



**HAL**  
open science

## Bayesian hierarchical modeling: application to the babassu palm tree population dynamics in Brazil

Nikolay Sirakov, Patrice Loisel, Bénédicte Fontez Nguyen The, Danielle Mitja, Thérèse Libourel Rouge, Alessio dos Santos Moreira, Izildinha Miranda

### ► To cite this version:

Nikolay Sirakov, Patrice Loisel, Bénédicte Fontez Nguyen The, Danielle Mitja, Thérèse Libourel Rouge, et al.. Bayesian hierarchical modeling: application to the babassu palm tree population dynamics in Brazil. International Statistical Ecology Conference., Jun 2016, Seattle, United States. hal-02797216

**HAL Id: hal-02797216**

**<https://hal.inrae.fr/hal-02797216>**

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Bayesian hierarchical modeling:  
application to the babassu palm tree population dynamics in Brazil**

**N. Sirakov<sup>a</sup>, P. Loisel<sup>a</sup>, B. Fontez<sup>a</sup>, D. Mitja<sup>b</sup>, T. Libourel<sup>b</sup>  
A. M. d. Santos<sup>c</sup> and I. Souza Miranda<sup>c</sup>**

<sup>a</sup>UMR 0729 MISTEA  
SupAgro - INRA  
2 place Viala 34060 Montpellier, France  
nikolay.sirakov@supagro.inra.fr  
patrice.loisel@supagro.inra.fr  
benedictte.fontez@supagro.fr

<sup>b</sup>UMR 228 ESPACE-DEV  
IRD, Université de Montpellier  
500, Rue Jean François Breton 34093 Montpellier, France  
danielle.mitja@ird.fr  
therese.libourel@univ-montp2.fr

<sup>c</sup>Instituto Socio Ambiental e de Recursos Hídricos, Programa de Pós-Graduação em Ciências Florestais  
Universidade Federal Rural da Amazônia (UFRA)  
CP. 917, CEP 66077-530, Belém, Pará, Brasil  
alessiomsag@gmail.com  
izildinha.miranda@ufra.edu.br

**Keywords:** population dynamics; babassu palm tree; bayesian modeling

**Abstract:** The babassu palm tree (*Attalea speciosa* Mart. ex Spreng.) is an endemic species of the amazonian forests. For decades, the progress of the pioneer front highlights this palm tree in the anthropogenic open areas: pastures and cultivated fields. The babassu is one of the "extractive" resources in Brazil: gathering activity followed by marketing of non-timber products. This activity involves people among the most disadvantaged in the country. Despite this fact, the knowledge of long term functioning of the palm tree is sorely lacking. Our goal is to understand its population dynamics in the pastures and to guide local populations towards a sustainable management of the species. Our modelization process is based on field data series collected between 2013 and 2015. This field research work was conducted *in situ* in the community of Benfica, state of Para, Brazil. First we selected transects inside pastures randomly, then we counted systematically all the individuals inside those transects. We had analyzed the babassu life cycle and we decided to modelize each one of the three major biological processes: mortality, growth and recruitment. We actually develop a multinomial hierarchical model approach which relies on aggregated data: sum of the individuals per stage and per transect. In this talk we present a Bayesian modeling framework analysis with MCMC algorithms for estimate mortality, growth and recruitment rates. Mortality and growth rates are estimated for all six biological stages. We detect and highlight a critical transition between stages 3 and 4. Biologically this transition corresponds to the transfer of the bud from the soil to the surface. The vulnerability of babassu thus increases enormously. Our results also underline differences between transects - important location variability.