



Spatial dynamic bayesian network to model deforestation in Brazilian Legal Amazon

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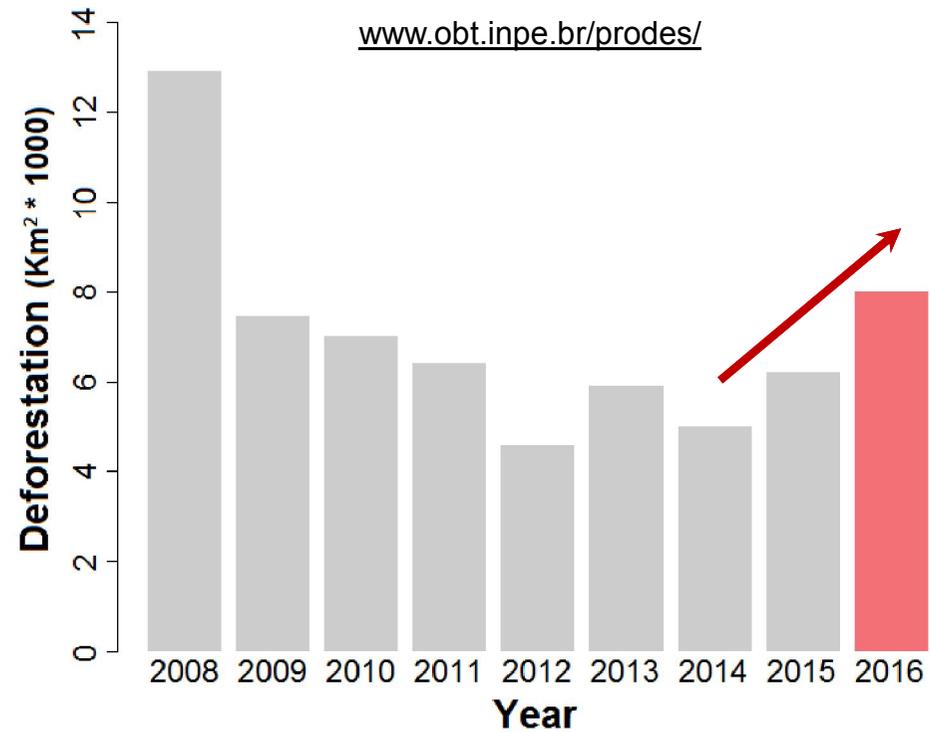
Motivation



PRODES

Deforestation monitoring system for Brazilian Amazon forest

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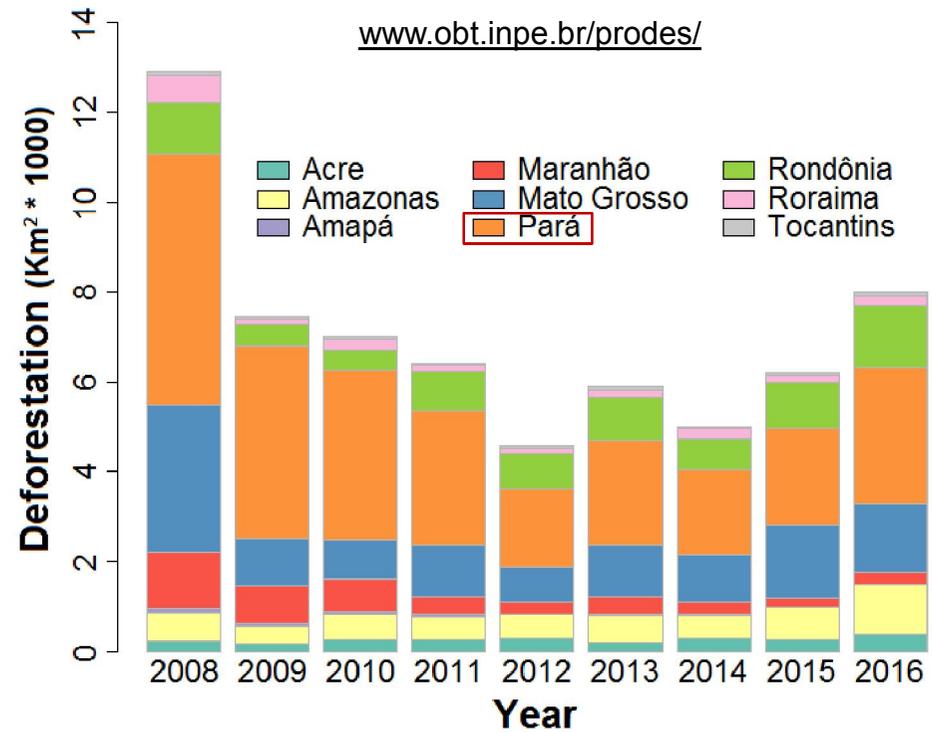
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Objective



Identify the most susceptible areas to deforestation over the years using a probabilistic approach

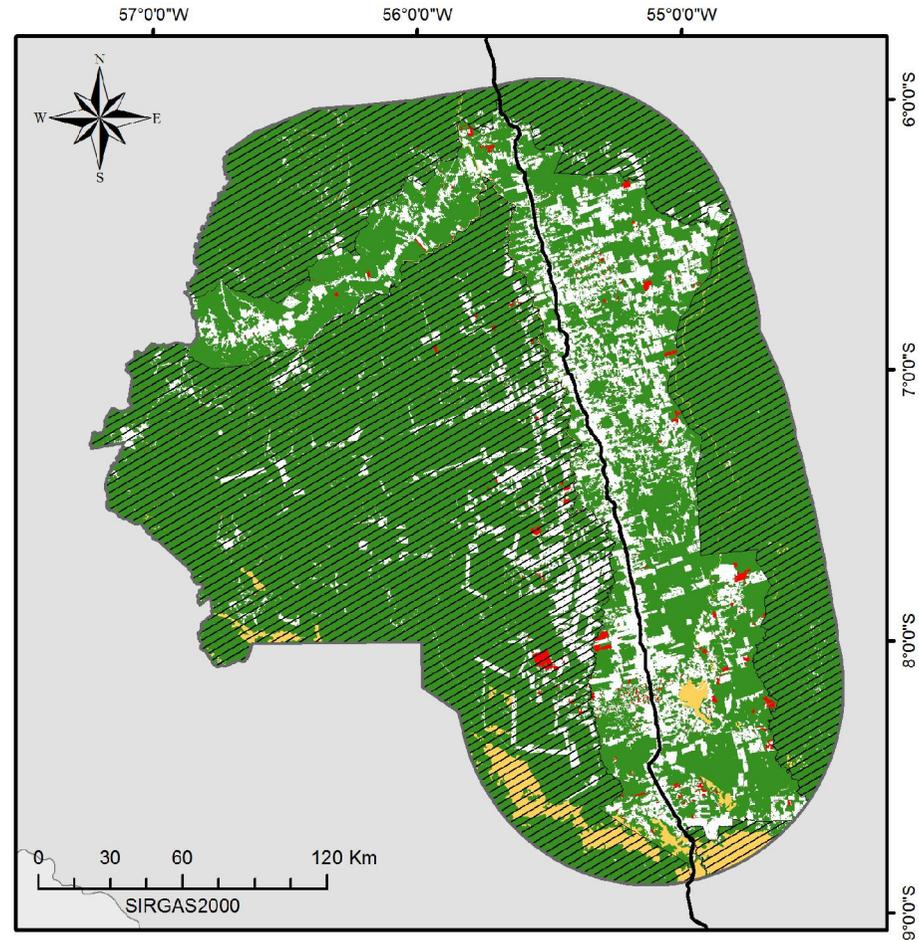


Study Area



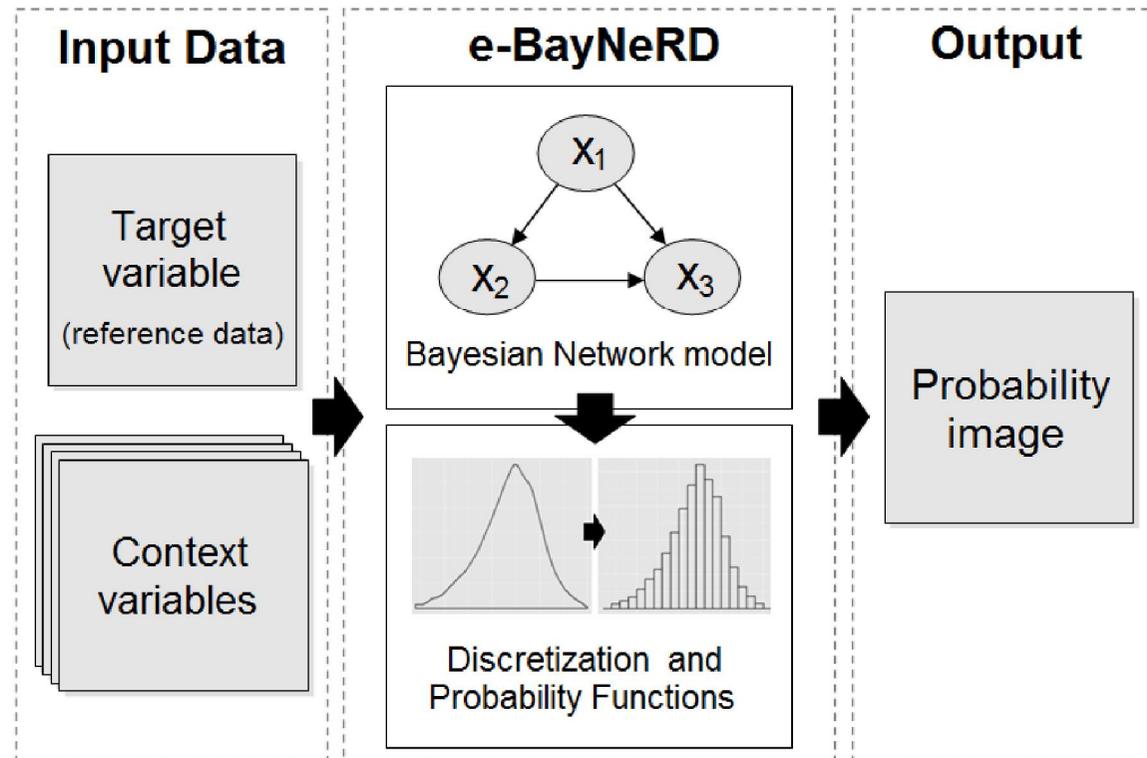
- Brazilian Legal Amazon
- BR163 highway
- ▨ Areas under environment protection laws
- Previous deforestations
- Deforestation in 2015
- Forest
- Non-forest

Data from PRODES Project



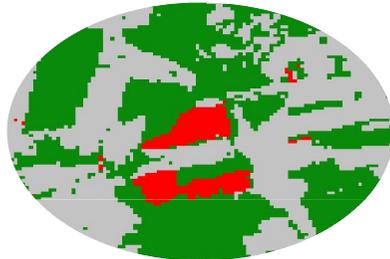
e-BayNeRD algorithm

Enhanced Bayesian Network for Raster Data



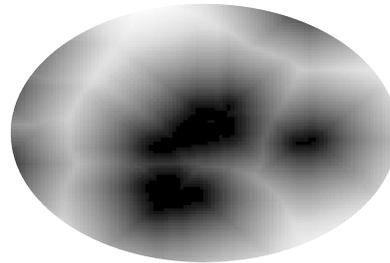
Silva et al. (2016) – Bayesian Network model to predict areas for sugarcane expansion in Brazilian Cerrado

Selected variables

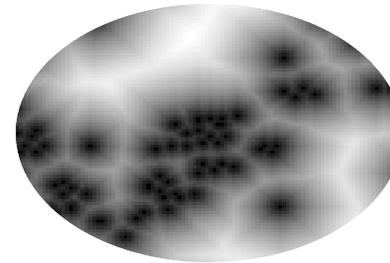


Deforestation in the current year

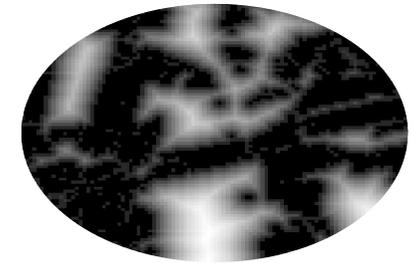
- Deforestation
- Forest
- Outside study area



Distance from degraded areas



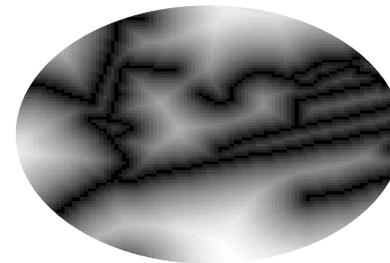
Distance from hot spots



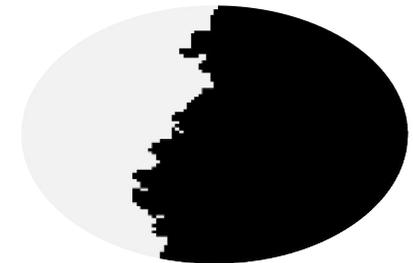
Distance from pasture areas



Proportion of deforested neighbours



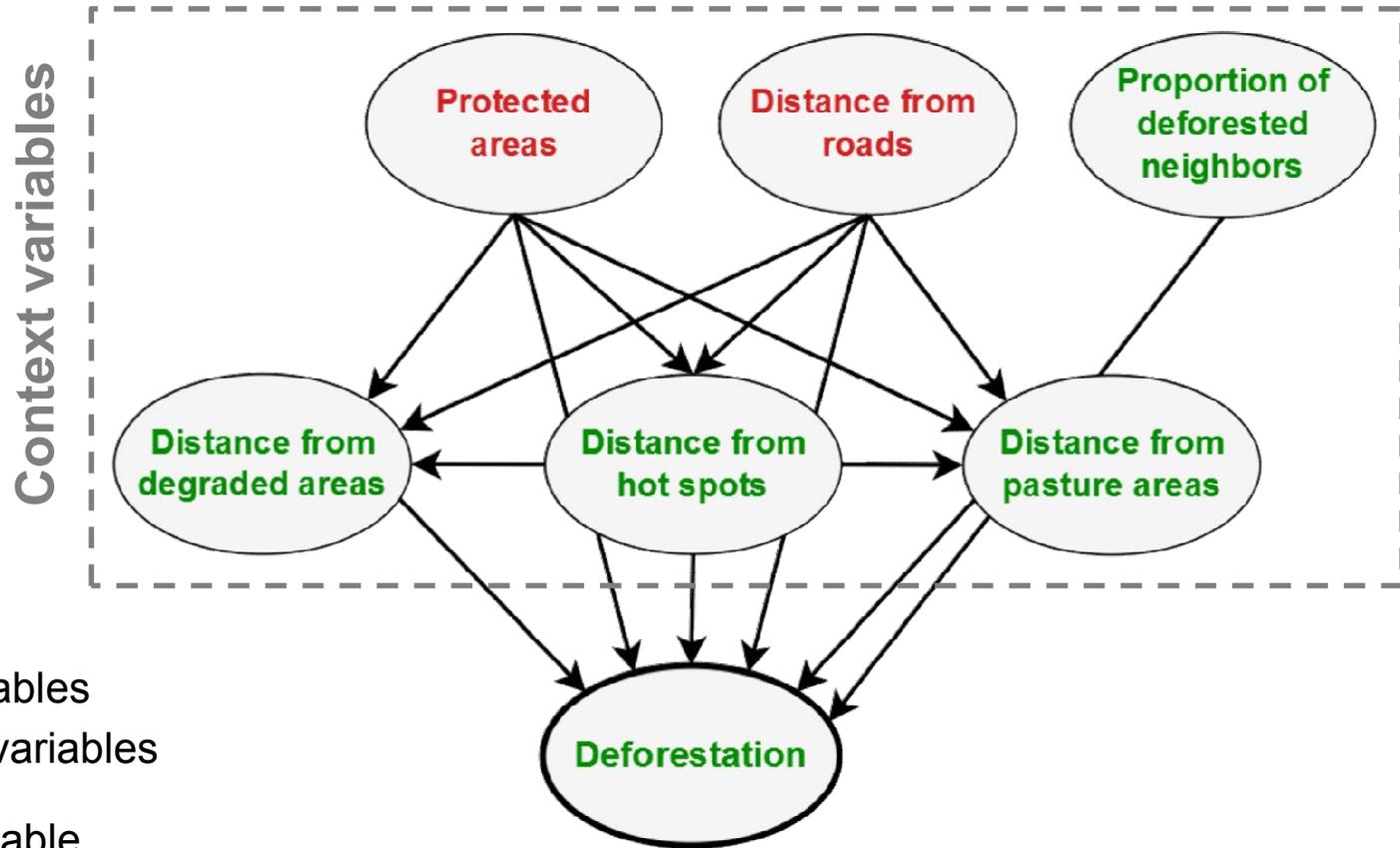
Distance from roads



Protected areas

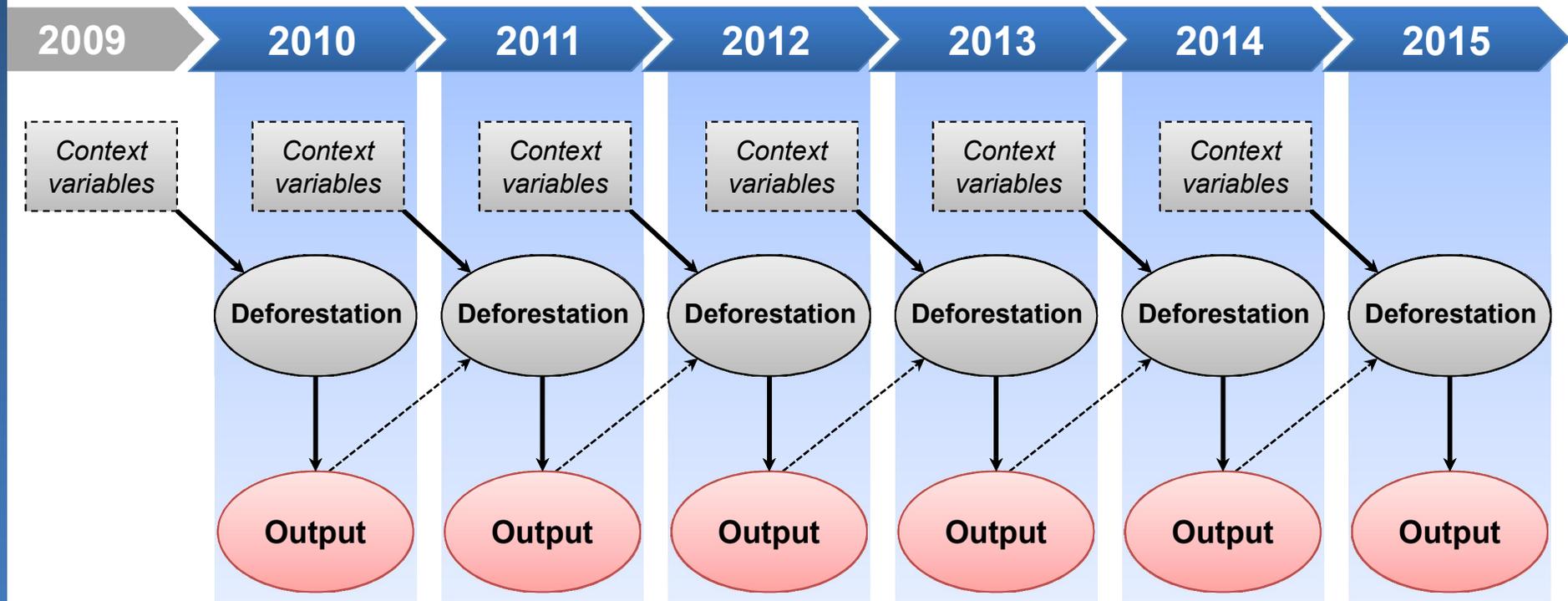


Bayesian network graphical model



-  Static variables
-  Temporal variables
-  Target variable
-  Context variables

Spatial dynamic bayesian network

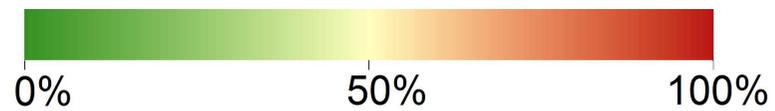


Results

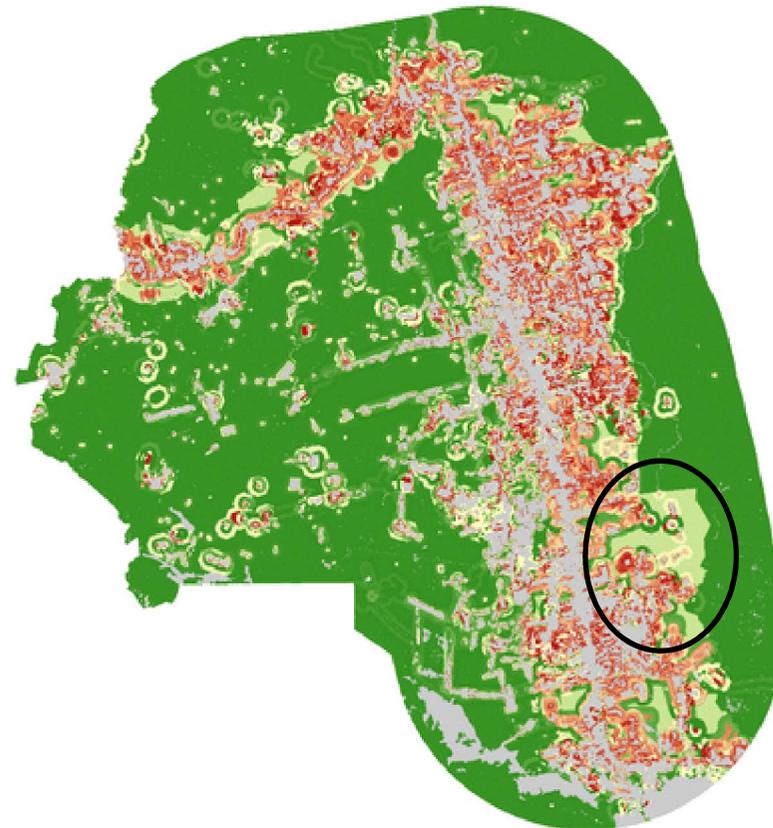
2010

Probability Images of each study year
(2010 – 2015)

Deforestation susceptibility



 Non-forest

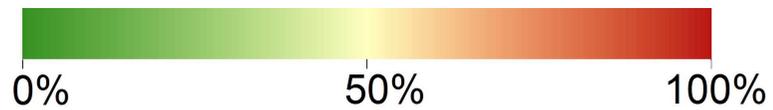


Results

2010

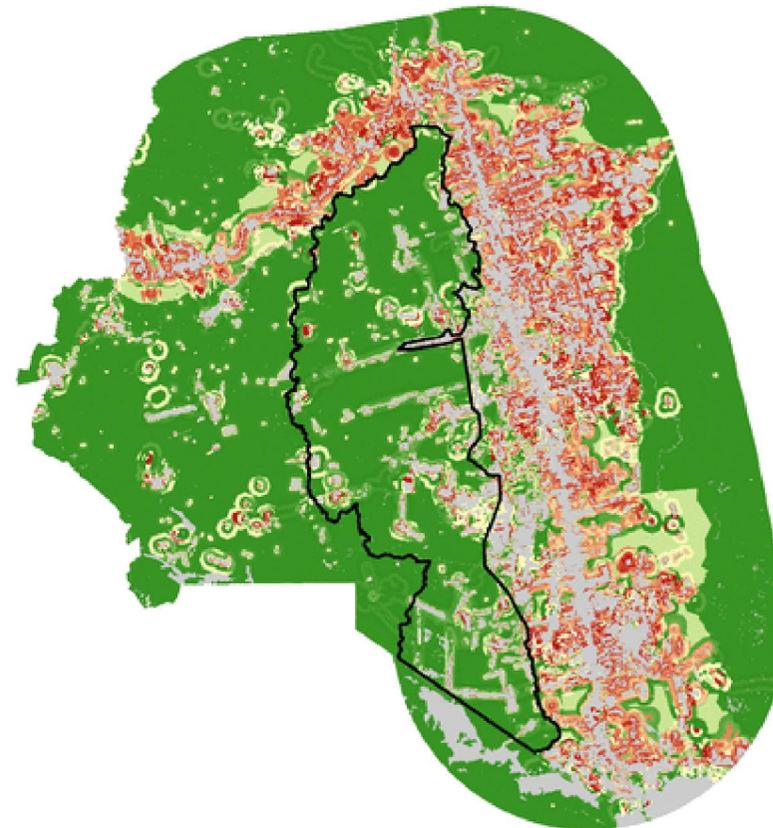
Probability Images of each study year
(2010 – 2015)

Deforestation susceptibility



 Non-forest

 Jamanxim National Forest

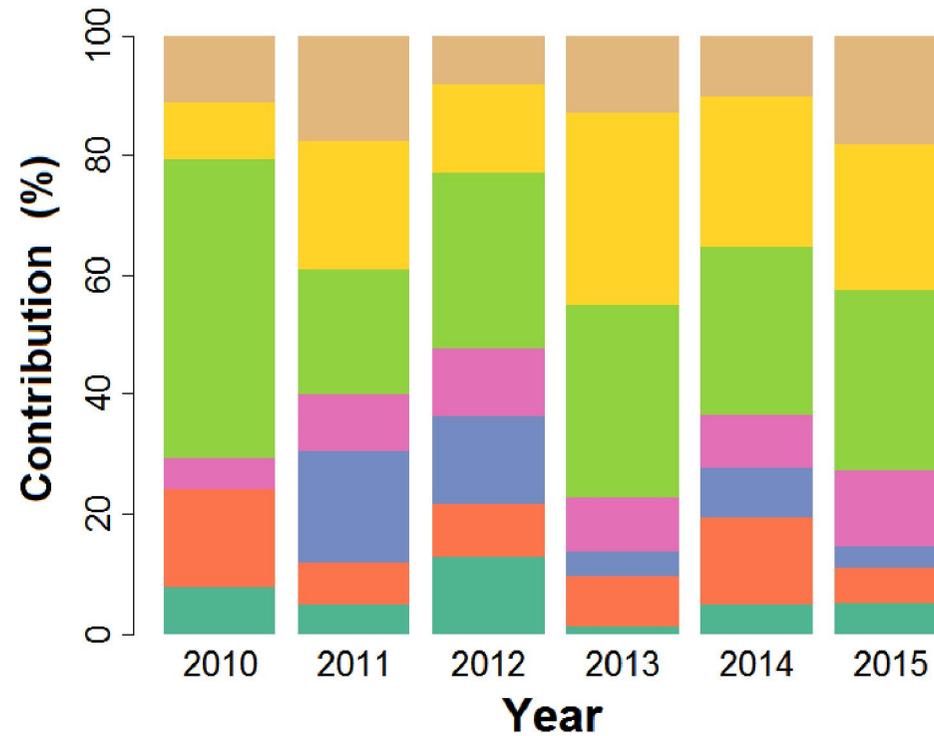


Results



Influence of each context variable
(Kullback-Leibler divergence)

- Distance from pasture areas
- Distance from degraded areas
- Distance from hot spots
- Distance from roads
- Previous year output
- Protected areas
- Proportion of deforested neighbors

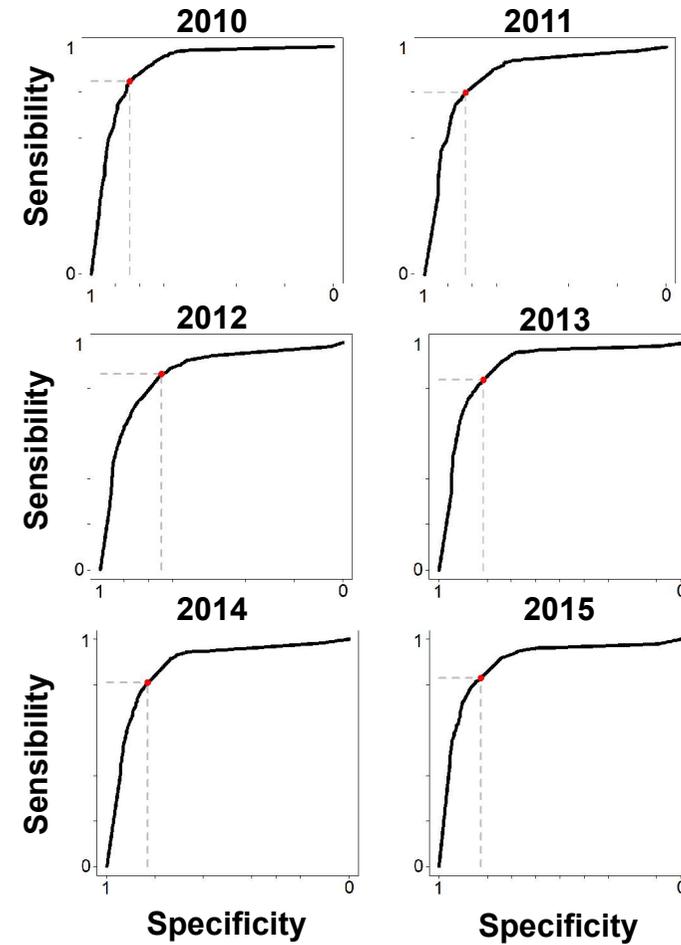


Method assessment

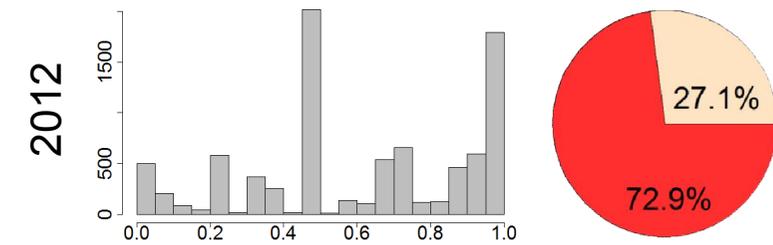
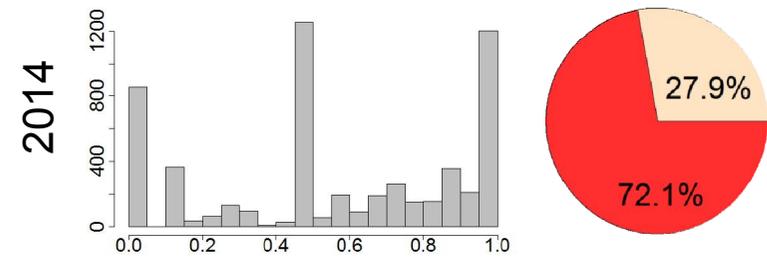
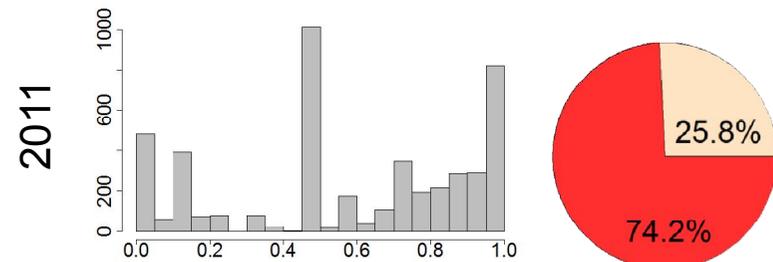
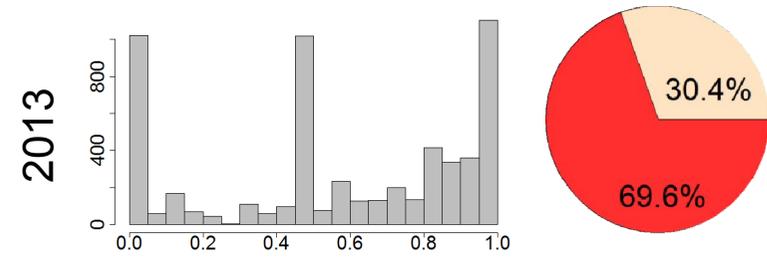
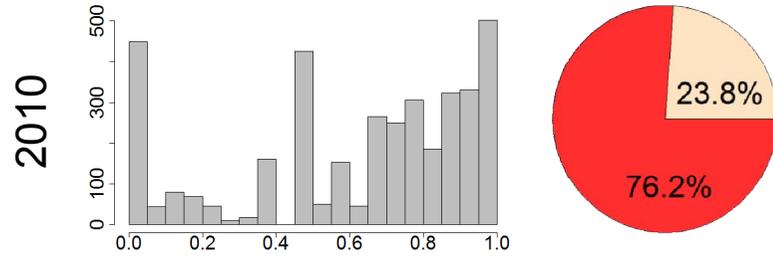


Receiver Operating Characteristic (ROC) curve

	Sensitivty	Specificity	Area under ROC curve
2010	0.84	0.84	90.5%
2011	0.80	0.83	87.3%
2012	0.86	0.75	86.3%
2013	0.84	0.82	89.3%
2014	0.80	0.83	87.9%
2015	0.83	0.82	89.3%



Method assessment



< 50%
 ≥ 50%

Final considerations



This study proposed a probabilistic method to identify susceptible areas to deforestation

Outputs can be used as indicators to the most critical areas to implement preventive action plans (Jamanxin National Forest)

Distance from hot spots and distance from degraded areas were the most important variables (selective logging)

Application of proposed method to other regions



Thank you!

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**FUNDO
AMAZONIA**



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