Mathieu BONNEAU
3461 SW 2nd avenue, #349
32607 GAINESVILLE, Florida – U.S.A.
Mobile: (+1)352-219-6166
Email: mbonneau@ufl.edu

KEY RESEARCH SKILLS & INTERESTS

TECHNICAL SKILLS

- **Spatial statistics:** Markov random field, kriging, model selection, data analysis, Reaction-Diffusion model.
- **Artificial Intelligence:** Markov decision process, stochastic dynamic programming, reinforcement learning.
- **Software:** Matlab (capable), R (moderate).
- **Languages** : French (native), English (fluent).

RESEARCH INTEREST

- Optimization and decision problems.
- Modelling.
- Application to conservation and ecology.

TEACHING

- **Teaching assistant:** 270 hours of practical work in Statistics and general Mathematics during PhD. From 15 to 35 students.
- **Ponctual lectures:** 2 hours lecture at Melbourne University and 4 hours lecture at the University of Florida.

RESEARCH POSITIONS

January 2014 to Now

Postdoctoral research associate.
U.S. Geological Survey – Florida, U.S.A.
Supervisors: Dr. Fred JOHNSON, Dr. Christina ROMAGOSA.

Project synopsis: (i) Based on a new extension of the Reaction-Diffusion model, a simulation framework has been proposed to predict the effect of different control strategies on the spatial repartition of an invasive species. The results have been applied to inform the management of the invasive Burmese pythons in the Everglades National Park in Florida. (ii) Invasive species often have to be managed spatially according to different objectives and constraints. Based on new approximations, the complex problem of optimal spatial allocation of resources can be formulated as an Integer Programming Problem. The solutions have been used to inform the management of the invasive black and white Tegu in South Florida. (iii) The extension of a network of protected lands is a complex dynamic decision problem, known as the Dynamic Reserve Design Problem (DRDP). A new approximate resolution method has been proposed to solve DRDPs with large state space. This new approach is expected to provide guidance for the establishment of the Everglades Headwaters National Wildlife refuge.

January 2013 to October 2013	**Postdoctoral research 'Survey and monitoring of *Hieracium aurantiacum* in Victorian Alpine National Park'.** University of Melbourne – Australia. Supervisor: Prof. Roger COUSENS, Dr. Cindy Hauser. **Project synopsis**: To eradicate a weed species which is colonizing a new habitat, multiple visits to the known infested areas are generally needed to prevent the reemergence of the plants (monitoring). The relation between the number of visits and the spread of *Hieracium* has been studied to inform the current monitoring program.
2009 to November 2012	**PhD thesis on '<u>Optimal adaptive sampling in Markov random fields, application for weeds mapping at the field scale</u>'.** INRA, Castanet-Tolosan – France. Supervisor: Dr. Nathalie PEYRARD, Dr. Régis SABBADIN, Dr. Sabrina GABA. **Project synopsis**: The design of strategy for sampling Markov random fields is a challenging optimization problem of interest in many practical studies. Reinforcement learning literature was adapted to find new sampling strategies. These strategies are exploited to improve weeds sampling at the field scale for the study of weeds spatial repartition.

OTHER RESEARCHE EXPERIENCES

2014	**Structured Decision Making workshop at Archbold Biological Station, Florida.** Containment of the black and white tegu in south Florida. Science support. ○ Problem framing and expert elicitation.
2013	**Structured Decision Making workshop at the U.S. National Conservation Training Center.** Management response to the threat of Burmese pythons in Arthur R. Marshall Loxahatchee National Wildlife Refuge. Science support. ○ Problem framing.
2010-2011 (6 months during PhD)	**Collaborated on a project with researcher in ecology at INRA-Dijon-France.** • Modeling weeds abundance spatial repartition in crop field. • Modeling cost of weeds sampling. • Regularly communicating project advancement and findings to a non-specialist audience.
2009	**Master thesis on 'Design of adaptive sampling method using kriging and a Boolean model'.** Supervisor: Dr. Nathalie PEYRARD, Dr. Régis SABBADIN.

EDUCATION

2008-2009	**2nd year master 'Mathematical Engineering at Toulouse'**. Paul Sabatier University, Toulouse – France.
2007-2008	**1st year master in 'Fundamentals mathematics'.** Paul Sabatier University, Toulouse – France.
2006-2007	**Bachelor in 'Computer Science and fundamentals mathematics'.** University of La Rochelle – France.

OTHER INTERESTS

Team player – Rugby since childhood, Sailing boat (cruising and regatta in France, Australia and the U.S.).

Outdoor activities – hiking, kayaking, road triping (crossed Australia and the U.S. in a van).

REFEREES

- **Current postdoctoral supervisor:** Dr Fred A. JOHNSON
  U.S. Geological Survey – Gainesville, Florida – U.S.

  Phone: (+1)352.264.3488
  Email: fjohnson@usgs.gov

- **Previous postdoctoral supervisor:** Dr. Cindy E. HAUSER
  School of BioSciences – The University of Melbourne – Australia.

  Phone: (+61)3.8344.3201
  Email: chauser@unimelb.edu.au

- **PhD supervisor:** Dr Régis SABBADIN
  MIAT – INRA Toulouse – France.

  Phone: (+33) 5.61.28.54.76
  Email: regis.sabbadin@toulouse.inra.fr

PUBLICATIONS

- **CONFERENCES**
  - **European Conference on Artificial Intelligence** (ECAI), 'A reinforcement learning algorithm for sampling design in Markov random fields'. Montpellier-France, August 2012.

6 pages article + oral presentation. First Author.

  - **French Days of Dynamic Programming and Learning** (JFPDA), 'Échantillonnage adaptatif dans les modèles de champs de Markov discrets'. Rouen-France, June 2011.

12 pages article + oral presentation. First Author.

  - **European Weeds Research Society** (EWRS), 'An adaptive sampling method using Markov random fields for weed mapping at the field scale'. Workshop, Dijon-France, February 2011.

Poster

  - **European Conference on Complex Systems** (ECCS), 'Solving adaptive sampling problems in graphical models using Markov decision process'. Workshop, Lisbonne-Portugal, Septembre 2010.

6 pages article + oral presentation. First Author.

  - **Shapes Recognition and Artificial Intelligence** (RFIA), 'Échantillonnage spatial basé sur le krigeage pour la reconstruction de cartes d'occurrence'. Caen, Janvier 2010.

8 pages article + oral presentation (Awarded 2nd best presentation). First Author.

- **JOURNAL**

  - **Biological Invasions**, 'Optimal weed monitoring schedule when detection and treatment success vary over time'. First Revision. First Author.

  - **Ecological Modelling**, 'Spatially Explicit Control of Invasive Species Using a Reaction-Diffusion Model'. First Revision. First Author.

  - **Environmental and Ecological Statistics**, 'Sampling for weed spatial distribution mapping need not be adaptive'. Accepted. First Author.

  - **Computational Statistics and Data Analysis** (CSDA), 'Reinforcement learning based design of sampling policies under cost constraints in Markov random fields'. Accepted. First Author.

  - **Journal of Artificial Intelligence** (RIA), 'Décision dans les agro-écosystèmes'. Accepted. Co-Author.

- **Agronomic Innovations**, 'Que nous disent les réseaux d'observations sur les réactions de la flore adventice aux évolutions des pratiques agricoles?'. Accepted. Co-Author.

In preparation :

- **Journal of Applied Ecology.** 'Implications of Demographic Uncertainty for Controlling Tegu Lizards in south Florida'. Co-Author.

- **Biological Invasions.** 'Management of Tegu lizards in Sout Florida: comparison of the current approaches and near-optimal strategy'. First Author.

- **Biological Conservation. '**Identifying an optimal management strategy for an imperial salamander using a category count model approach'. Co-Author.

- **Biological Conservation.** 'A generalized short-term gain heuristic for the dynamic reserve site selection problem'. First Author.

- **Biological Conservation.** 'Optimal design of protection zones for marine mammals: a framework to quantify zone efficacy and optimally minimizing lethal collision risk from watercraft under management constraints'. Co-Author.

- **BOOK CHAPTER**
  - Advanced Modelling Techniques Studying Global Changes in Environmental Sciences, 1st Edition. Co-Author of the chapter Decision in Agro-Ecosystems.

- **TECHNICAL REPORTS**
  - 'How to model weed spatial distribution using Markov random fields'. First Author.

  - 'Weed species richness explains most of sampling duration in arable fields'. First Author.

- **THESIS**
  - 'Échantillonnage adaptatif optimal dans les champs de Markov, application à l'échantillonnage d'une espèce adventice'. PhD thesis.

  - 'Échantillonnage spatialisé optimal basé sur le krigeage'. Master Thesis.

- For the journal Ecological Applications.