Exploratory analysis of Recurrent deforestation warnings in São Félix do Xingu - Brazilian Amazon

Alber Sanchez
alber.ipia@inpe.br

TREES
TRopical Ecosystems and Environmental Sciences lab
INPE
TreesLab
Instituto Nacional de Pesquisas Espaciais - INPE
Brazil

April 1, 2023

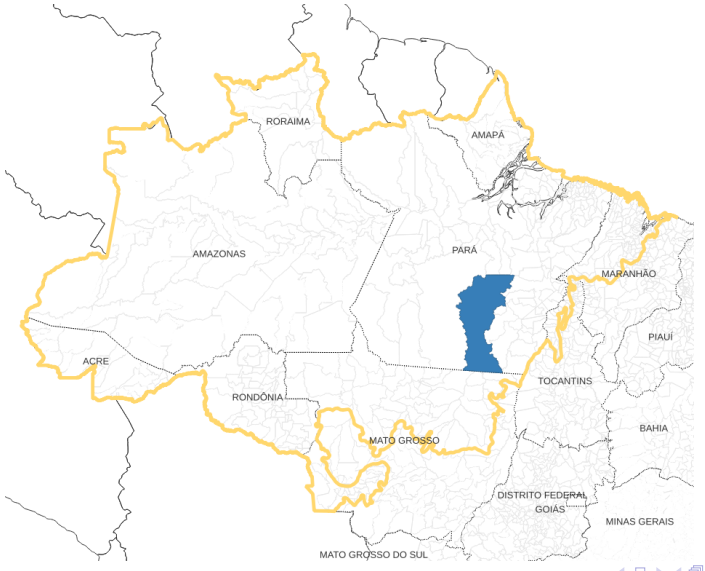
Introduction

- Deforestation by successive degradation remains a challenging question in the scientific literature.
- We think a potential answer to this question could be found in DETER's warning.
- This answer could play an important role, for example, for improving the national estimation of greenhouse gases.
- We used DETER data from 2016 to 2021 of São Félix de Xingu, Pará, Brazil.
- São Félix de Xingu is among the towns with the highest deforestation rates according to PRODES.

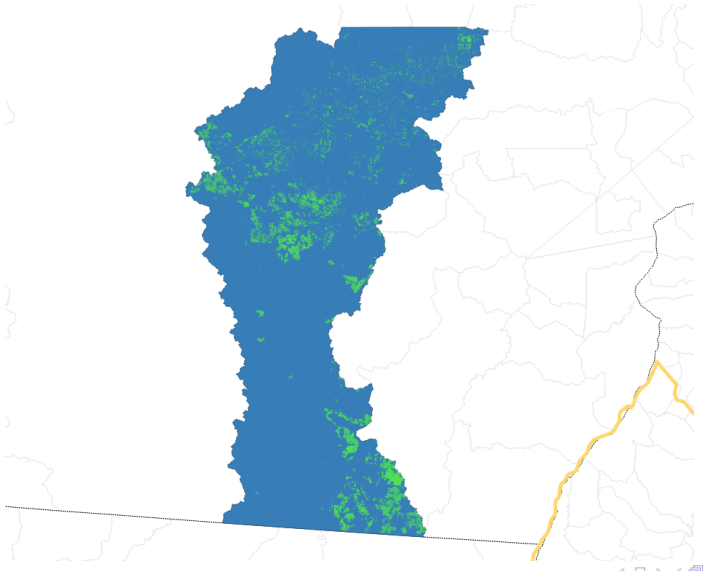
What is DETER?

- DETER is a GIS which produces a fast assessment of deforestation and forest degradation in the Brazilian Amazon [SDA$^+$06].
- DETER is an important tool for environmental protection and effective law enforcement.
- DETER employs Linear Mixture Models of CBERS imagery and human experts to deter and issue warnings of deforested (or degraded) areas larger than 3 ha [DAMV$^+$22].
- Annually, DETER takes from PRODES the current forested area, stating anew issuing warnings.

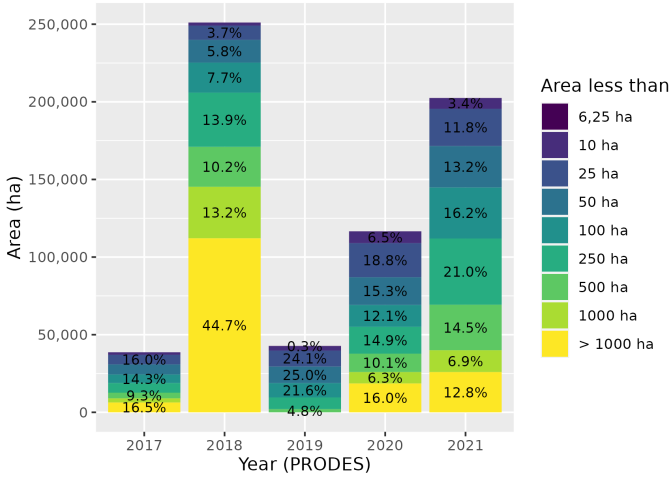
São Félix do Xingu, Pará, Brazil



DETER warnings in São Félix do Xingu

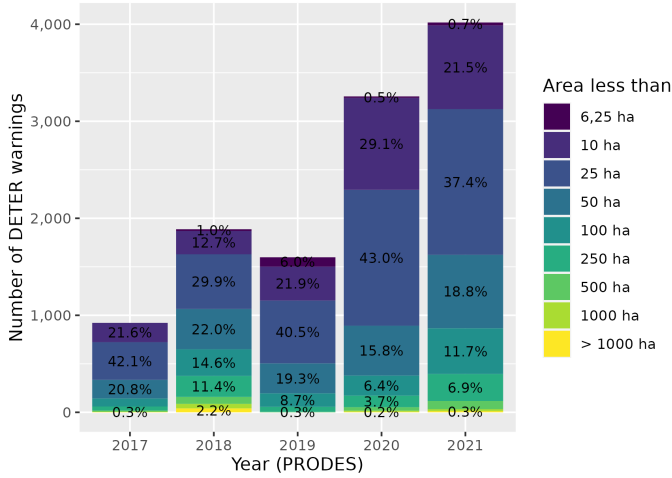


Area of DETER warnings in SFX



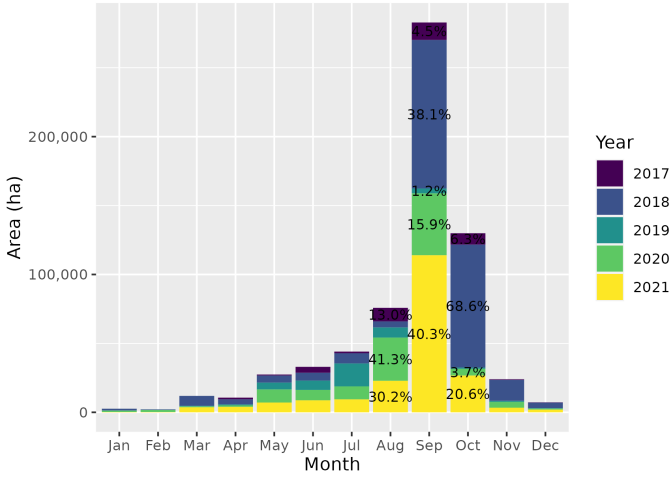
Note the increasing trend and its area distribution.

Number of DETER warnings in SFX



Note the increasing trend and the small peak in 2018.

Periodicity of DETER warnings in SFX

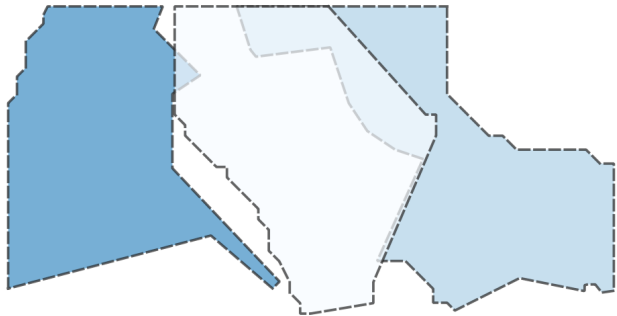


Note Sep-Oct 2018 and Aug-Sep 2020

DETER warnings and time

- The spatial properties of DETER warning areas are inconsistent along time (shape, size, area, position).

Warning subareas are inconsistent along time

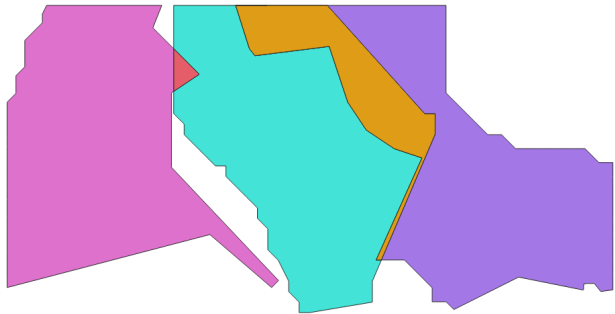


Note how DETER warnings overlap differently with time.

DETER warnings subareas

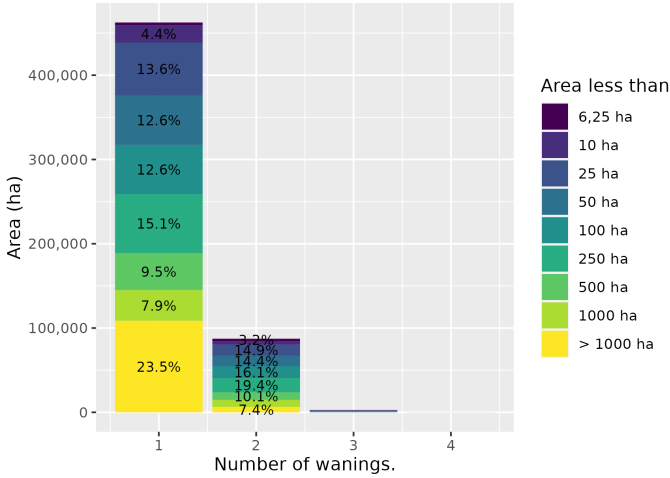
- The spatial properties of DETER warning areas are inconsistent along time (shape, size, area, position).
- DETER subareas maintain their spatial properties along time.

DETER warning subareas



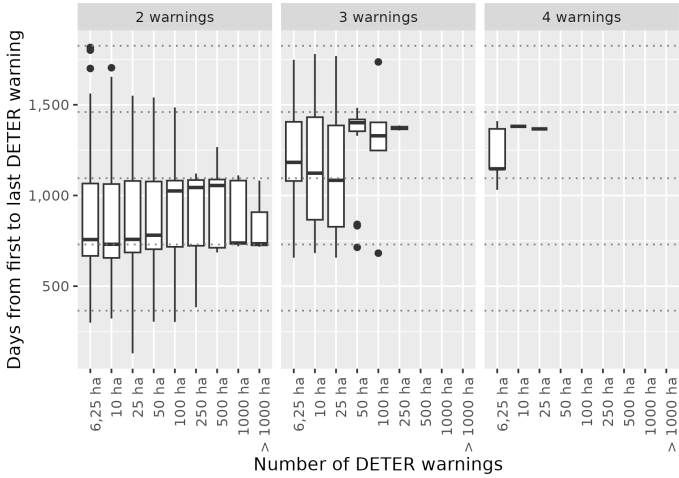
Note how 3 DETER warnings produce 7 subareas!

Subareas of recurrent warnings



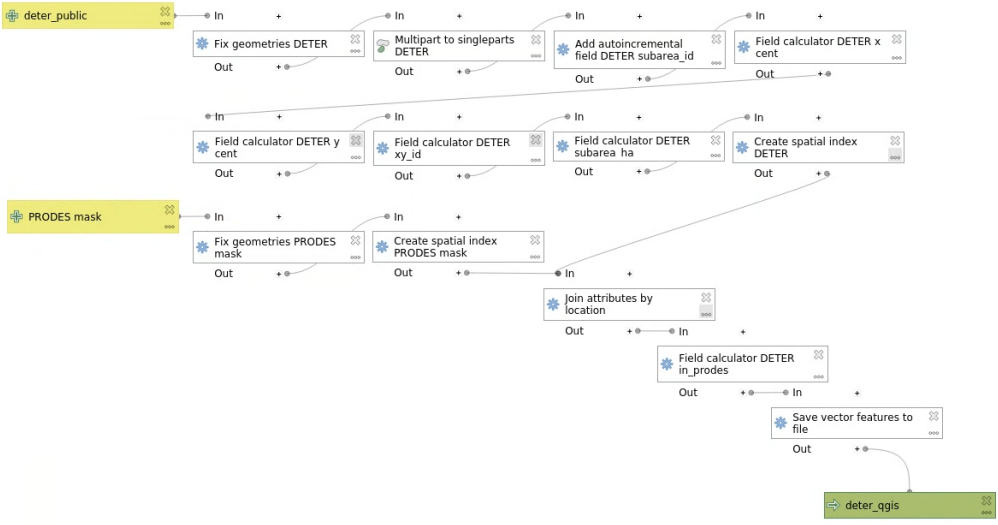
Most subareas are issued a single warning.

Days between first and last warnings



The mean lag between 2 and 3 warnings is one year.

Reproducibility - DETER processing



DETER data preprocessiing before analysis.

Final remarks

- The analysis of DETER warning subareas along time could improve the characterization of forest degradation along time.
- Potential applications of our work are:
  - Improve estimation of emissions of greenhouse gases, i.e. our data could help avoiding double counting.
  - Identify spatio-temporal areas which could help training Machine-Learning algorithms for automatic indentification of forest degradation.
- Code available at `https://github.com/albhasan/treesburnareas`

References I

Claudio Aparecido De Almeida, Luis Maurano, Dalton M. Valeriano, Gilberto Câmara, Lúbia Vinhas, Marisa Da Motta, Alessandra Rodrigues Gomes, Antonio Miguel Vieira Monteiro, Arlesson Antônio De Almeida Souza, Cassiano Gustavo Messias, Camilo Daleles Rennó, Marcos Adami, Maria Isabel Sobral Escada, Luciana De Souza Soler, and Silvana Amaral, *Metodologia Utilizada nos Sistemas PRODES e DETER - 2a Edição (atualizada)*, Tech. report, Instituto Nacional de Pesquisas Espaciais (INPE), 2022.

Yosio Shimabukuro, Valdete Duarte, Liana Anderson, Dalton Valeriano, Egídio Arai, Ramon Freitas, Bernardo Rudorff, and Maurício Moreira, *Near real time detection of deforestation in the Brazilian Amazon using MODIS imagery*, Ambiente e Agua - An Interdisciplinary Journal of Applied Science **1** (2006), no. 1, 37–47.