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Modelling and forecasting tropical deforestation: advances and perspectives

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European Commission

cirad

1. Deforestation and demography in Africa
2. `forestatrisk` Python module
   - Specifications
   - Improvements
   - Model performance
3. Forecasting spatial deforestation spatially
4. Perspectives

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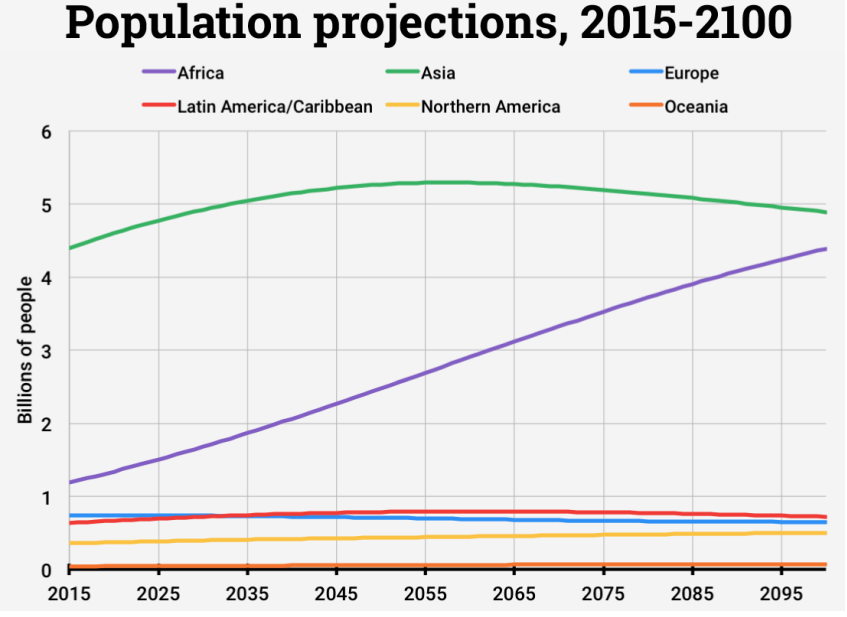
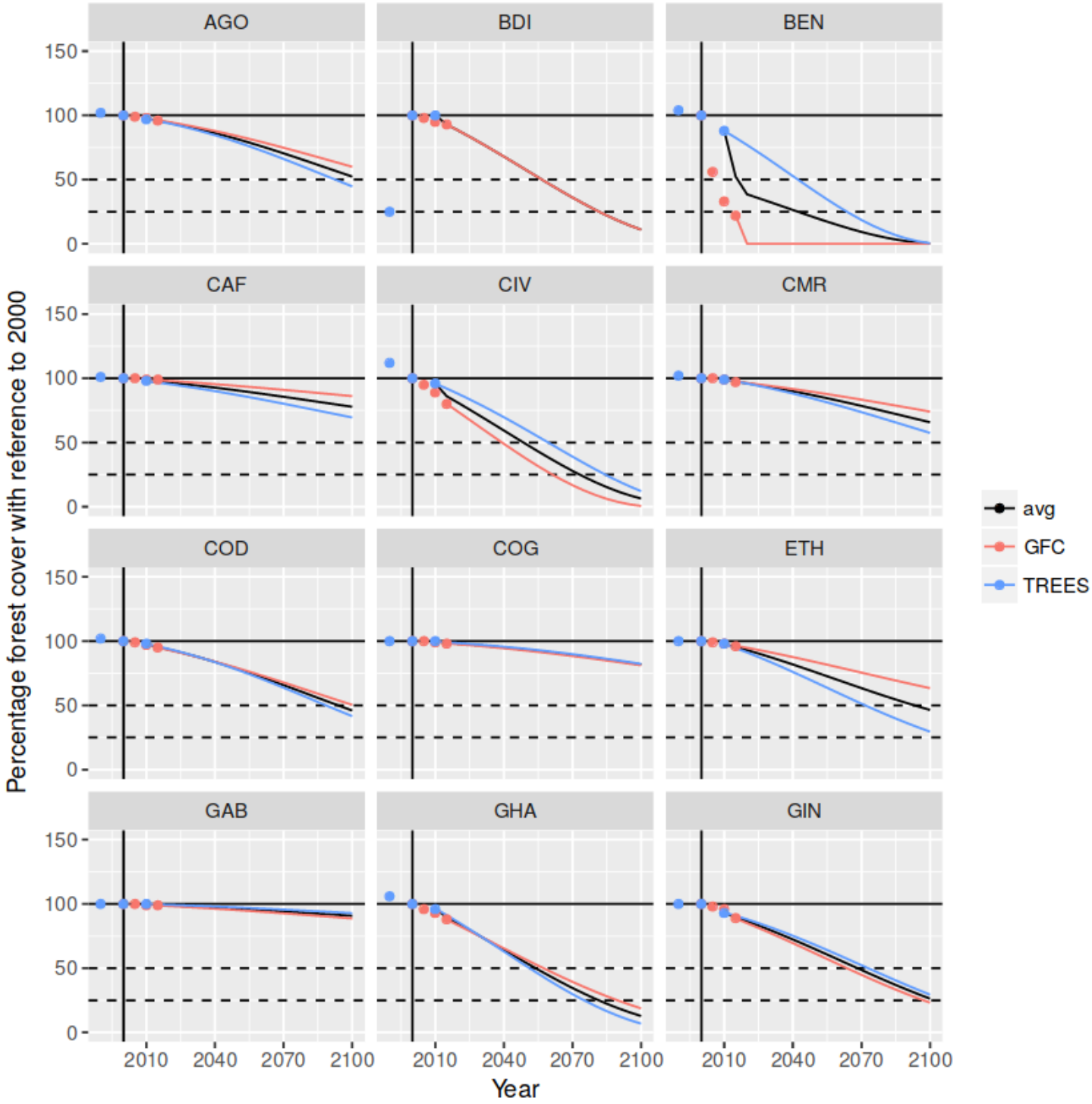
Deforestation and demography in Africa

- The fate of African tropical forests
- Associated to demographic explosion
- $\log D = \beta_0 + \beta_1 \log F + \beta_2 \log P$
- Data on deforestation :
  1. JRC : 1990-2000-2010
  2. GFC : 2000-2005-2010-2015
- Projection of forest cover in 2050, 2100




AGO
BDI
BEN
CAF
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ETH
GAB
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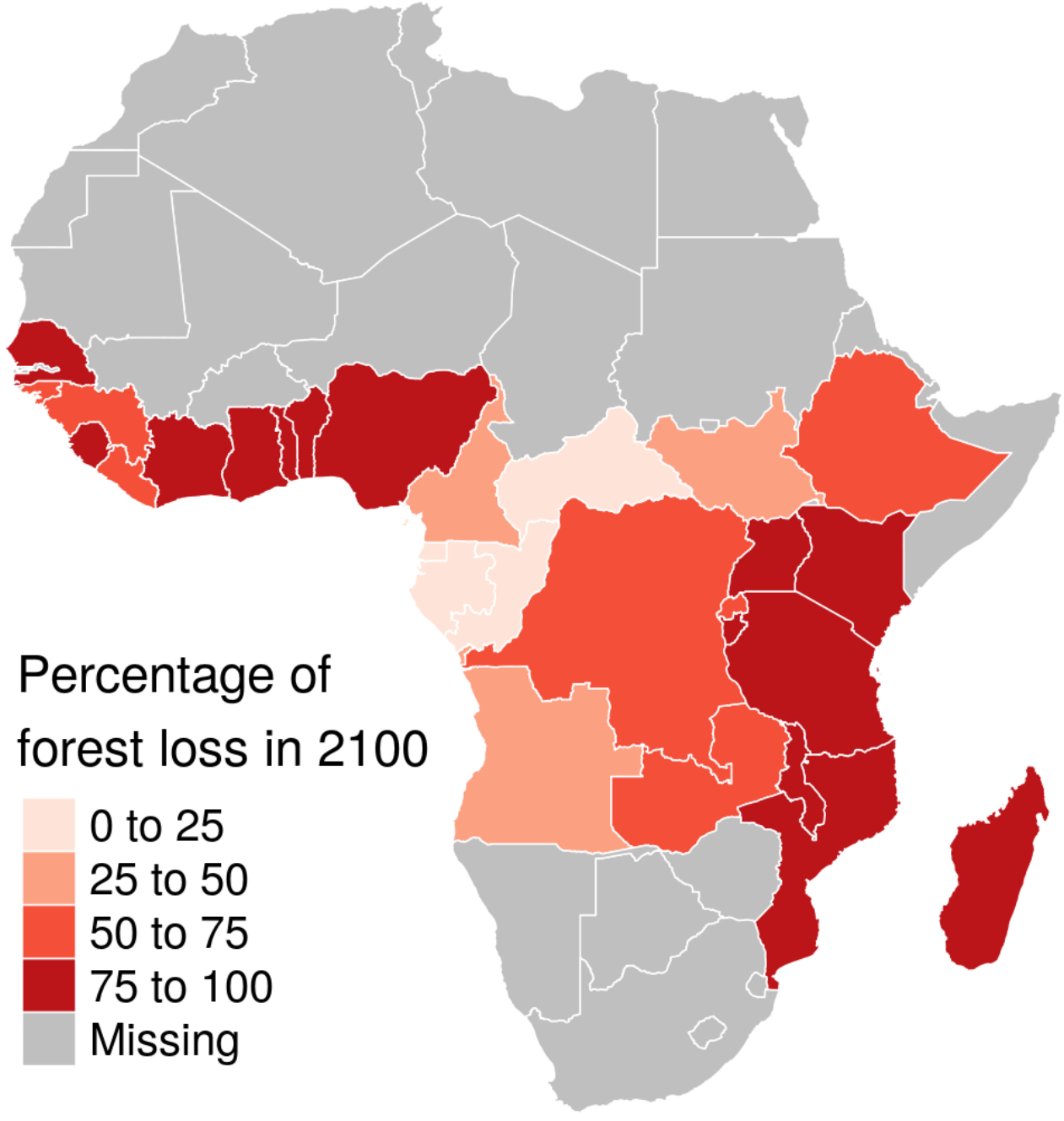
GIN
150
100
50
0
2010
2040
2070
2100
Year
Percentage forest cover with reference to 2000
avg
GFC
TREES


Percentage of
forest loss in 2100
0 to 25
25 to 50
50 to 75
75 to 100
Missing

Perspectives

- Scientific articles
- Integration of Roadless data on deforestation ?
- Use of the results for future deforestation scenario in Africa
- Predictions in percentage of forest loss : $\sim$ independent of forest definition

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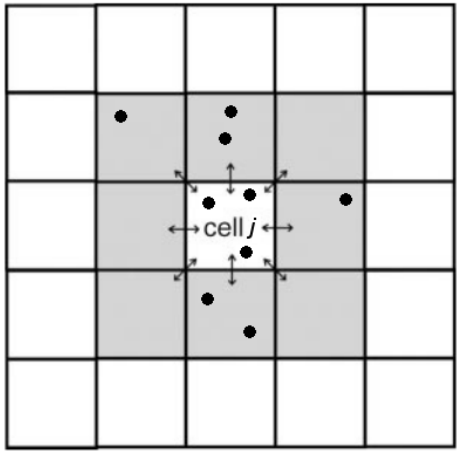
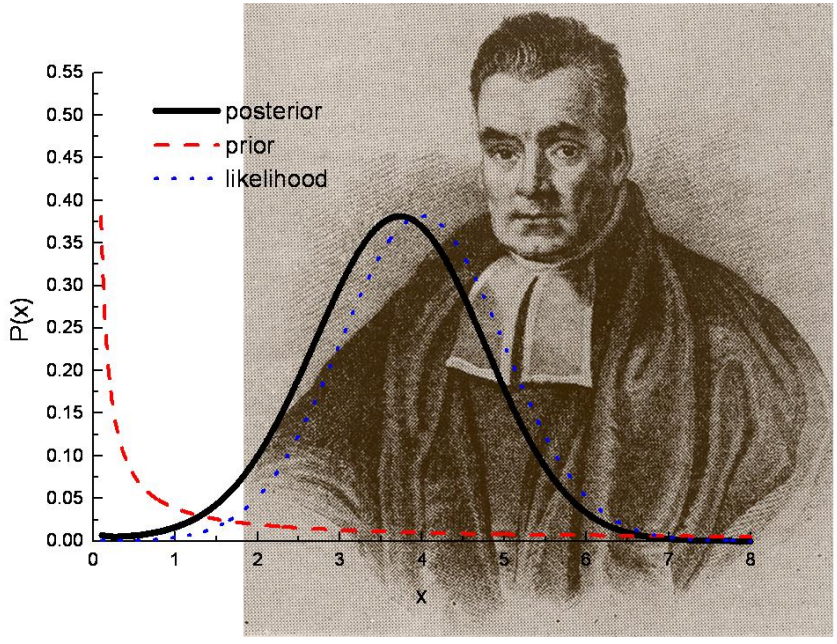
Specifications

`forestatrisk` Python module specifications

- Spatial probability of deforestation
- $\text{logit}(\theta_i) = f(\text{spatial factors}_i) + \rho_j$
- Factors : accessibility (dist. towns, roads, villages), landscape (dist. forest edge), land-tenure (protected areas)
- ρ_j : spatial random effect

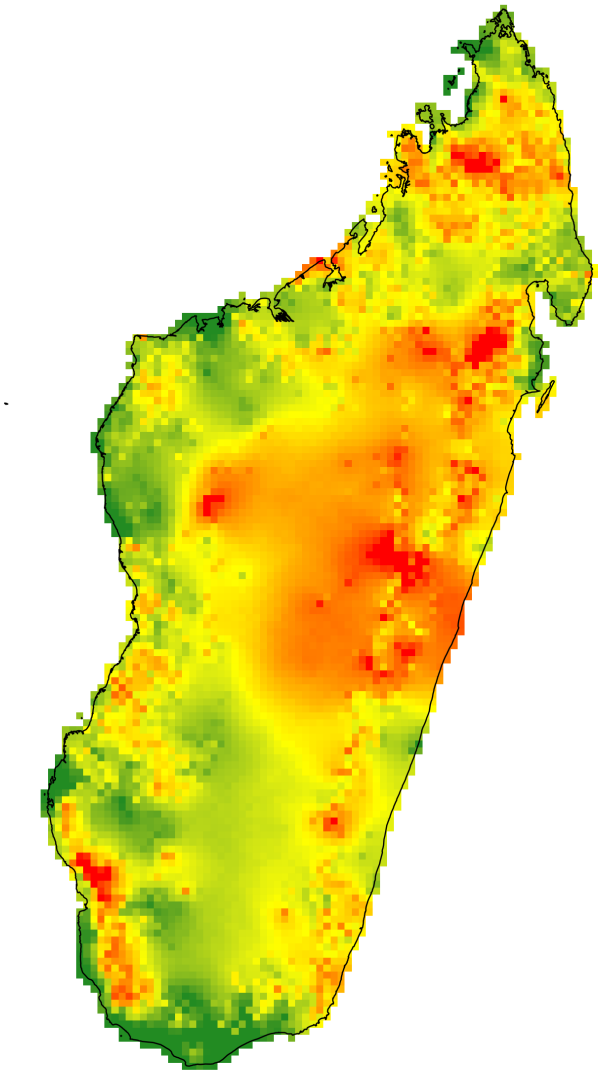




https://github.com/ghislainv/forestatrisk

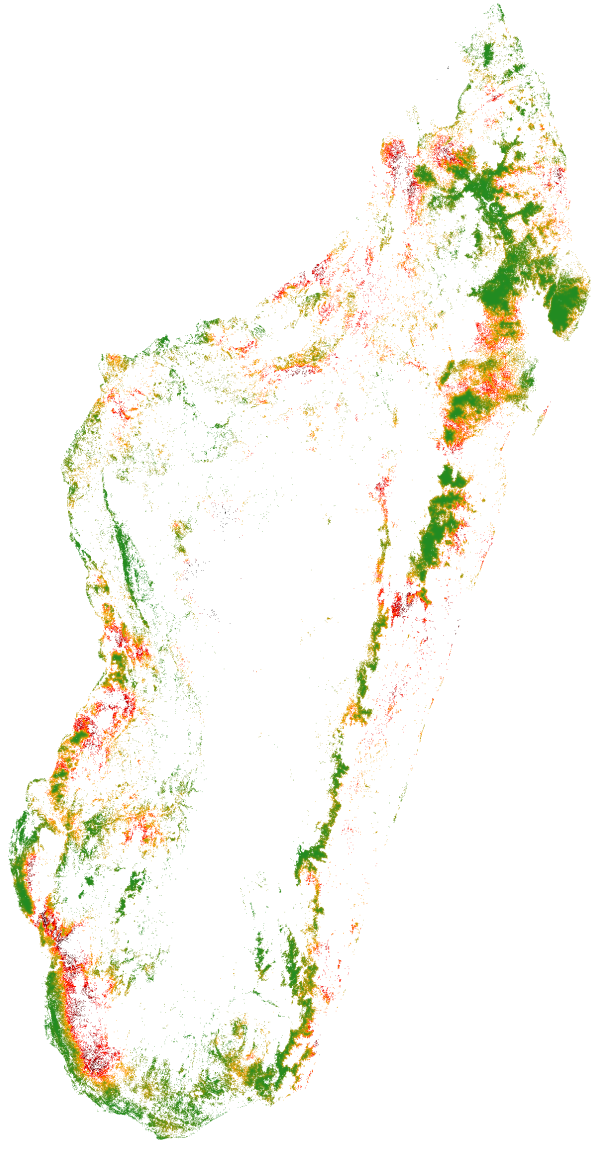
Spatial random effects

- Hotspots of deforestation
- Not explained by the fixed env. factors



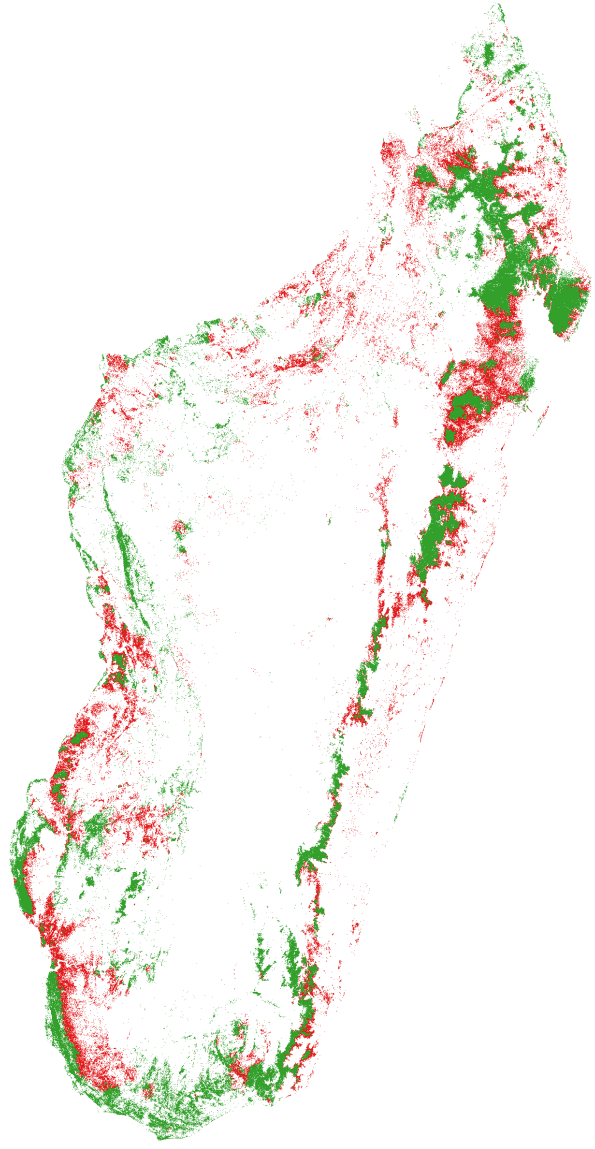
Spatial probability of deforestation

- Computed at 30 m resolution
- Greener : lower probability
- Darker red : higher probability



Future forest cover

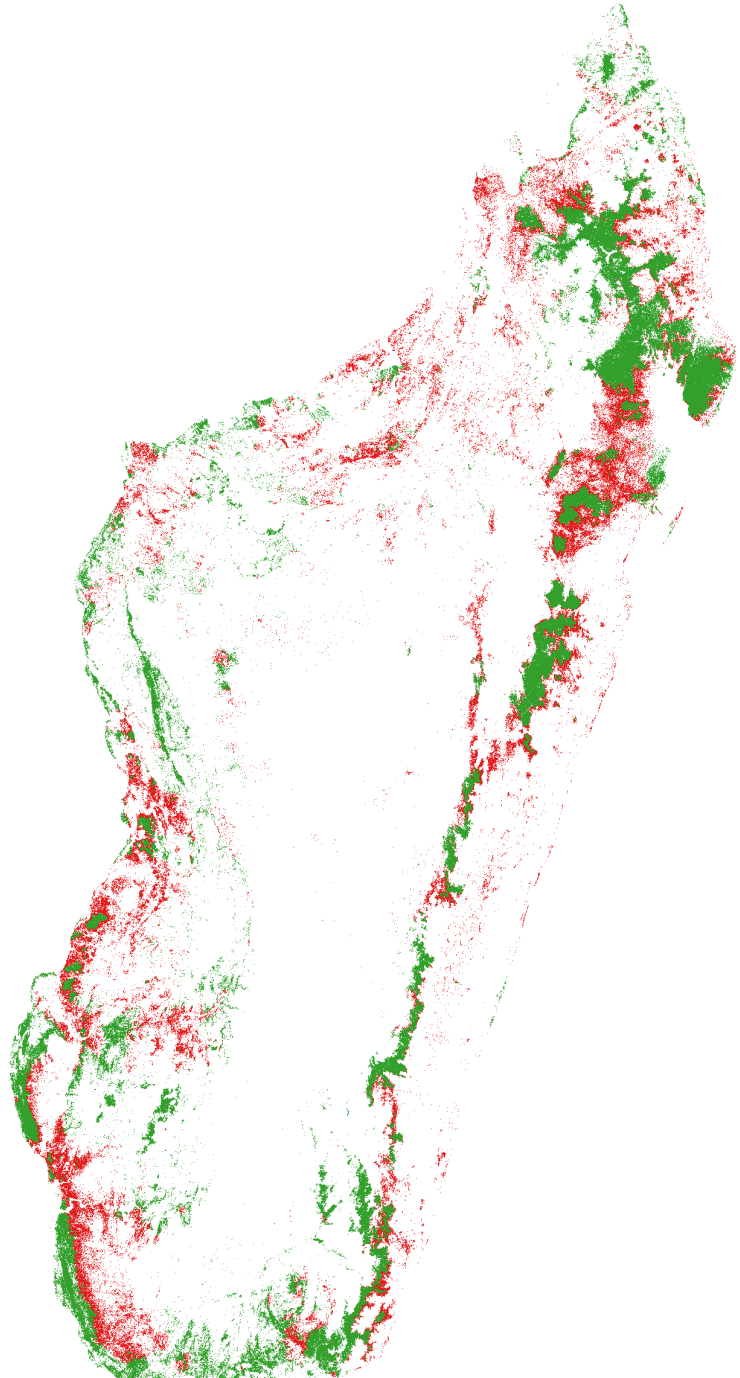
- green : residual forest in 2050
- red : deforested area 2010-2050



Improvements

Improvements

- Python 2.7 and Python 3.x compatible
- Tests with `reticulate` R package to
- Spatial random effects limited to country border
- Set of new functions for model validation



Model performance

Model peformance

model	deviance	perc
null	27629	0
nsre	25365	8
icar	19279	30
full	0	100

TODO : Add map of differences

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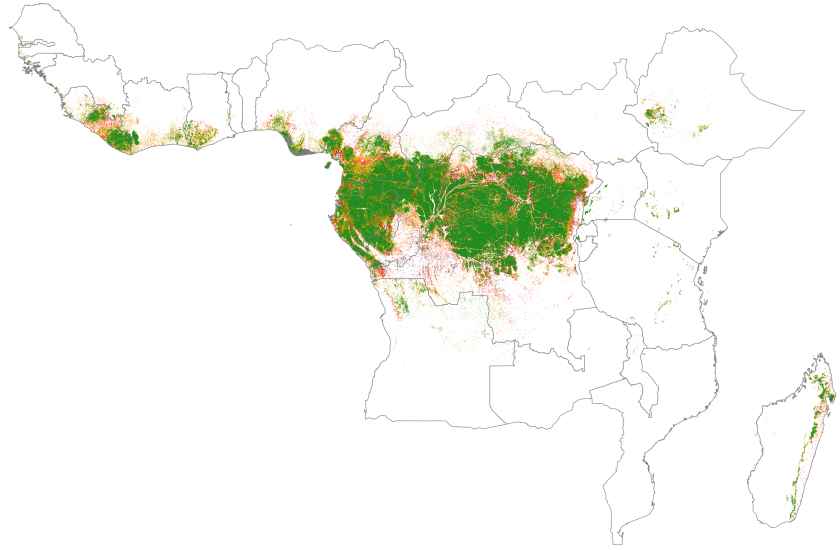
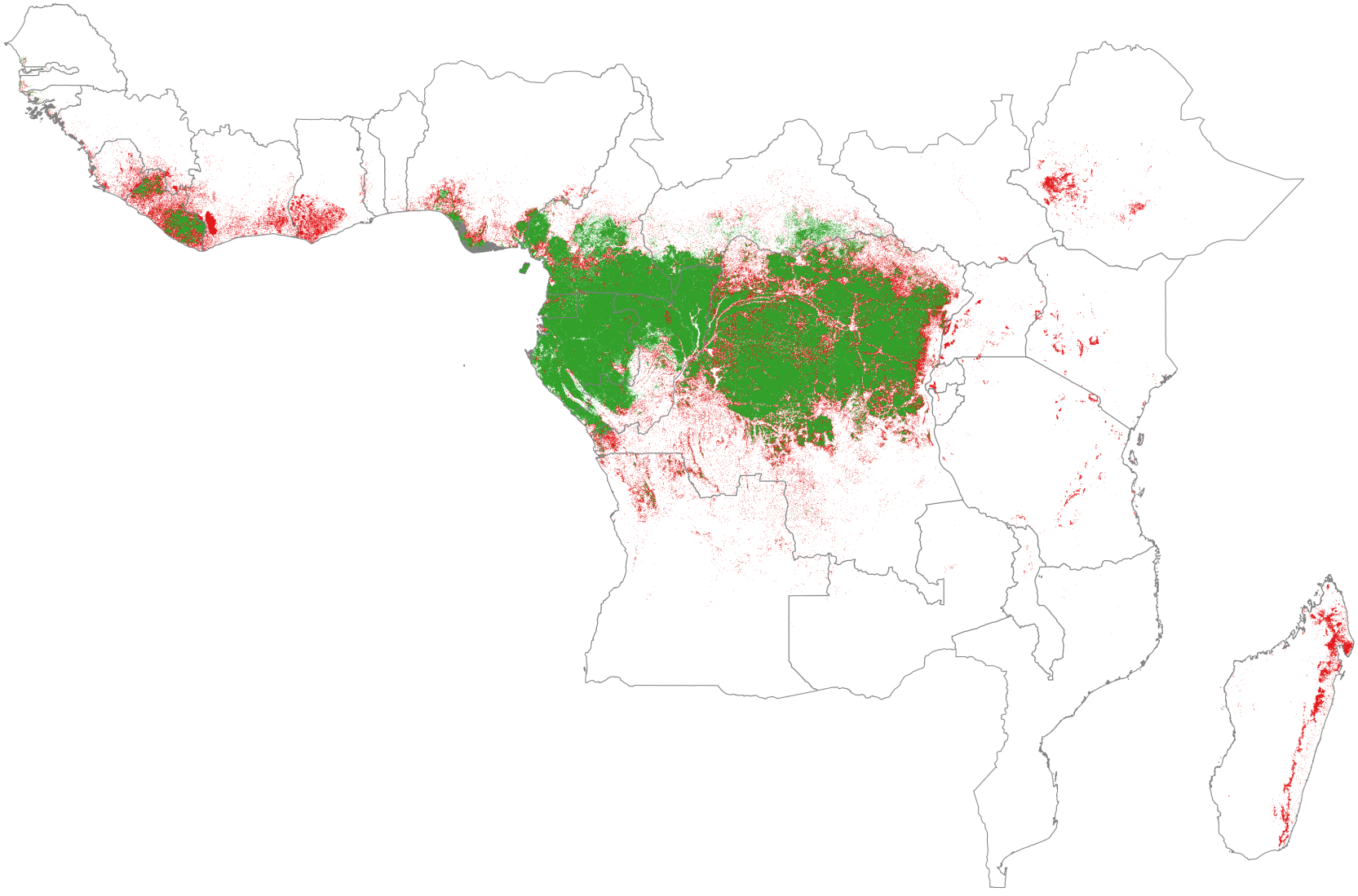
Africa

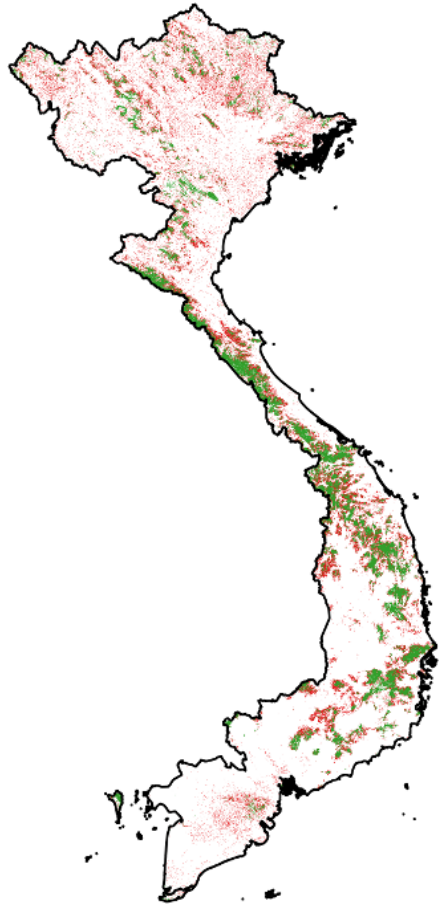
- Map of deforestation probability in 2015
- Future forest cover in 2050, 2100





Asia

- 11 countries in tropical Asia
- Including MMR, THA, KHM, LAO, VNM (ReCaREDD focus countries)
- Ex. Vietnam in 2050 (half current deforestation rate)



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Perspectives

1. Finalize the deforestation-demography study
2. Consolidate the code for the `forestatrisk` Python module and publish a methodological paper
3. Update the spatial prediction for Africa taking into account the demography
4. Extend projection to South America and publish the pantropical future forest cover map in 2050

. . . Thank you for attention . . .