ABSTRACT:
Despite the intense international interest in statistical modelling of complex data, and of improved modelling of ecological and environmental data, there are still substantial gaps in both the statistical theory and methods and their application in this field. These gaps motive the current PhD research proposal: to create new knowledge in Bayesian statistics to address problems in ecology and environmental sciences that involve complex data. The outputs of this research will benefit not only the fields of Bayesian statistics and environmental sciences, but will also translate to other areas of statistics and applied sciences.

In the context of global change, is important to better understand the impact of human activities on ecosystems. Until now, a lot of efforts were put in the study of biodiversity declines, and less attention was paid in how ecosystem functions are affected. However, how ecosystems work is a major question in ecology and what is the functioning response to human stressors should become a main topic in future ecology research. The phd research project aims to study response of some species community to environmental changes including human induce changes. Study species community involving multitrophic levels is really relevant because it could be seen as a proxy of ecosystem functioning. Indeed, that aims to understand how species interact with each other and with their environment. The final goal would be to be able to explain and predict the functioning changes in ecosystems regarding species community composition and distribution.

Keywords: Bayesian modelling, complex ecological and environmental data,
HOST LABORATORY PROFILE
LMAP, Laboratory for Mathematics and its Applications - Pau (UPPA/CNRS)- UMR CNRS 5142.

PRINCIPAL ACTIVITIES

I. Scientific Context
Almost every area of human endeavour has been impacted in the past few decades by new forms of data. An immediate example is ‘big data’. In addition to a greater volume of data from traditional sources, there are also many more sources of potentially useful data. For example, traditional observational data can be more easily acquired using new technology, and can be complemented by new digital data acquired by sensors such as satellites, wearables and automatic monitoring devices. Complex data can also include ‘systems data’ which require a fusion of data sources to comprehensively describe a complicated process.

Bayesian computational statistics offers an appealing framework for modelling and analysis of all of these forms of complex data. For example, models that encourage sparsity and adaptive sampling can help to address the problem of big data; informative priors can be employed to support little data; and Bayesian networks are an effective way of describing complicated systems.

An area of application that is of strong interest to the E2S-UPPA consortium is in ecology and environmental sciences.

II. Objectives and Work plan
Despite the intense international interest in statistical modelling of complex data, and of improved modelling of ecological and environmental data, there are still substantial gaps in both the statistical theory and methods and their application in this field.

These gaps motive the current Phd proposal: to create new knowledge in Bayesian statistics to address problems in ecology and environmental sciences that involve complex data.

The outputs of this research will benefit not only the fields of Bayesian statistics and environmental sciences, but will also translate to other areas of statistics and applied sciences.

Application
In the context of global change, is important to better understand the impact of human activities on ecosystems. Until now, a lot of efforts were put in the study of biodiversity declines, and less attention was paid in how ecosystem functions are affected. However, how ecosystems work is a major question in ecology and what is the functioning response to human stressors should become a main topic in future ecology research. The phd research project aims to study response of some species community to environmental changes including human induce changes. Study species community involving multi-trophic levels is really relevant because it could be seen as a proxy of ecosystem functioning. Indeed, that aims to understand how species interact with each other and with their environment. The final goal would be to be able to explain and predict the functioning changes in ecosystems regarding species community composition and distribution.
Coral reefs are typically complex communities of high ecological interest due to their regression. These fragile ecosystems are submitted to many stressors including direct and indirect human perturbation (fisheries, tourism, ocean warming, acidification, pollution) and natural events (cyclones, starfish predation). The study of changes of this ecosystem with complex species interaction and subject to strong anthropogenic pressures is an example applicable to the research PhD project.

Study organisms at community level often imply a compilation of multiple data sources to obtain a representative image of the ecosystem and then involve multivariate high dimensional data. In addition to that, study changes implicate spatio-temporal structure of the data. And other issues remain related to regression problems. In a nutshell, study changes in species community can be really challenging and usual statistical methods used in ecology do not well handled this complexity.

**REQUIRED COMPETENCES,**

The applicants should have a MSc-degree with double competence in ecology and statistics (or comparable skills), have experience with programming, good communication skills and interest in working in a cross-disciplinary team. Sound experience with Bayesian statistics, hierarchical modelling, quantile mapping and curve fitting and multivariate spatio-temporal analysis is sought. It is an advantage, but it is not required, to have an experience with cross-disciplinary research.

**REQUIRED DOSSIER,**

Applicants should e-mail to Benoit Lique and Kerrie Mengersen: i/ a letter of application detailing candidate's motivations, ii/ candidate's MSc marks and ranking, iii/ a resume (CV) and iv/ a brief statement of research interest and skills. Names and email of three references will be appreciated. Candidates completing their MSc-degree in the Spring 2019 are also encouraged to apply. Following evaluation of the applicants CV's by the selection committee, interview with the selected candidates and ranking will be carried out.

**Limiting date:** apply before 2019/05/30

**CONTACTS**

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