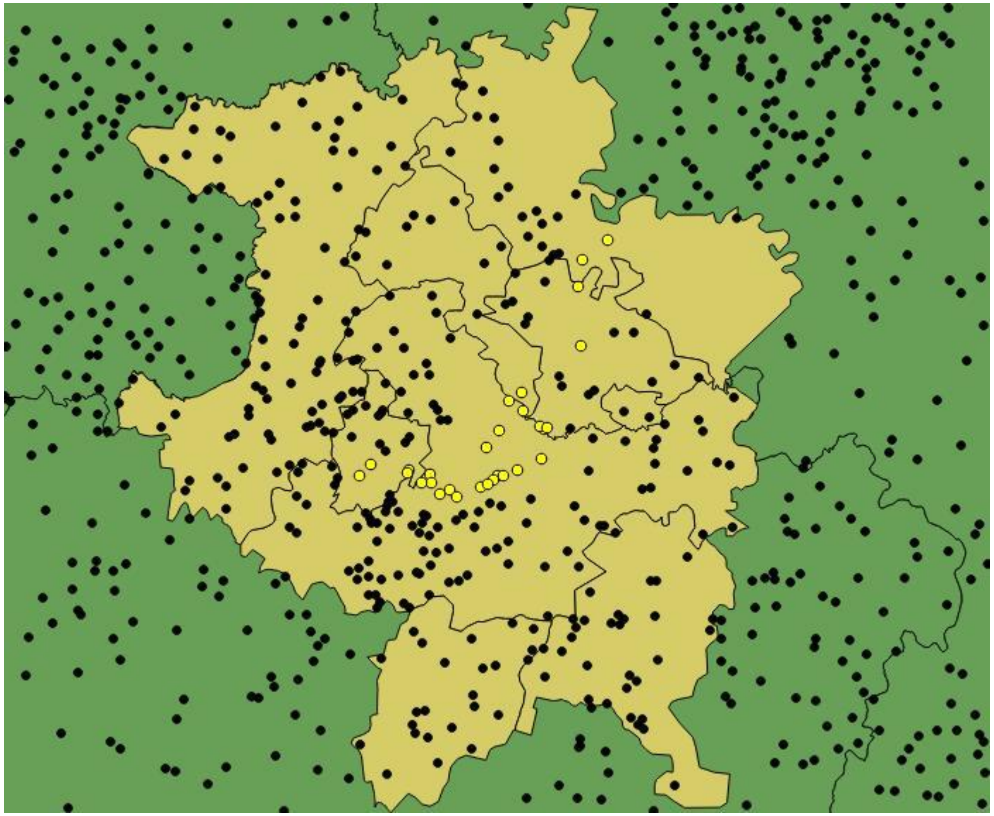
Calibration 00-06 -> Validation 06-12 -> Simulation 12-30

Step 2: Validate trends in forest loss and gains not necessarily related to woodfuel (Prospective Landscape Simulation submodel)



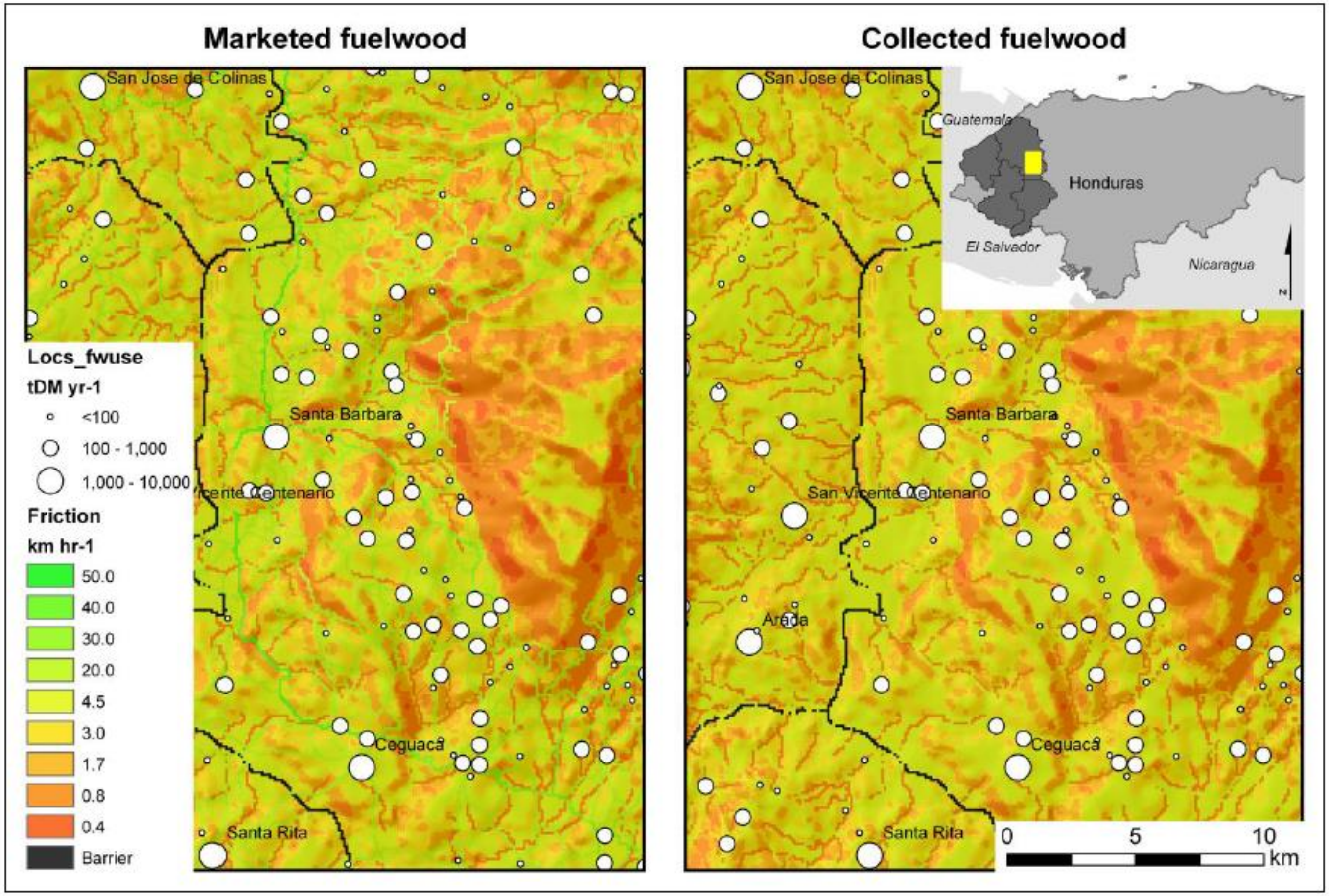
Step 3: Clip & process selected localities

- To account for fuelwood-driven degradation within selected localities of interest



Step 4: Friction maps

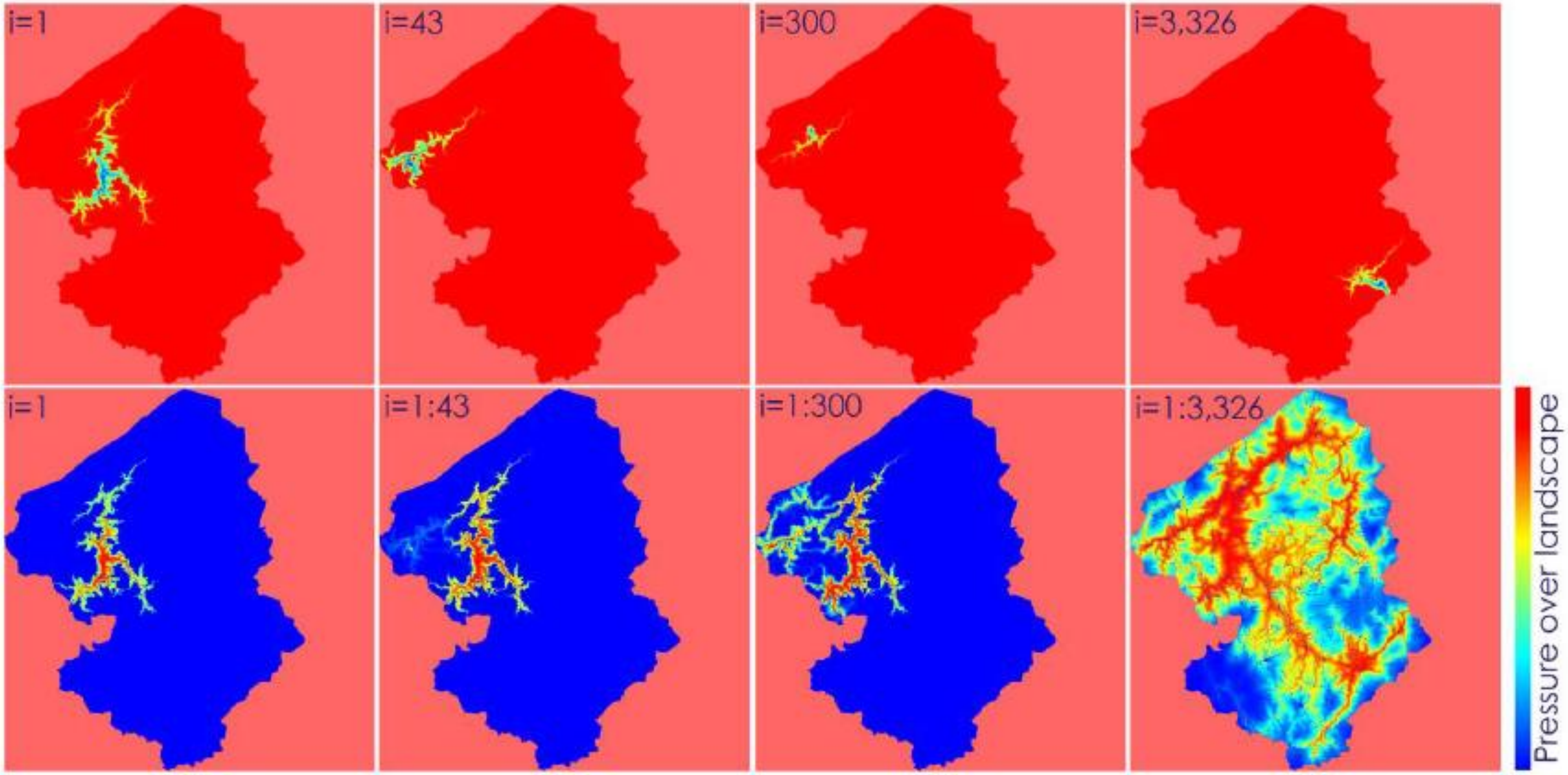
Figure A.3. Friction maps for driving (marketed) and walking fuelwood collectors



Notes: Velocities are actually added as impedance values in s m^{-1}, but we express them here in km hr^{-1} for the sake of clarity.

Step 5: Woodfuel harvest *"pressure maps"*

Figure A.4. Schematic representation of the modified IDW interpolator

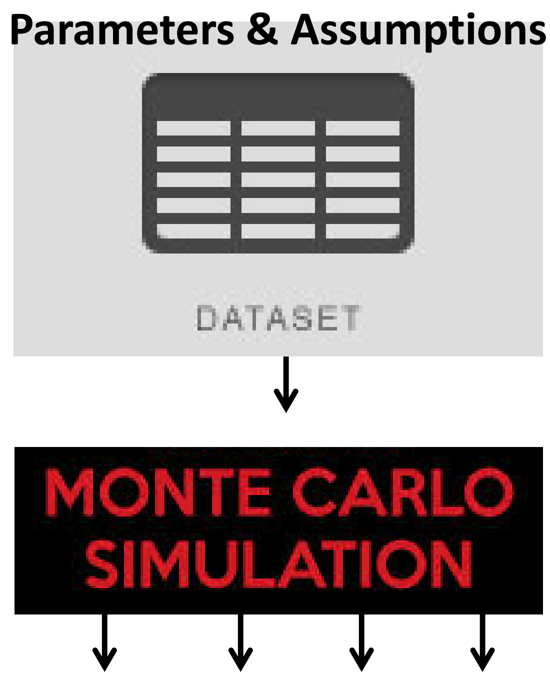


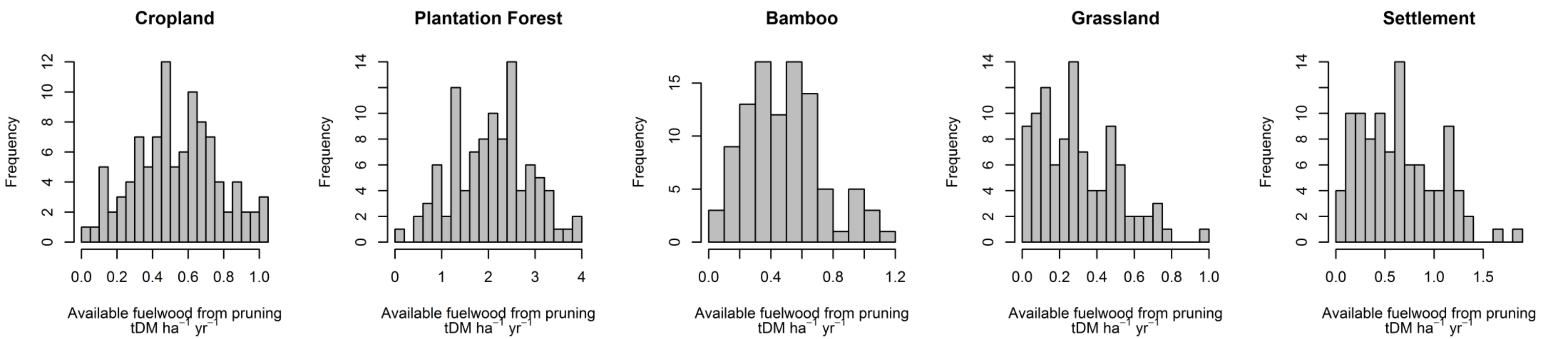
Notes: A travel limit of one hour was set for the sake of clarity. Only commercial wood sellers who use vehicles are considered. "1:n" corresponds to the sum of all cost maps between 1 and n using the IDW algorithm (lower row); even though only a few single cost maps are shown (upper row).

Step 6: Landscape simulations of alternative scenarios

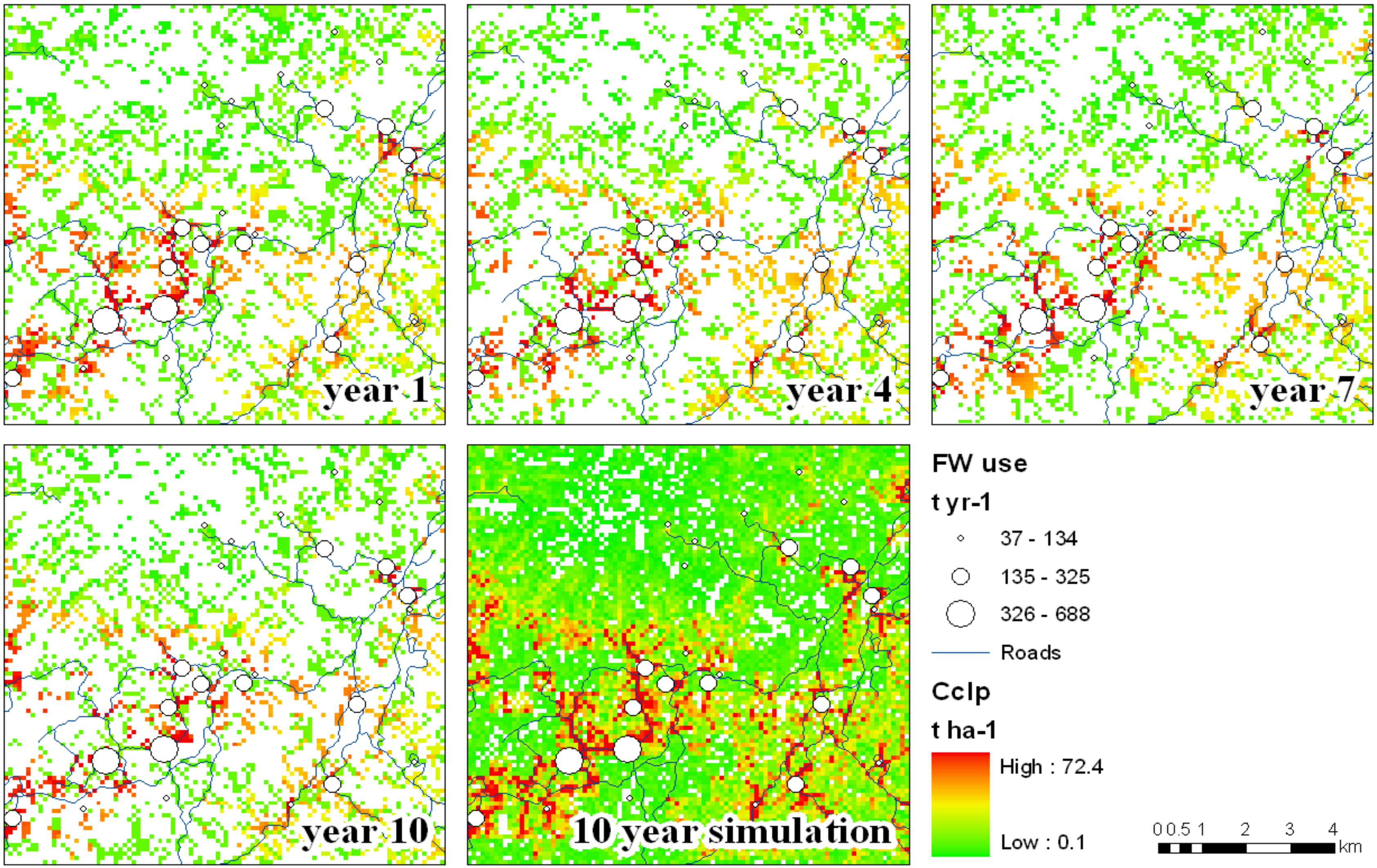
- This is the core modeling script, where woodfuel supply and demand interact.
- Is more complex than the rest consisting on multiple R, FFmpeg and LaTeX scripts apart from Dinamica EGO ones.
- Is the only one that should be worked with when developing alternative scenarios.

Step 6: Integrates uncertainty of many input parameters:

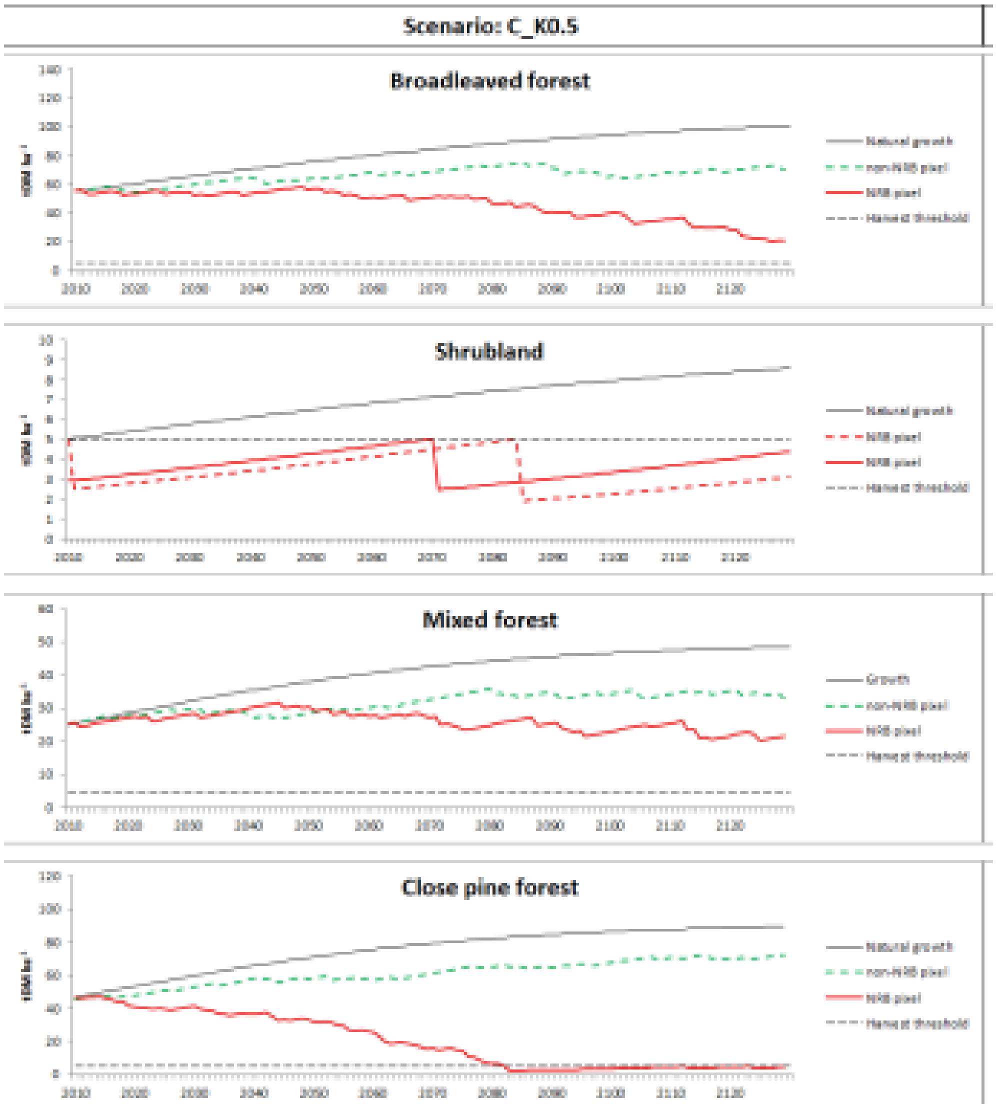




Step 6: Integrates tunable degrees of stochasticity in collection patterns, driven by preassure maps (Step 5).

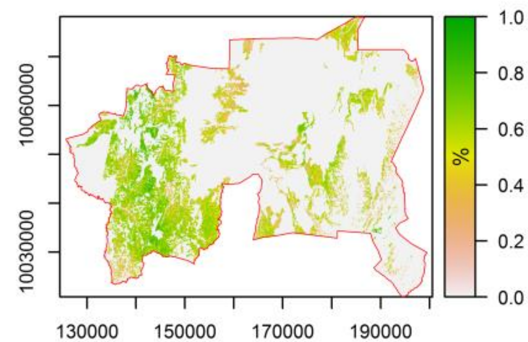


Step 6: Estimate the expected response of the vegetation to disturbance in terms of AGB growth.

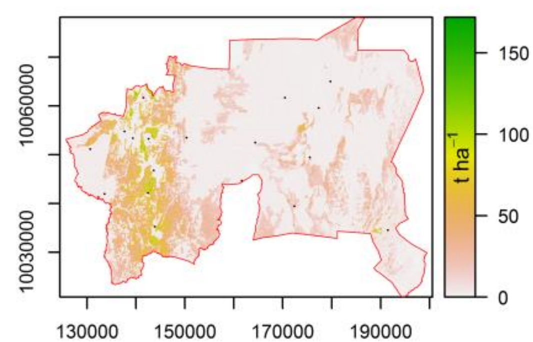


Example of *response of vegetation* to fuelwood extracion at **pixel level**

fNRB: period 2000 to 2030

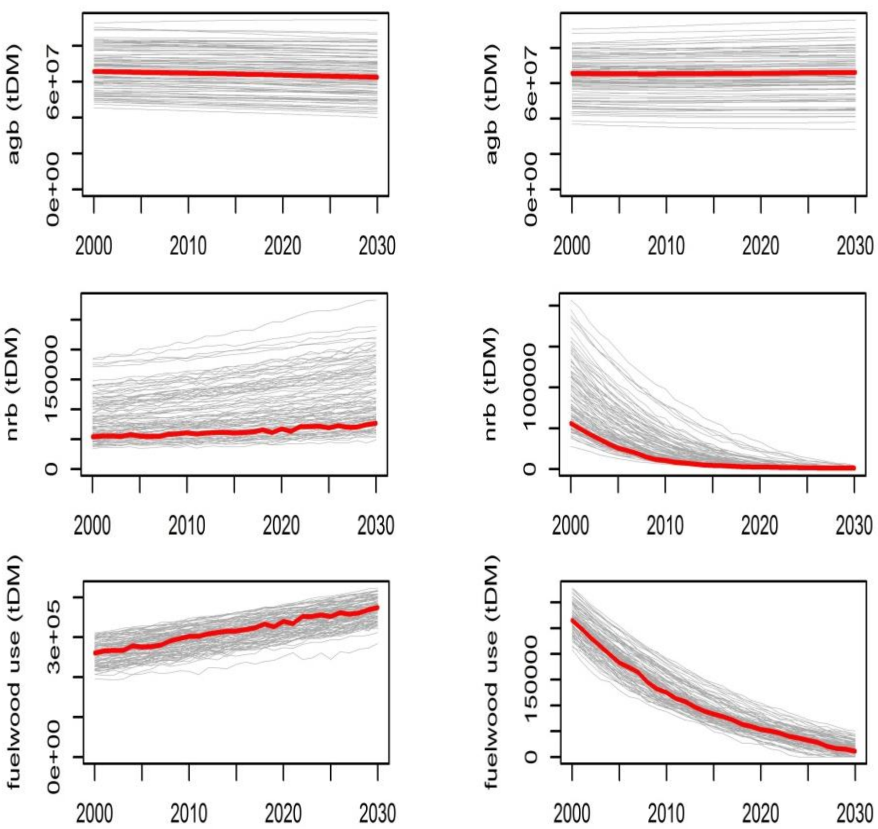


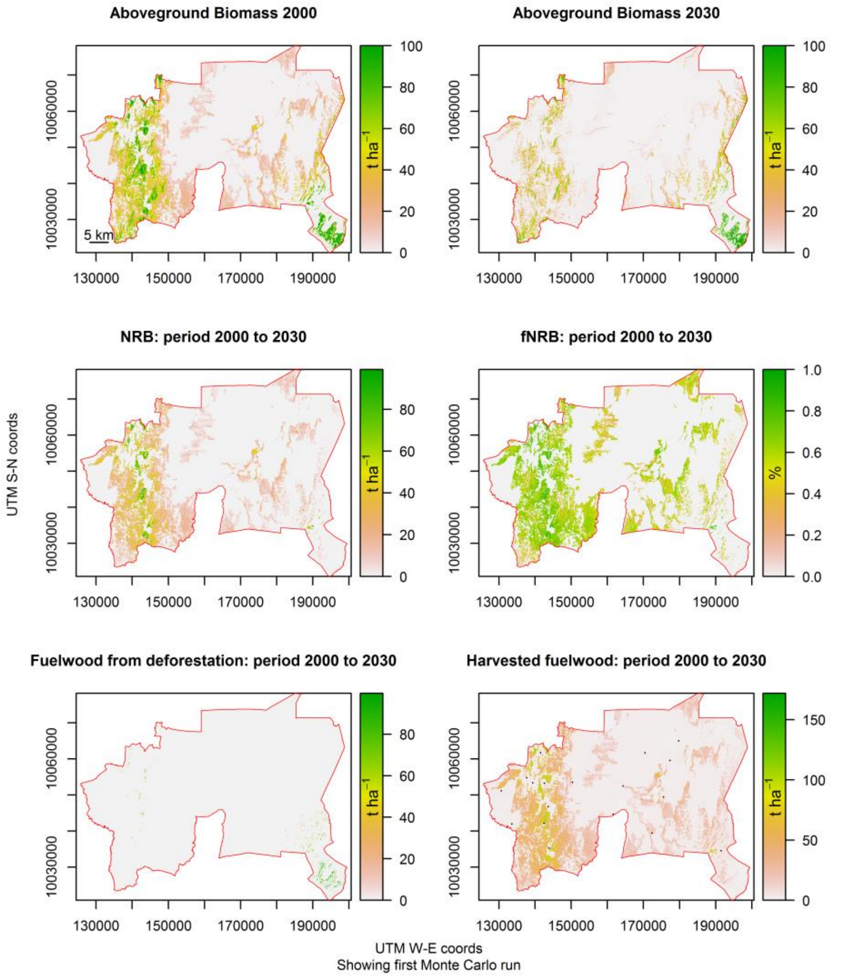
Harvested fuelwood: period 2000 to 2030



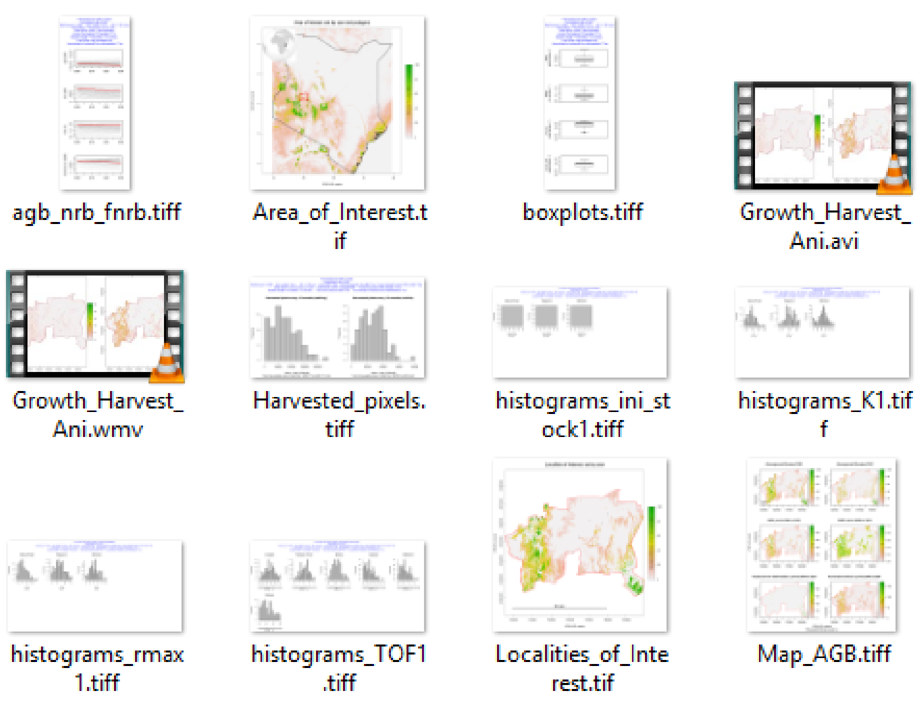
Step 6: Create scenarios and compare the effect of interventions that reduce fuelwood consumption.

Business as Usual **vs** Clean Cookstoves





Step 6: Produces tables, graphs, maps, animations and a pdf report for key results. Save all other results as tables and geotiff maps.



Summary table of key results by administrative unit

	NOM_MUN.x	NRB_MC_mean	NRB_MC_sd	CON_TOT_MC_mean	CON_TOT_MC_sd	CON_NRB_MC_mean	CON_NRB_MC_sd	fNRB	fNRB_sd	fNRB_nrb	fNRB_nrb_sd
1	Platón Sánchez	26509.14	190.79	38084.16	345.17	36839.24	59.48	0.70	0.01	0.72	0.01
2	Jaltocán	7775.19	459.62	11098.57	36.05	10624.64	338.14	0.70	0.06	0.73	0.07
3	Huejutla de Reyes	53999.44	368.03	85192.20	388.64	78686.61	1145.10	0.63	0.01	0.69	0.02
4	Huazalingo	1490.96	207.87	8843.66	45.20	6700.07	647.45	0.17	0.14	0.22	0.17
5	Atlapexco	1130.20	279.92	5695.52	99.10	4368.91	133.09	0.20	0.25	0.26	0.25
6	Chiconamel	1733.38	133.49	2681.17	90.71	2575.84	99.95	0.65	0.08	0.67	0.09
7	Chalma	22355.90	990.83	31591.36	418.97	30378.05	857.12	0.71	0.05	0.74	0.05
8	Chiconamel	17007.43	310.82	23424.19	1.26	22687.65	292.42	0.73	0.02	0.75	0.02
9	San Felipe Orizatlán	27854.90	1126.65	47628.07	270.61	44371.54	1056.53	0.58	0.04	0.63	0.05

Note:
NRB_MC_mean and NRB_MC_sd are average and standard deviation of NRB values for all Monte Carlo realizations per choosen administraive unit.
CON_TOT_MC_mean and CON_TOT_MC_sd are average and standard deviation of fuelwood use for all Monte Carlo realizations per choosen administraive unit.
CON_NRB_MC_mean and CON_NRB_MC_sd are average and standard deviation of fuelwood use driving degradation for all Monte Carlo realizations per choosen administraive unit.
fNRB and fNRB_sd are the fraction of non−renewable biomass and its standard deviation respectively for all Monte Carlo realizations per choosen administraive unit.
fNRB_nrb and fNRB_nrb_sd are the fraction of non−renewable biomass and its standard deviation respectively, but only accounting for fuelwood use driving degradation.

Table automatically generated by NRBv1.0, but the script producing this table is still in its Beta version

Impa

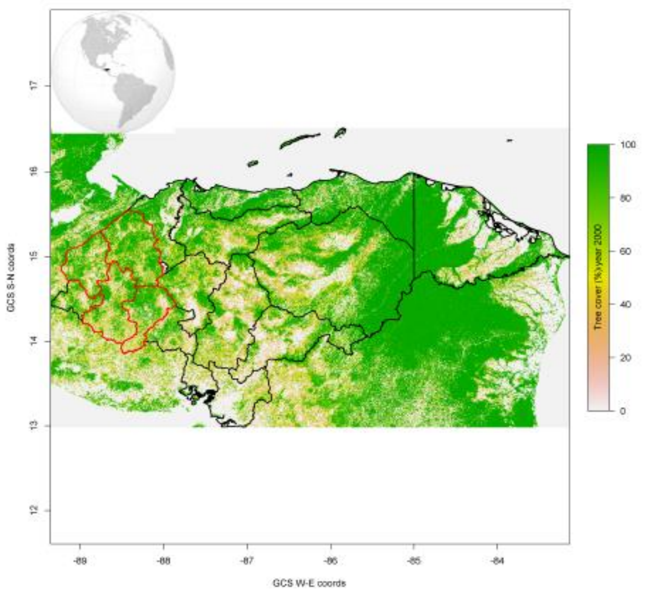
Spatiotemporal modeling of fuelwood environmental impacts: towards improved accounting for non-renewable biomass

MoFuSS: Modeling fuelwood savings scenarios - version 1.0

Summary Report for Honduras

This is an automated report generated by Mofuss. The present document summarizes main results of the model for the red polygon in the map shown here below.
Mofuss was ran by Your Name Surname, from Your Department and/or University in the city of Ås, Norway, on February 7, 2016.

Area of Interest: set by user (red polygon)



Project funded by:

Many more parameters can be tuned in its current version.

Table 1. Model inputs and parameters (*continued*)

	#	Input dataset	Type of data†	Mandatory/ Optional	Availability‡	Description
Non-Spatial Data	34	Harvest threshold walking	Integer value	mandatory	user defined	Minimum amount of AGB per pixel "attractive" enough for walking fuelwood collectors.
	35	Harvest threshold vehicle	Integer value	mandatory	user defined	Minimum amount of AGB per pixel "attractive" enough for driving fuelwood collectors.
	36	Harvestable pixels walking	Integer value	mandatory	user defined	Percentage of the landscape assumed to be visited by walking fuelwood collectors at each time step.
	37	Harvestable pixels vehicle	Integer value	mandatory	user defined	*Idem* but for driving fuelwood collectors.
	38	Harvestable pixels passing through Monte Carlo	yes/no	mandatory	user defined	If Yes, the percentage of the landscape assumed to be visited in each time step will vary randomly assuming a 100% SD.
	39	Prune factor for walking fuelwood collectors	Integer value	mandatory	user defined	A value that multiplies the number of all harvestable pixels with the highest pressure, to allow for an stochastic subsequent "re-selection". For example, a prune factor of 10 means that 10 times the amount of harvestable pixels with the highest pressure will be selected. Within this new sample, 10% of pixels will be randomly re-selected. Prune factor high values drive the seeding mechanism to fully stochastic while a prune factor equal to [illegible]
	40	Prune factor for driving fuelwood collectors	[illegible]	[illegible]	[illegible]	[illegible]
	41	Modified IDW exponent	[illegible]	[illegible]	[illegible]	[illegible] e or less concentrated around demand centers. Can [illegible] points.
	42	Modified IDW exponent passing through Monte Carlo	[illegible]	[illegible]	[illegible]	[illegible] Monte Carlo runs.
	43	Cost-distance passes	[illegible]	[illegible]	[illegible]	[illegible] tool. The higher the value, the most accurate results,
	44	Maximum distance for gathering fuelwood	[illegible]	[illegible]	[illegible]	[illegible] elled by vehicle or walking to gather fuelwood.
	45	Number of Monte Carlo histograms per figure for forests and woodlands	[illegible]	[illegible]	[illegible]	[illegible] d in each Tiff figure. Will depend on number of
	46	Number of Monte Carlo histograms per figure for TOF	Integer value	mandatory	user defined	*Idem*
	47	Re-run Monte Carlo	yes/no	mandatory	user defined	If NO, the same Monte Carlo datasets are used every time. Useful when comparing scenarios or conducting sensitivity analysis.
	48	Maps and animations switch	yes/no	mandatory	user defined	If NO, maps and animations (eventually time consuming) are not produced.
	49	Path to R.exe	string	mandatory	user defined	Path to R executable file, for 32 or 64 bit OS.
	50	Path to FFmpeg.exe	string	mandatory	user defined	Path to FFmpeg executable file, for 32 or 64 bit OS.
	51	Number of CPU cores	Integer value	optional	user defined	Number of CPU cores (physical or virtual) to be used by different modules.

† Almost any raster or vector format is accepted as NRBv1.0 uses the Geospatial Data Abstraction translator Library: www.gdal.org

‡Guesstimate based on global datasets accessible from the Internet.

48	Maps and animations switch
49	Path to R.exe
50	Path to FFmpeg.exe
51	Number of CPU cores

MoFuSSv2.0 (UNAM-SEI) wish list for 2017:

- User-friendliness:
  - Automatic reports
  - Easy "one-click" instalation
  - Manuals
  - Video tutorials and training webinars
  - Worldwide default datasets and parameters
  - A growing community of users
- Improved features:
  - Optimization algorithms to inform about cookstove deployment strategies
  - Multiple LULCC transitions
  - In ensemble with other drivers models. (e.g. fires and grazing from UFMG).
- Validation
  - Good-practice guidance for independent validation of results
- Dream on features
  - Coupled to behavioural change modeling


Image © 2013 DigitalGlobe
Image U.S. Geological Survey
© 2013 Cnes/Spot Image
lat 14.882802 long 88.273409° elev 223 m