A spatial model for the location of deforestation in French Guiana

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Context

- Beginning: october 2013
- Main supervisor: Bruno Hérault (CIRAD)
- Main objective: Capacity building on modelling through providing a spatialized model of future deforestation in the Guiana Shield

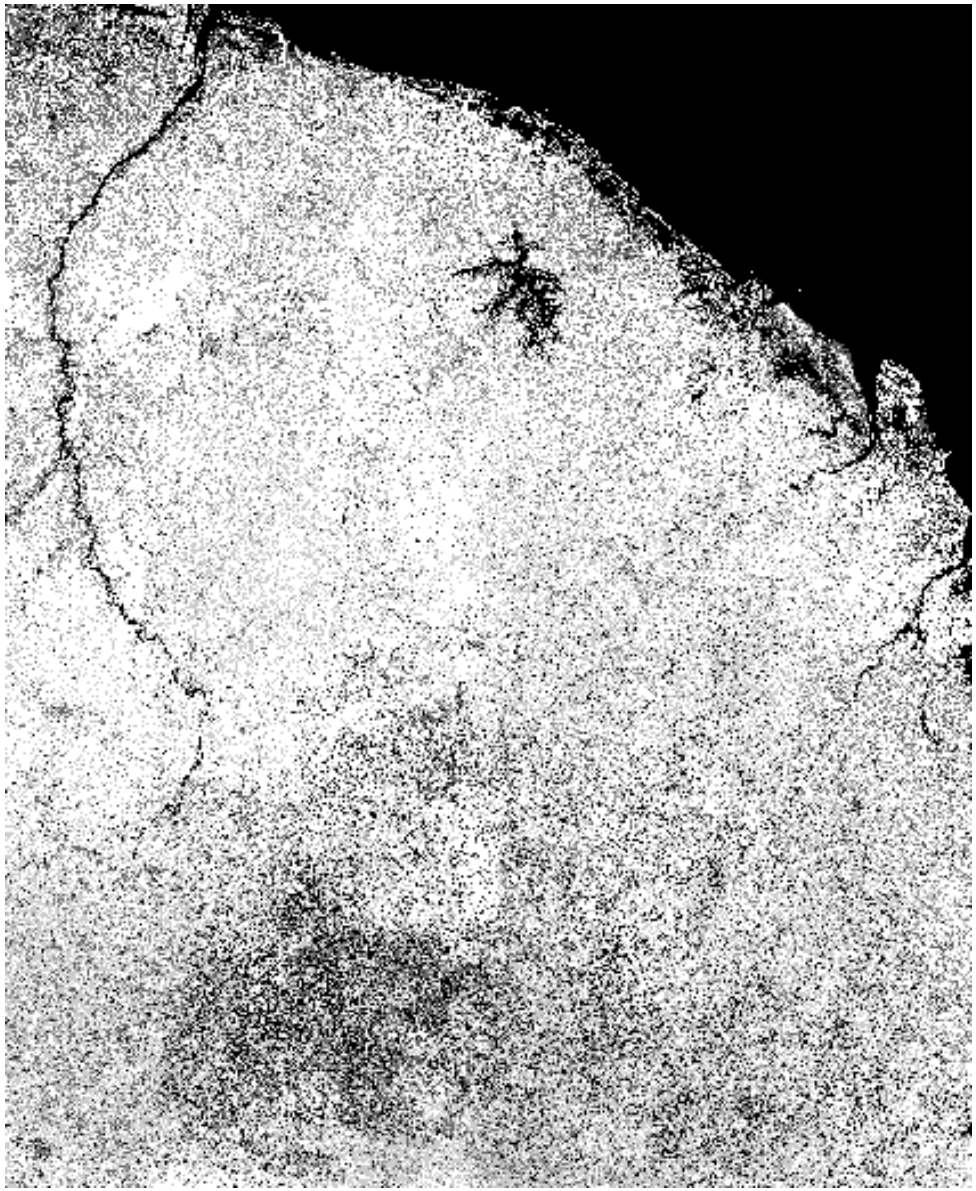
Objectives

- Produce a map of probability of deforestation in French Guiana for the period 2004-2008 at 30 meters resolution
- Using simple, free and opensource softwares (R and GRASS)
- A simple model, with as little input data as possible

Deforestation data

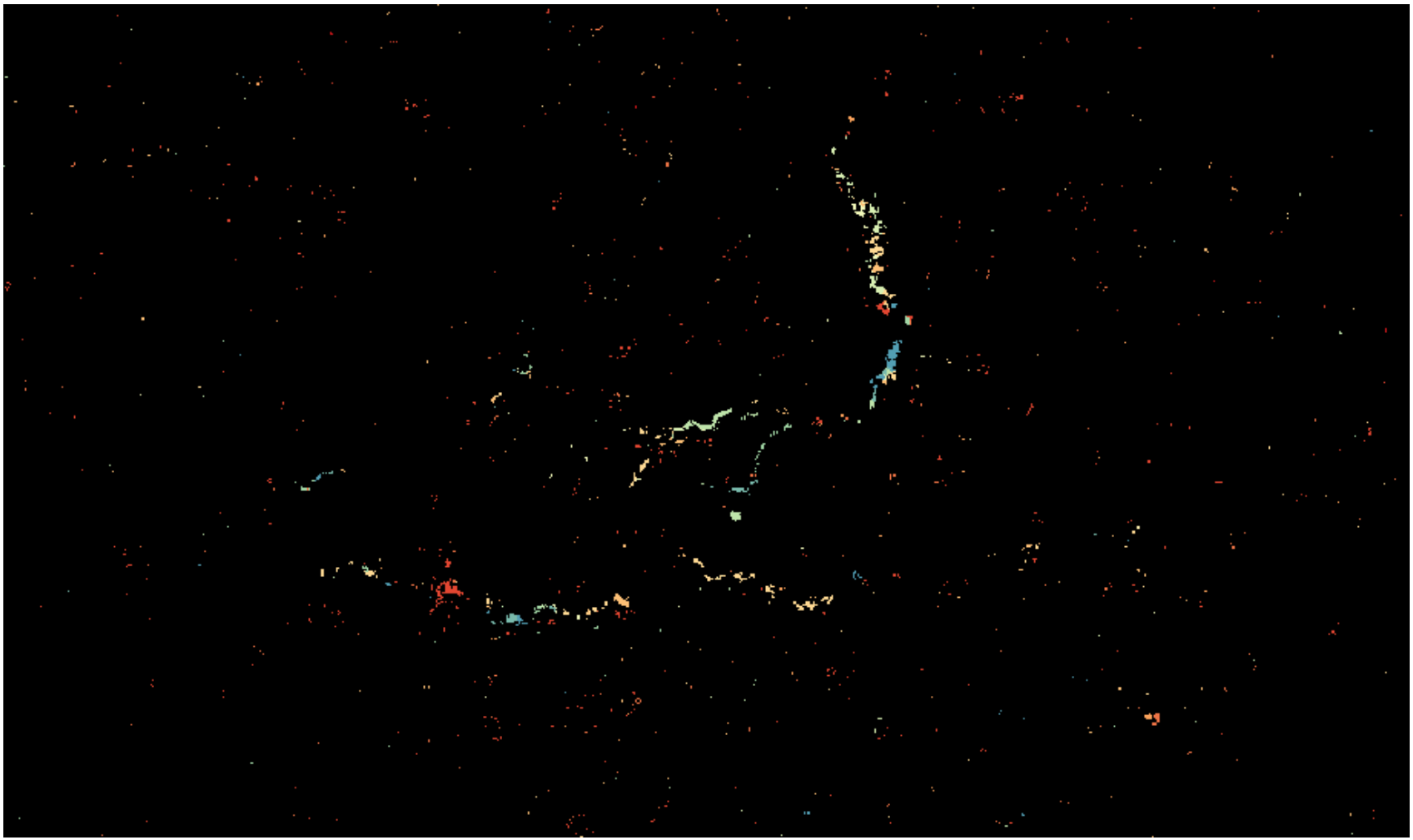
- Maps by Hansen et al. (2013) - U. of Maryland
- Forest cover 2000 and forest cover change 2001-2013
- Threshold forest cover $= 75\%$
- Neighbouring filter (eliminate isolated pixels)

Choosing an appropriate threshold and filtering: original forest cover 2000 data



Choosing an appropriate threshold and filtering: final forest cover 2000 data

Filtering forest cover change data : original deforestation map

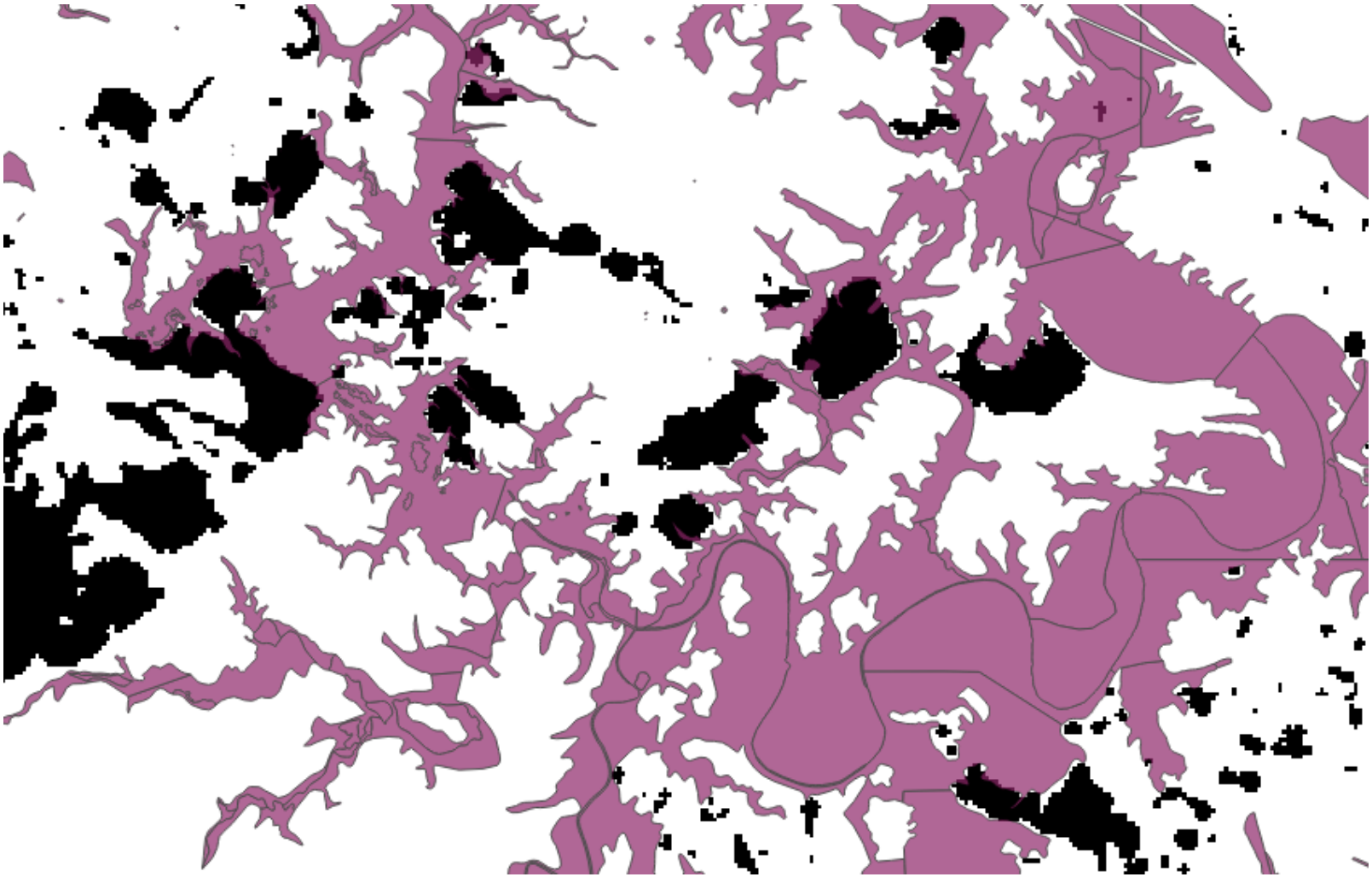


Filtering forest cover change data : final deforestation map

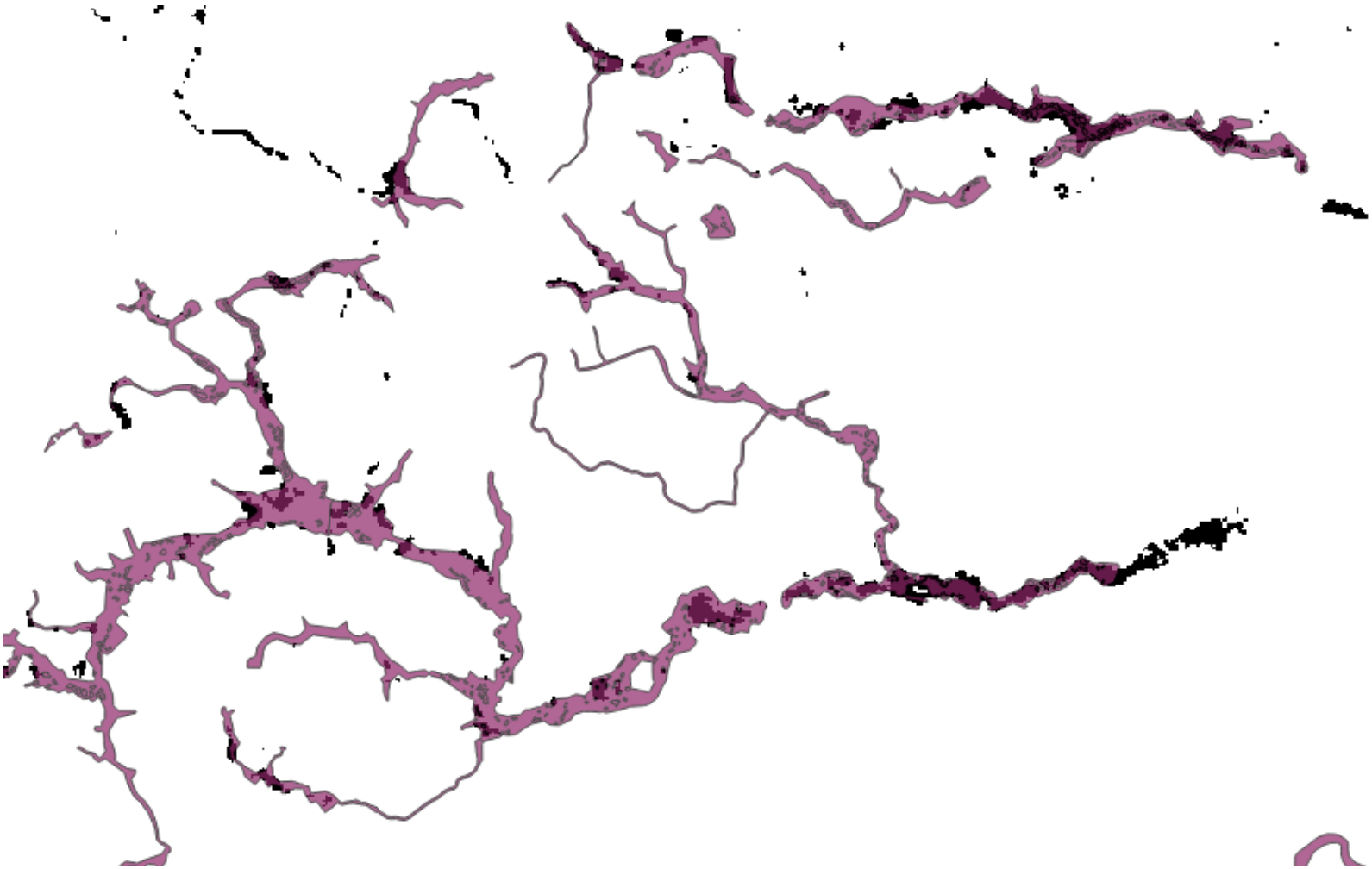
Explanatory variables

- Distance to previous (2000-2004) deforestation (based only on Hansen data)
- Index of forest fragmentation (based only on Hansen data)
- Distance to closest road (2008 network)
- Distance to closest forest track (2008 network)
- Distance to main cities
- Protected areas
- Elevation (available at 90 meters resolution worldwide)
- Hydromorphy

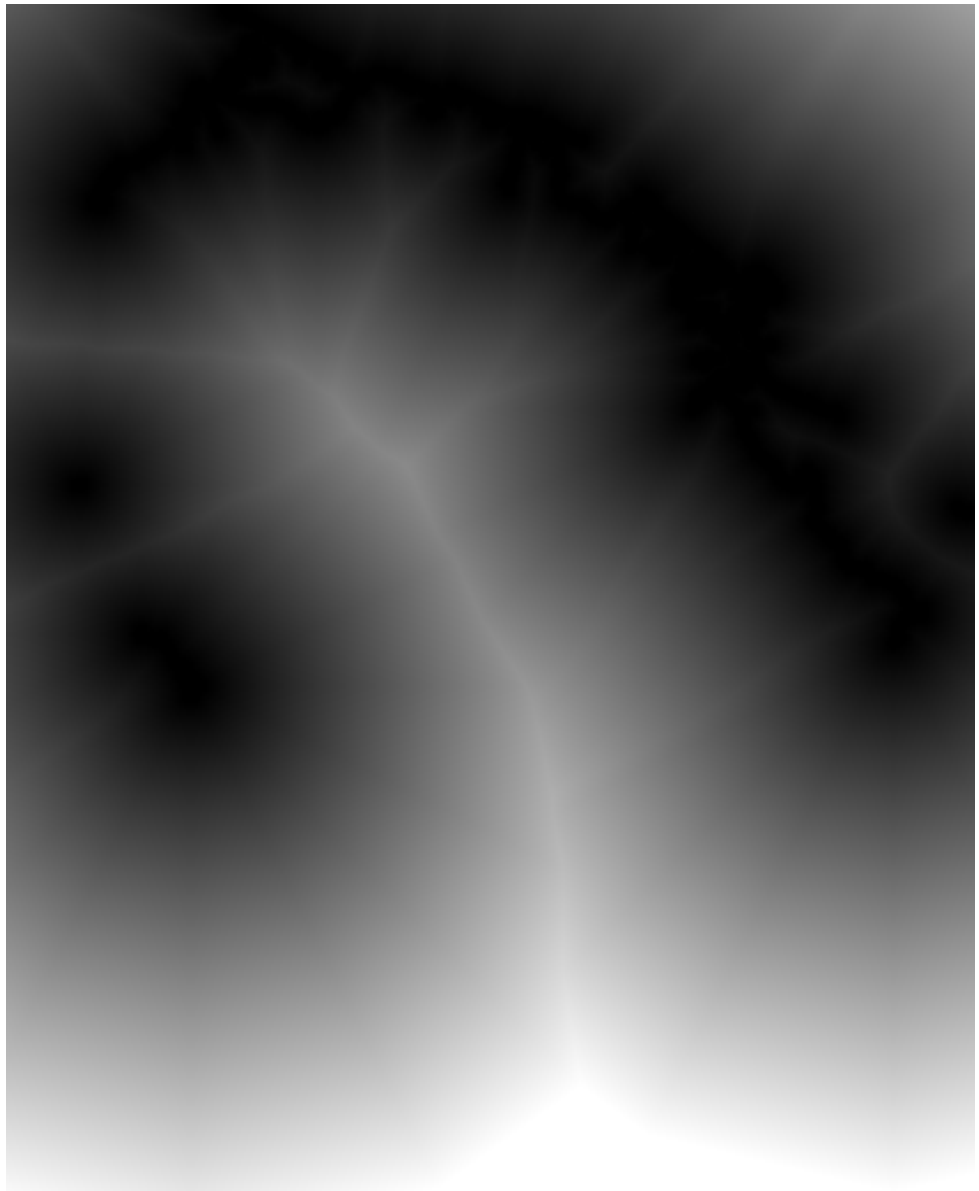
Example: Deforestation and Hydromorphy in coastal area



Example: Deforestation and Hydromorphy in gold mining area



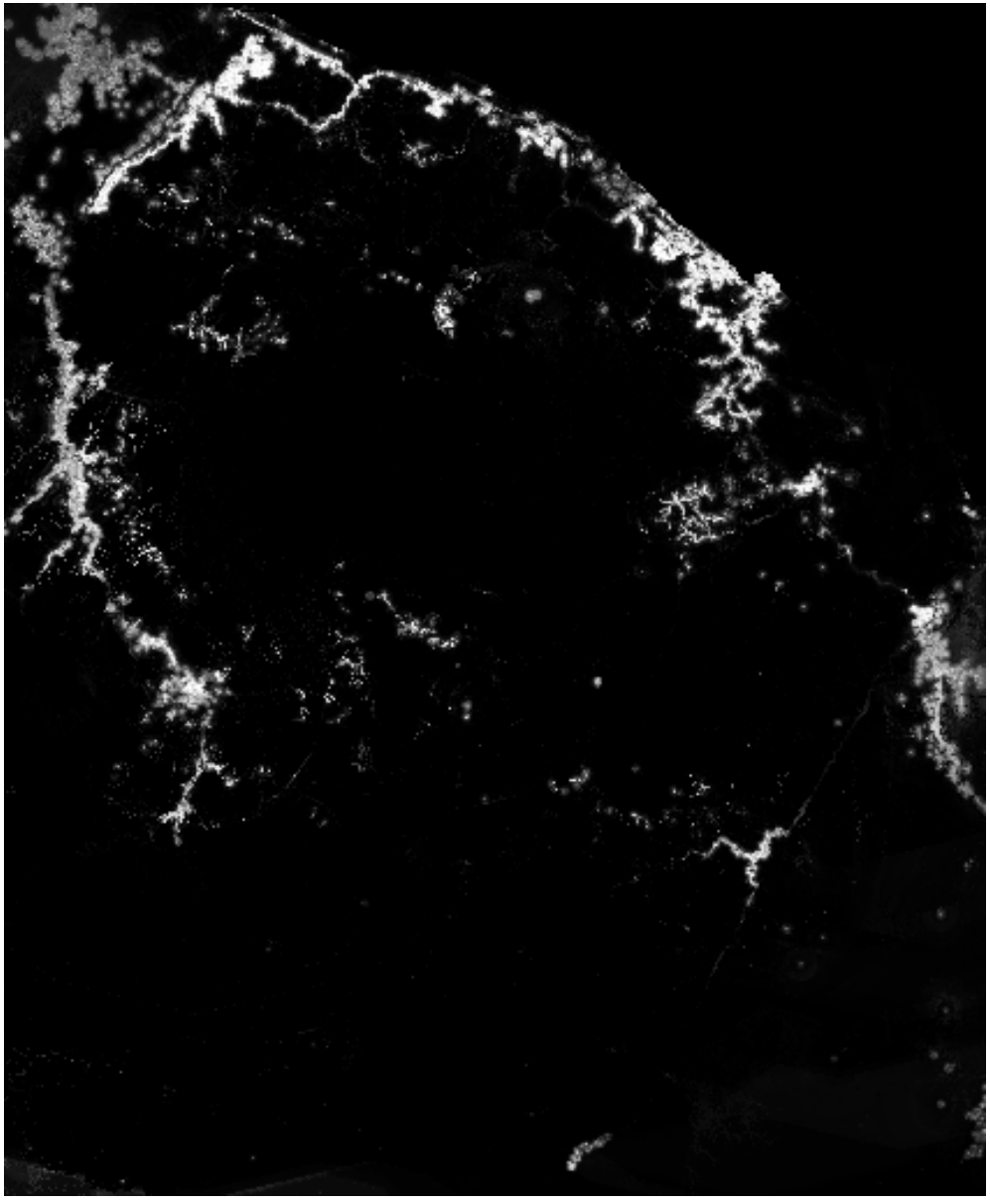
Example: Distance to road (2008 network)



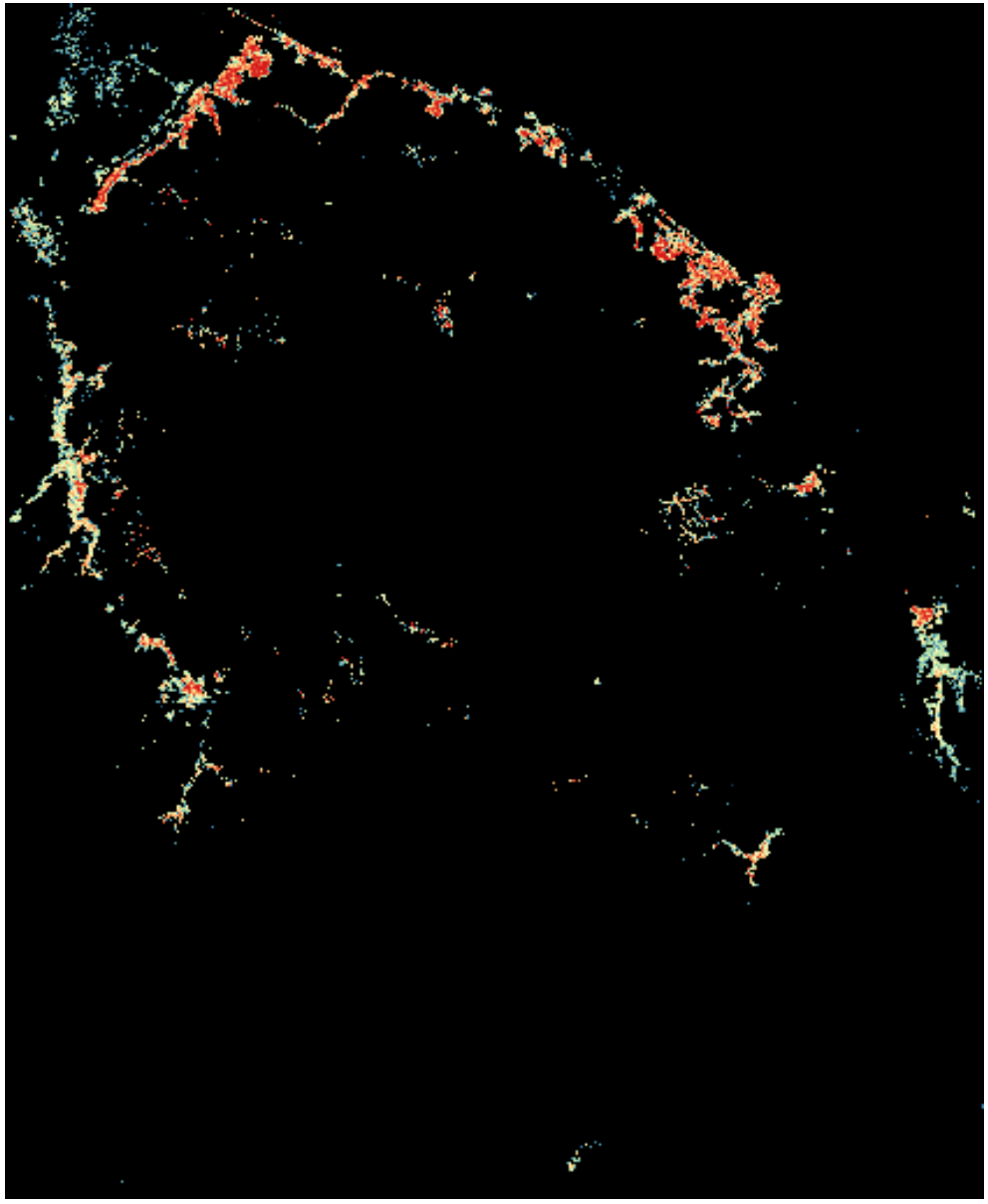
Modelling the probability of deforestation: Random forest classification

- Widely used for forest cover mapping but never for deforestation modelling as far as we know
- Sampling: 50'000 deforested pixels during 2004-2008 (half of all deforested pixels) and 100'000 not-deforested pixels during 2004-2008 (a tiny fraction of all not-deforested pixels, but...)

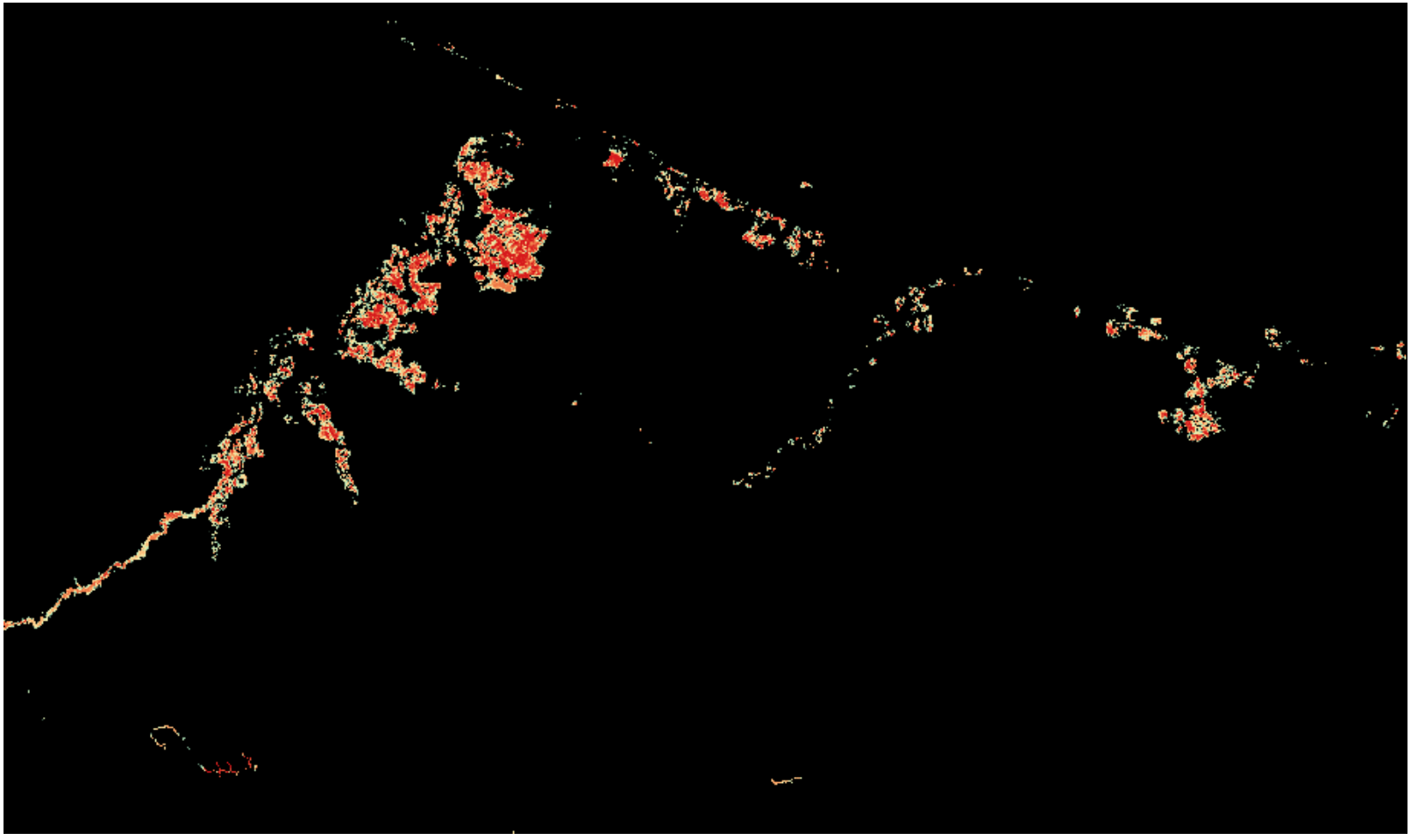
Results



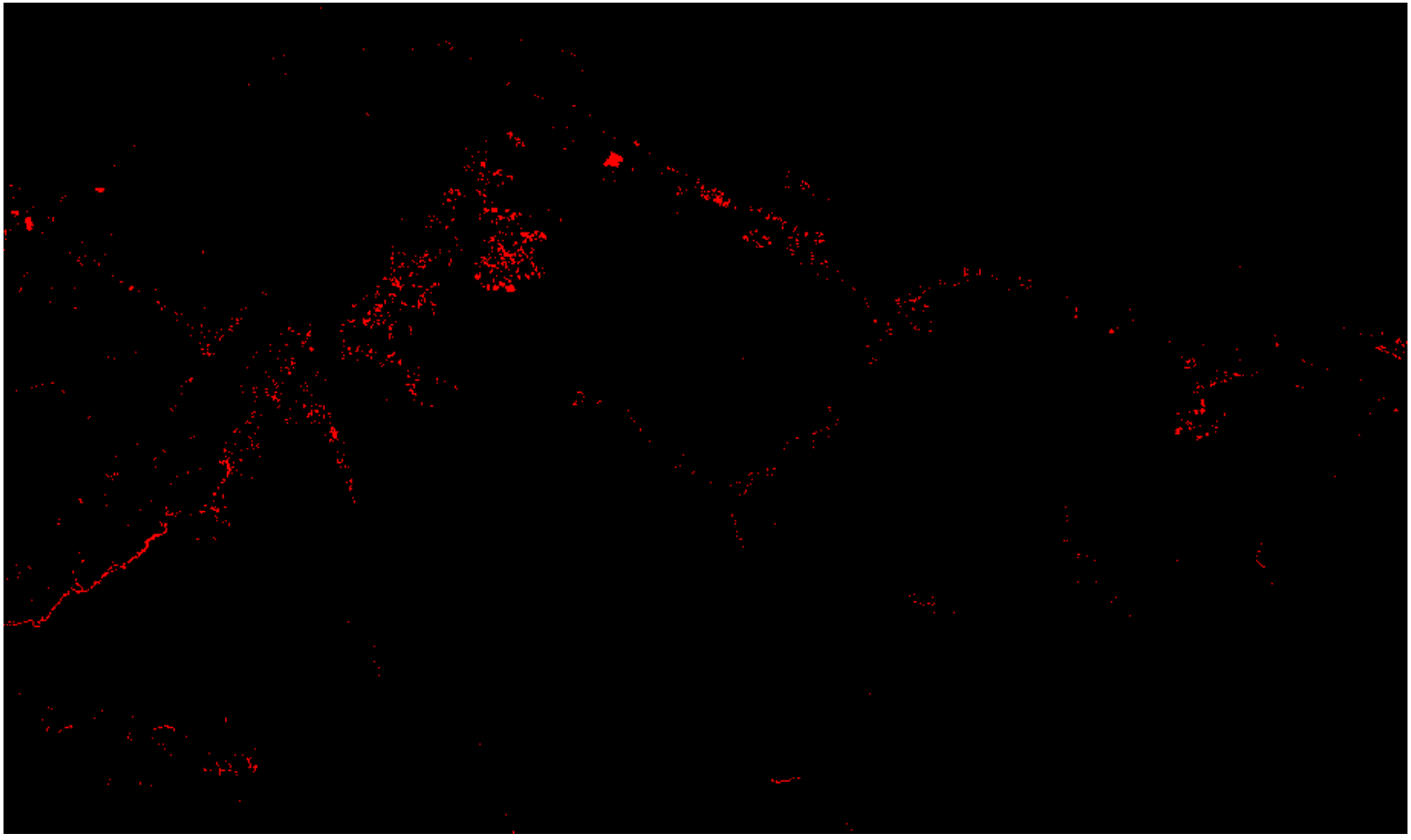
Results



Results



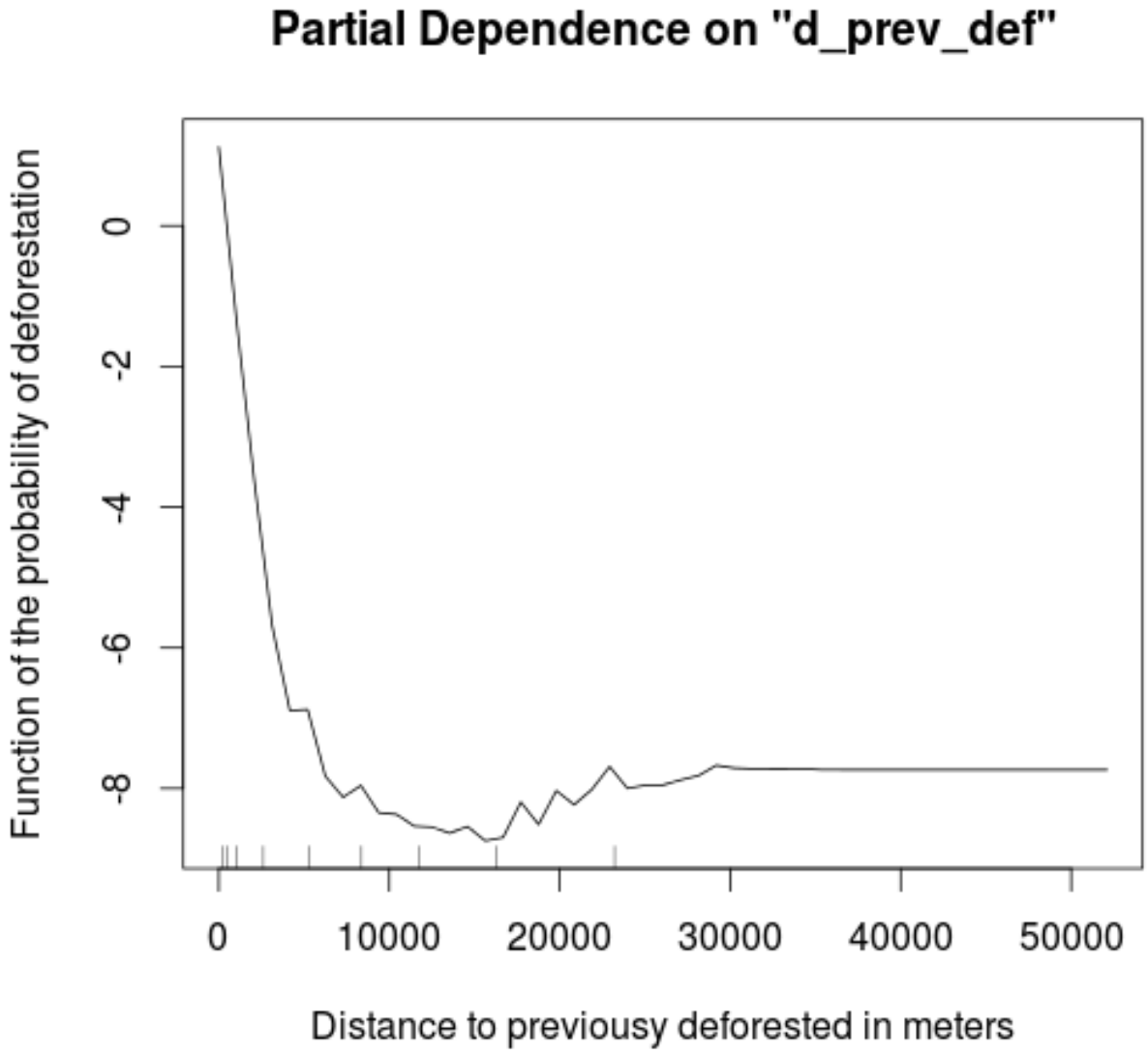
Results



Confusion matrix - First assessment of model's quality

- True negatives: 97'436 on 99'999 samples
- True positives: 49'333 on 50'000 samples
- False negatives and false positives: 2'537 and 667 (2.5 and 1.3% respectively)
- Validation on all pixels still to produce

Deforestation and explanatory variables



Perspectives: coupling with the model of intensity of deforestation

- First part of the modelling process: model the intrinsec probability of deforestation (focus on geographic variables, no notion of quantity)
- The model of intensity of deforestation will define the number X of pixels to be deforested to reach a certain level of deforestation
- Pixels with highest probability of deforestation will be deforested first
- Relevant scale? Town?

Modelling the intensity of deforestation: demography in French Guiana

- Population expected to double during the next 20 years, which impact on deforestation levels?
- Alternative scenarios: capacity of the different towns to implement their existing urban plannings to limit the magnitude of deforestation
- Need for a reflexion on the main drivers of the intensity of deforestation in the neighbouring countries