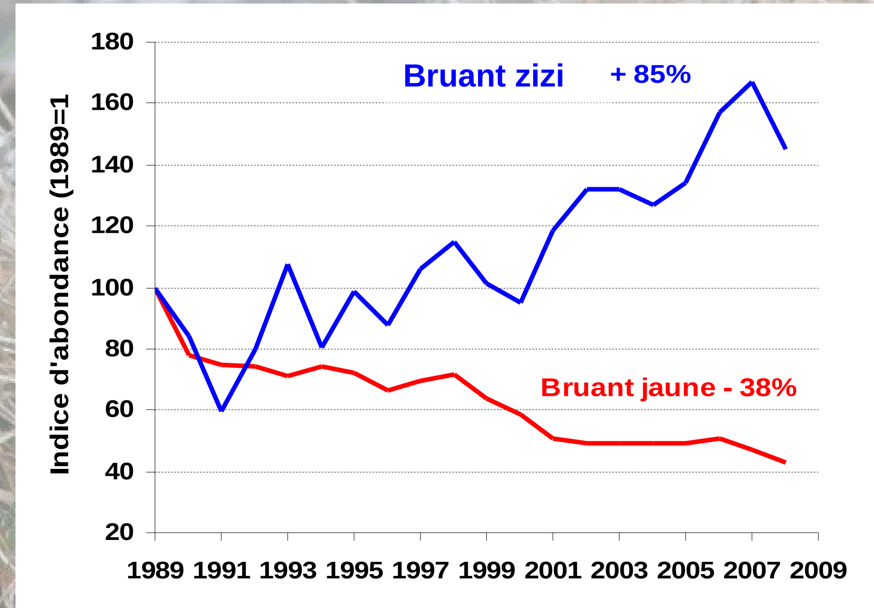
Modèles de niche

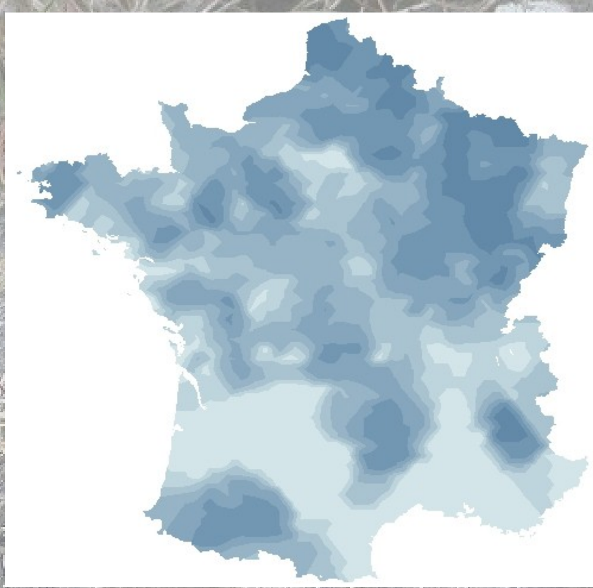
Cas concrets d’utilisation

Frédéric JIGUET UMR7204 MNHN-CNRS-UPMC

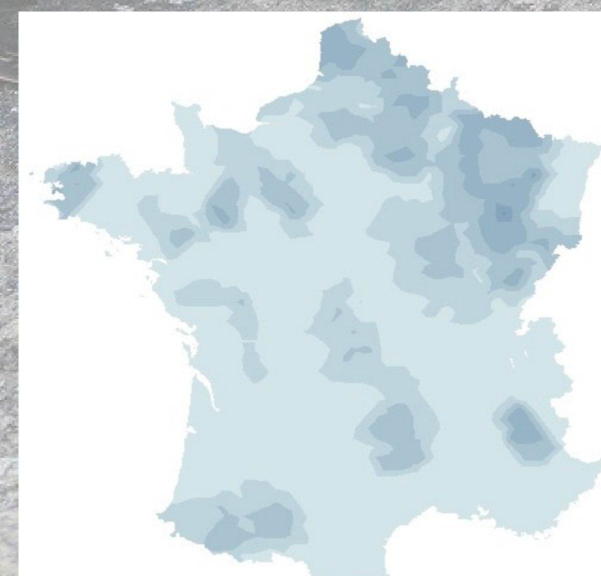
Prédictions simples



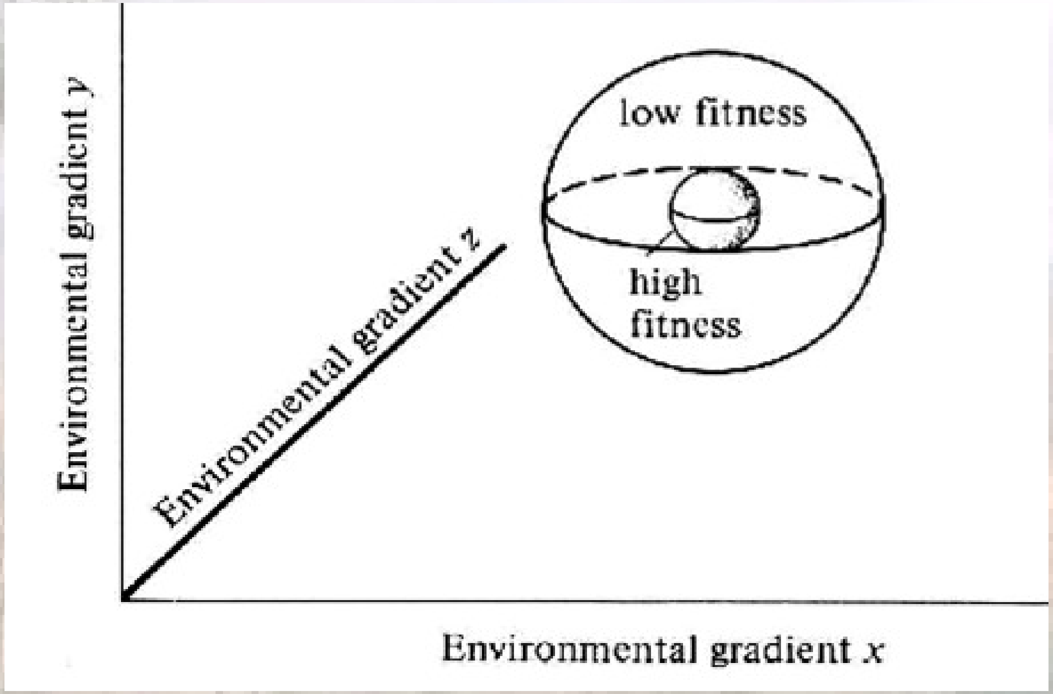
2001-8



Si +3°C



La niche écologique (Hutchinson 1957)

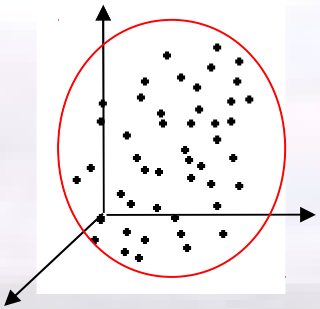


Principes généraux de la modélisation de niche

Espace écologique

Informations environnementales

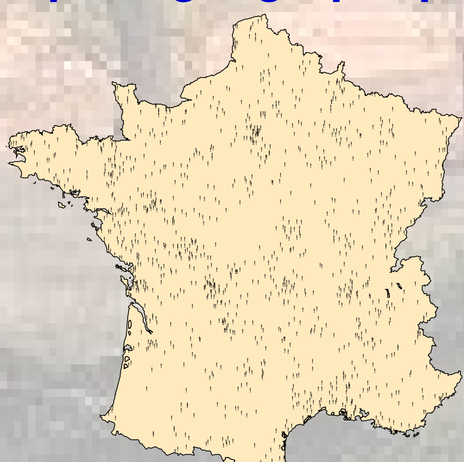
Algorithmes

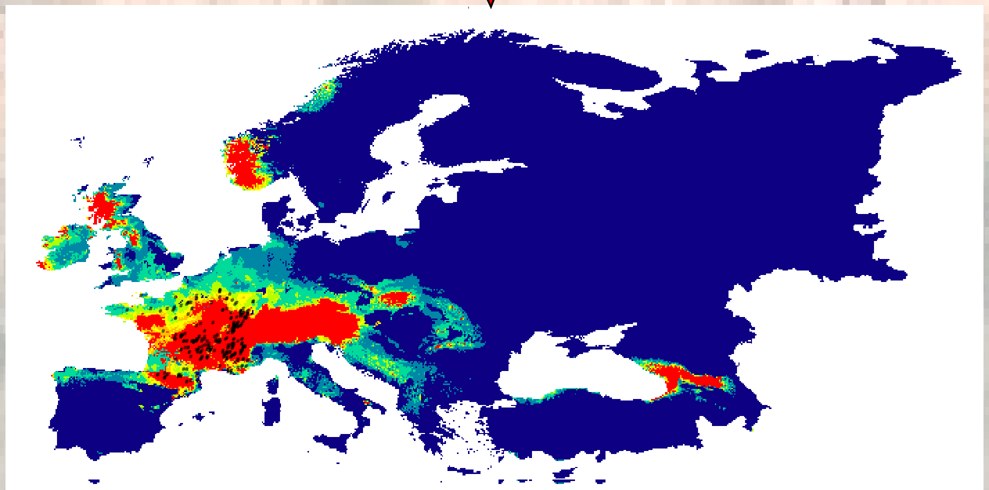


N dimensions

Projection

Espace géographique





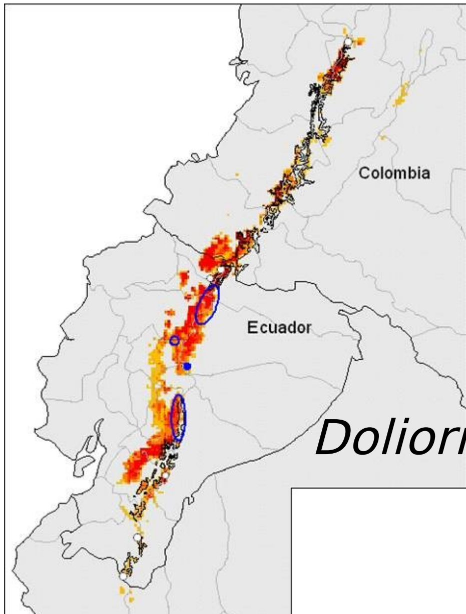
Prédire la distribution d’espèces rares

2 espèces jumelles allopatriques rares

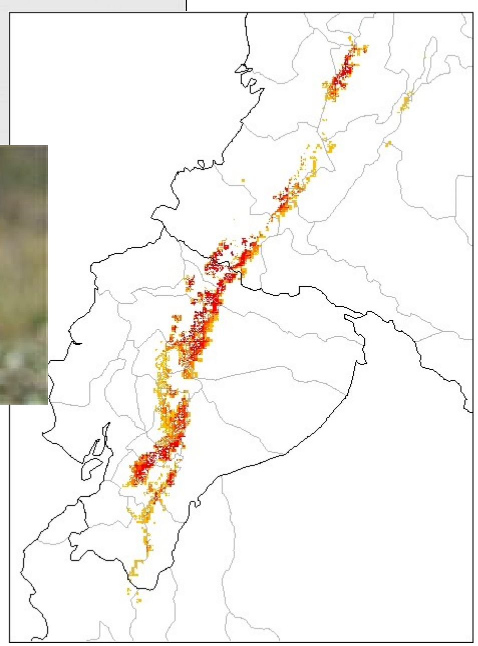
(n = 7 et 13 données)

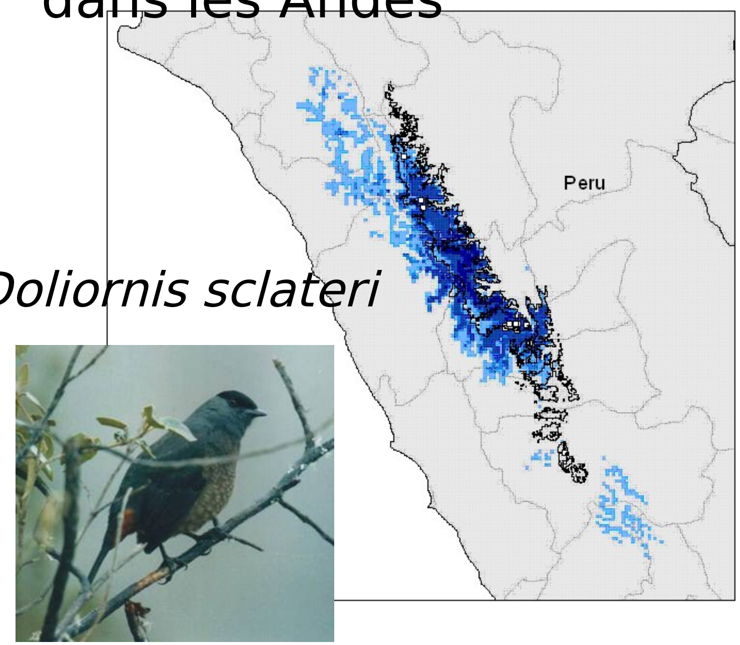
Cotingas du genre *Doliornis*

dans les Andes



Doliornis remseni



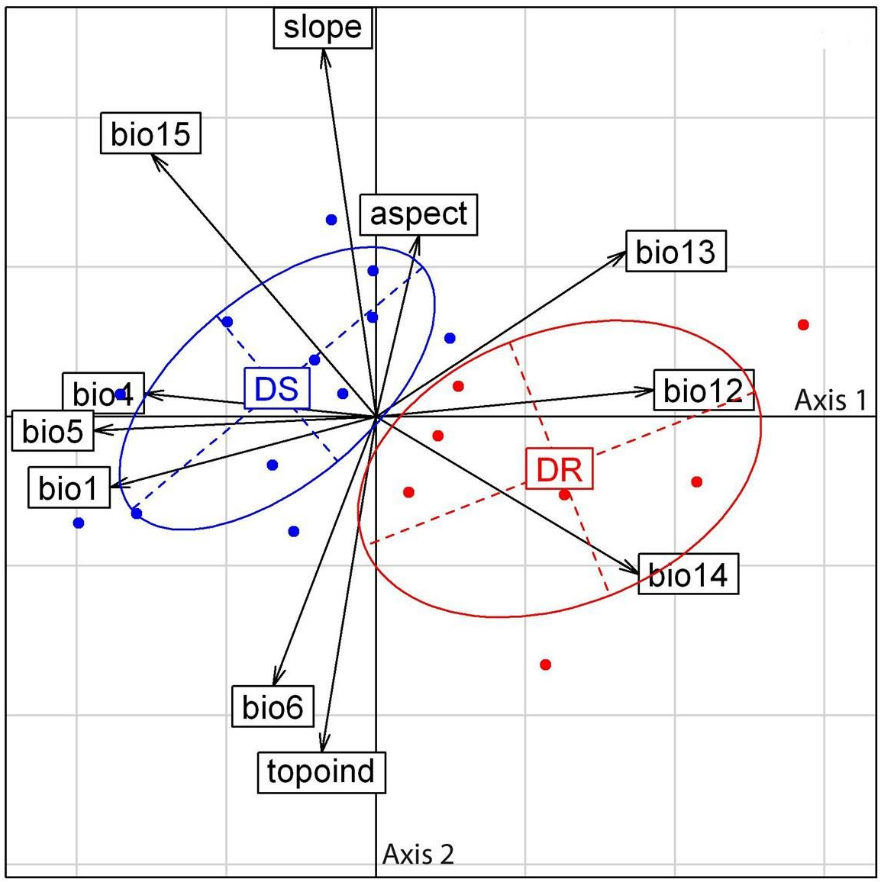


Doliornis sclateri

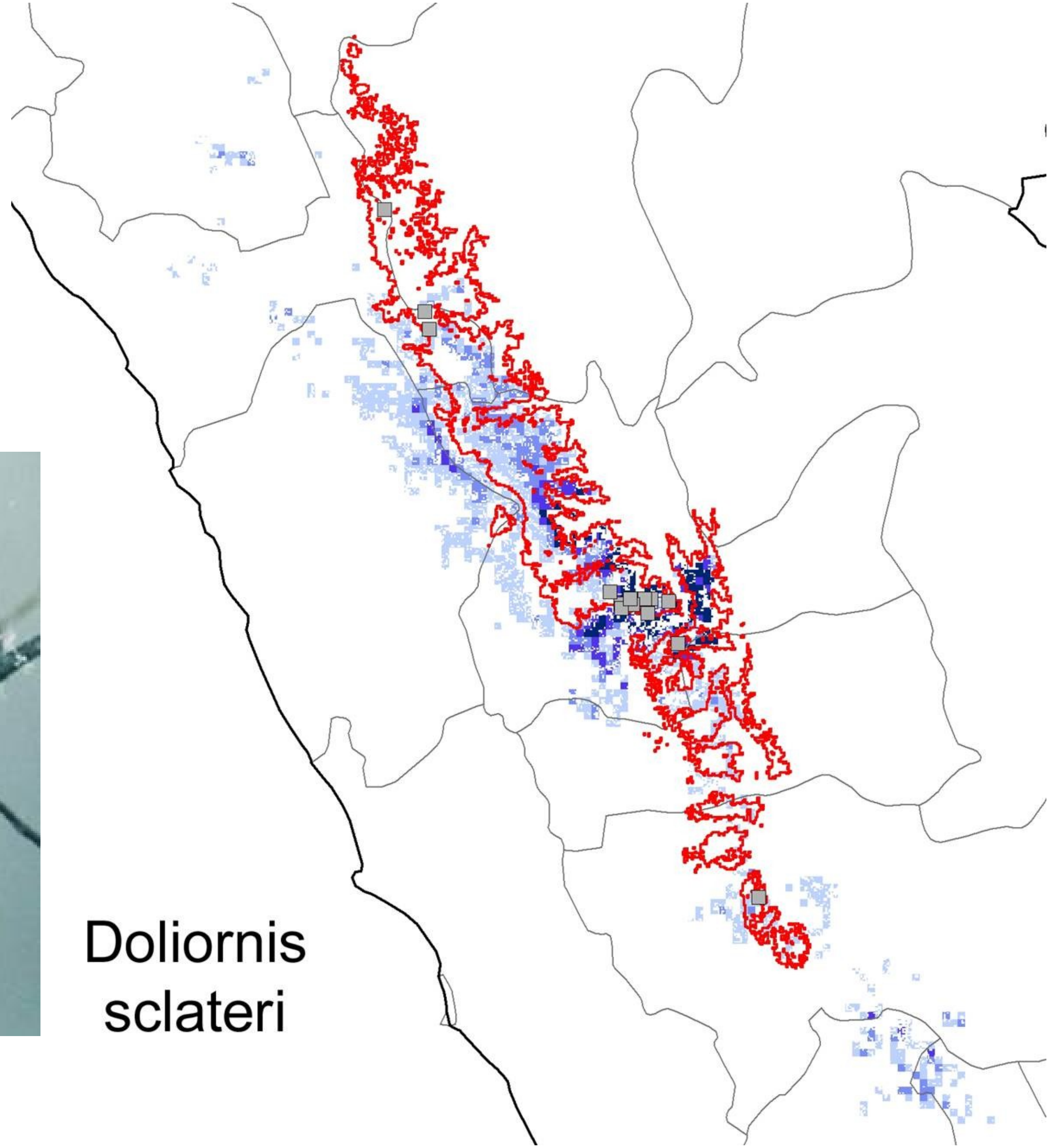
J. Field Ornithol. 81(4):325–339, 2010 DOI: 10.1111/j.1557-9263.2010.00289.x

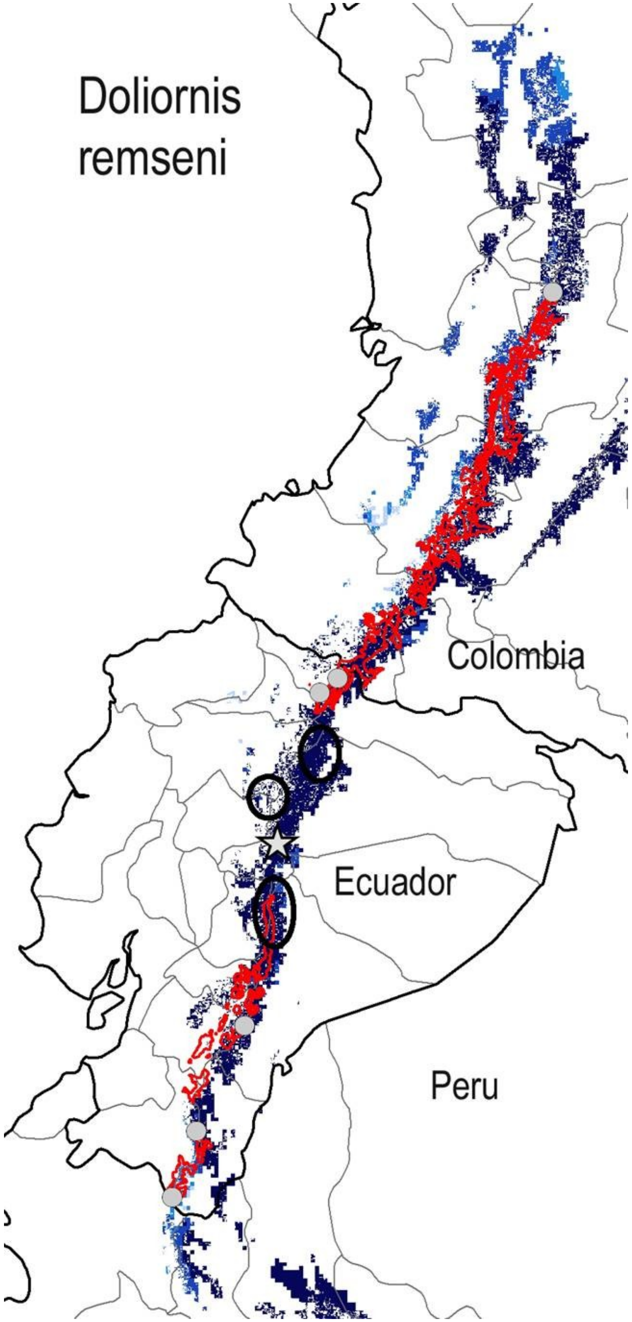
Predicting potential distributions of two rare allopatric sister species, the globally threatened *Doliornis* cotingas in the Andes

Frédéric Jiguet,[1,3] Morgane Barbet-Massin,[1] and Pierre-Yves Henry[2]



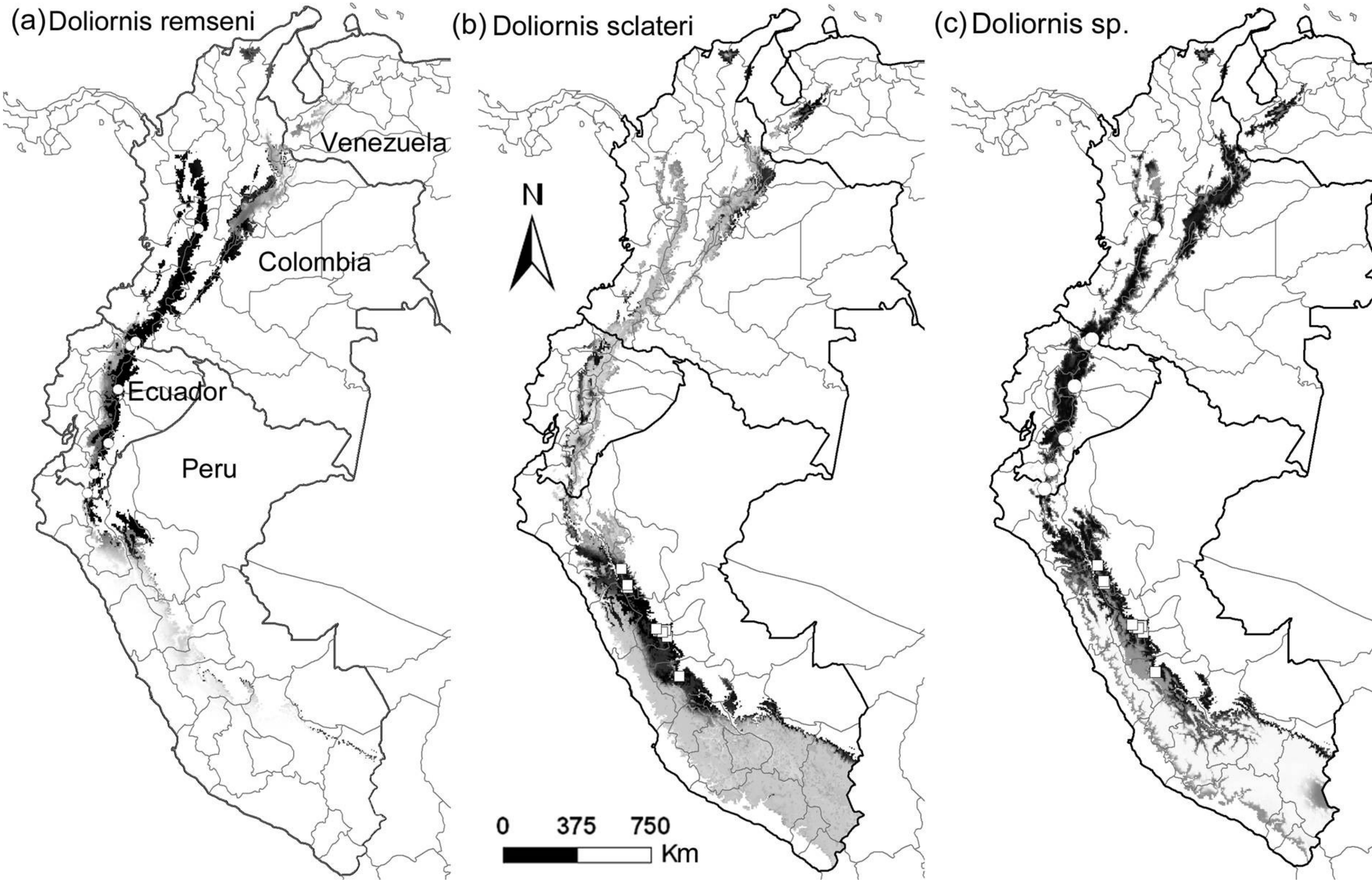
Doliornis sclateri



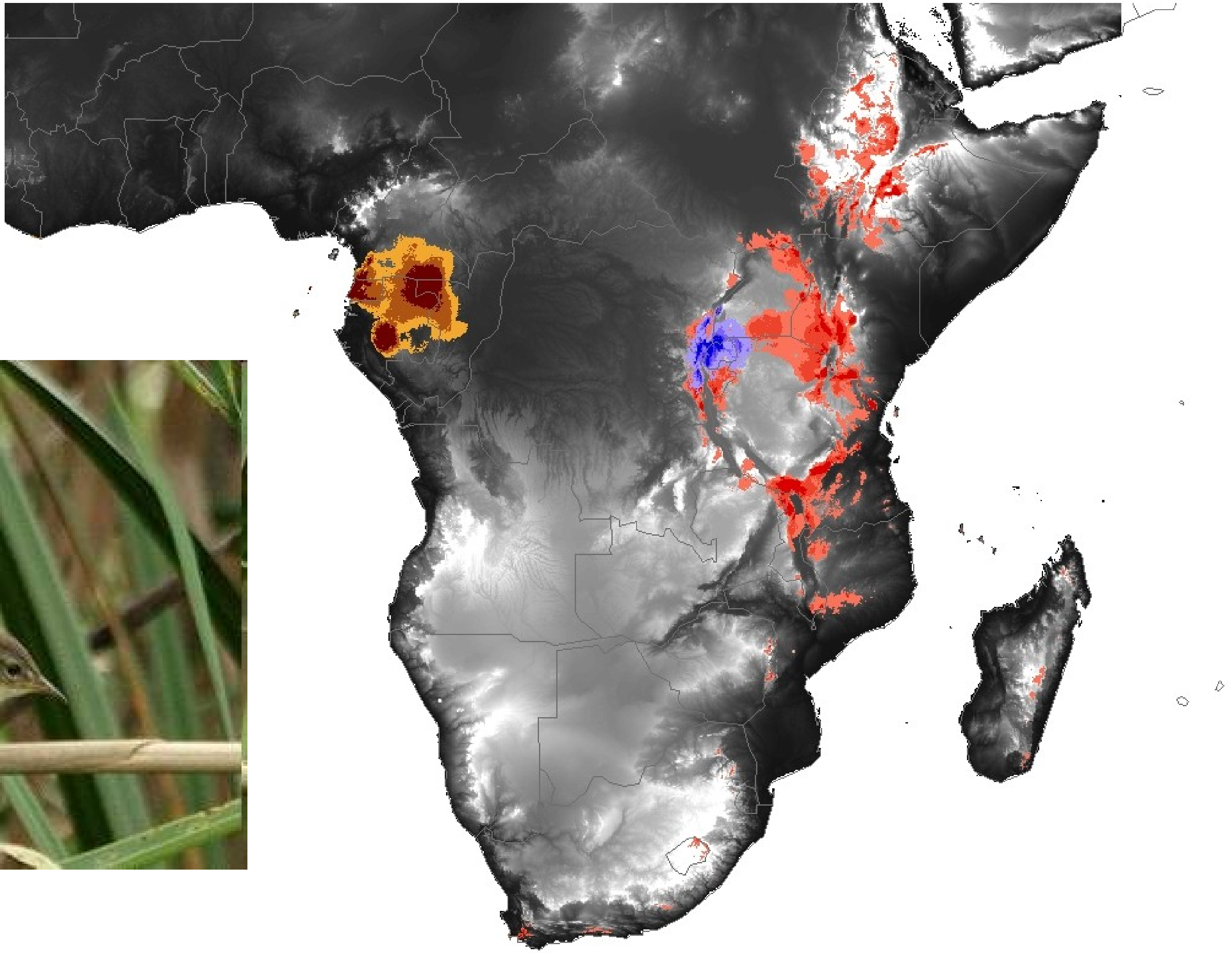

Doliornis
remseni
Colombia
Ecuador
Peru


ARKive
www.arkive.org
© Mark B. Robbins / VIREO

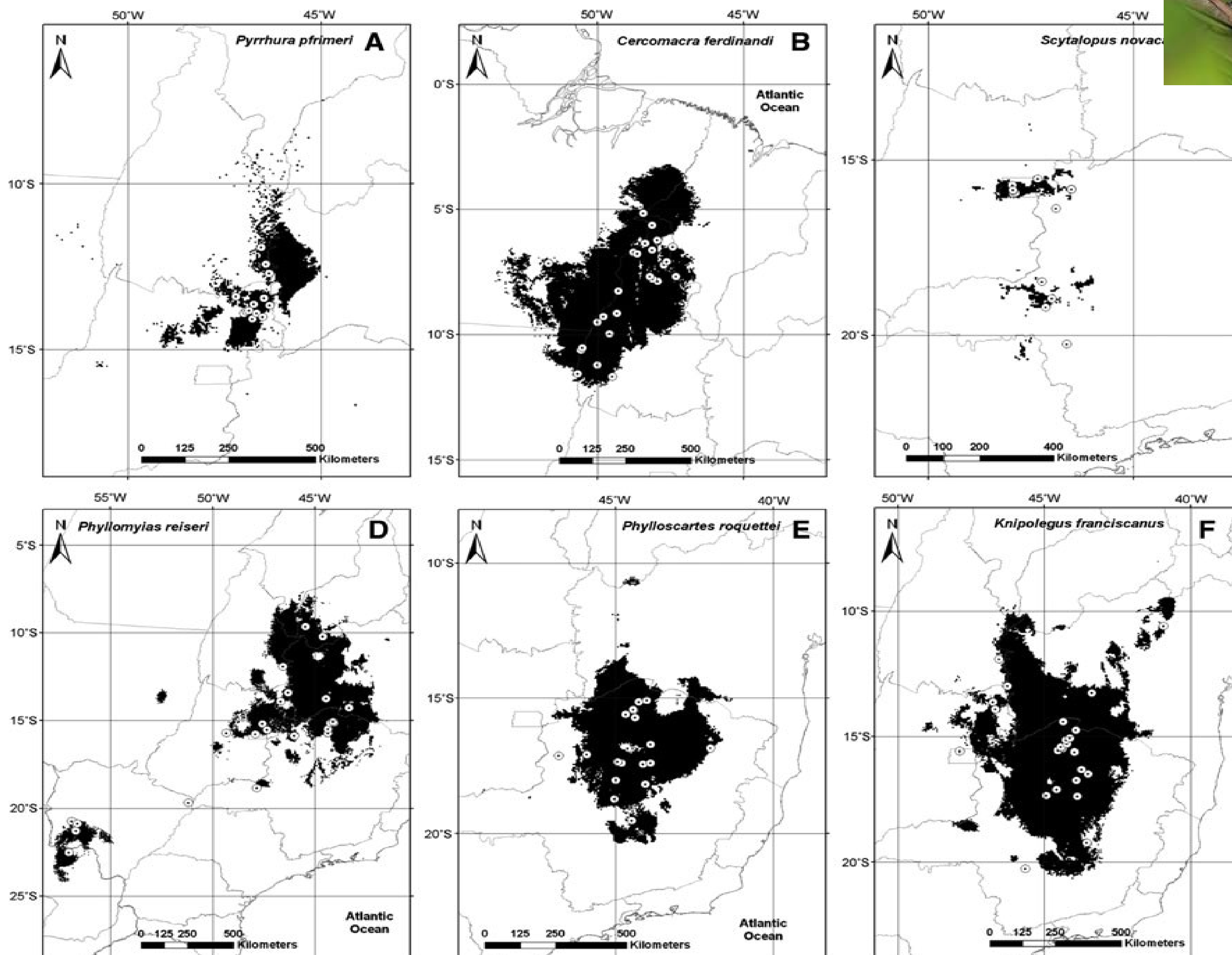
Doliornis sp.



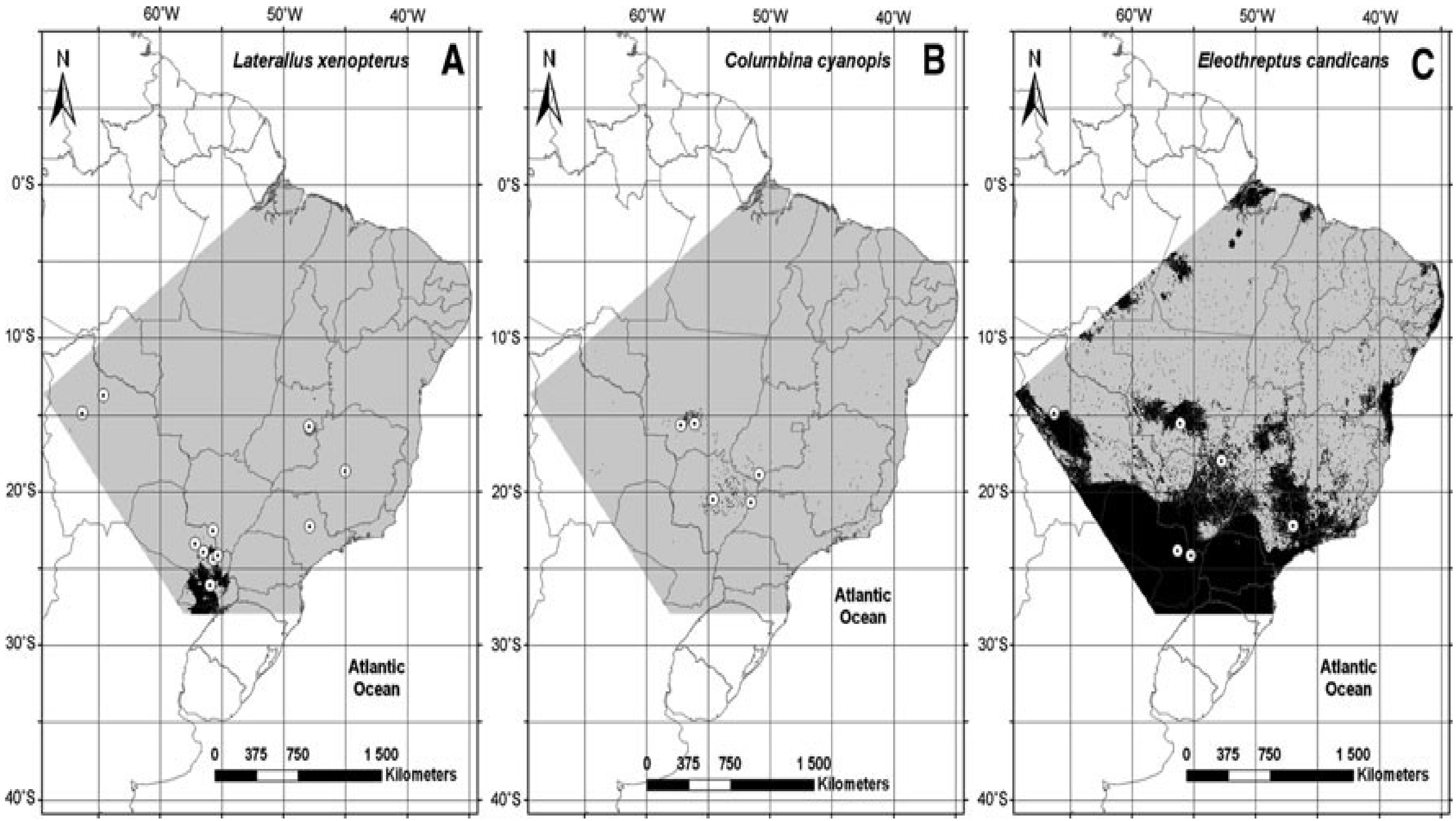
Bradypterus sp.



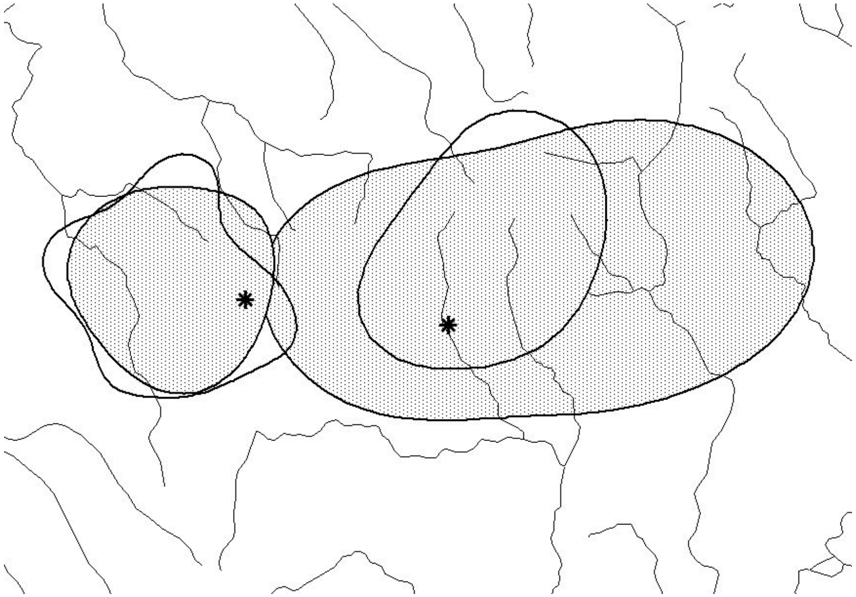
Oiseaux rares au Brésil

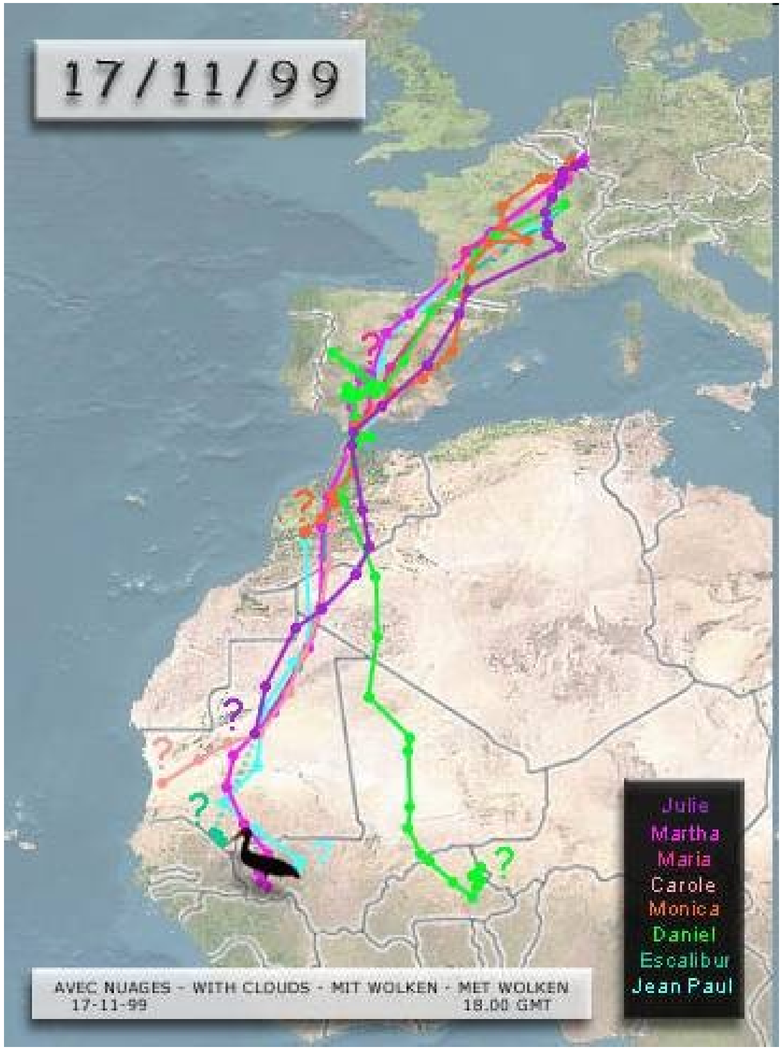


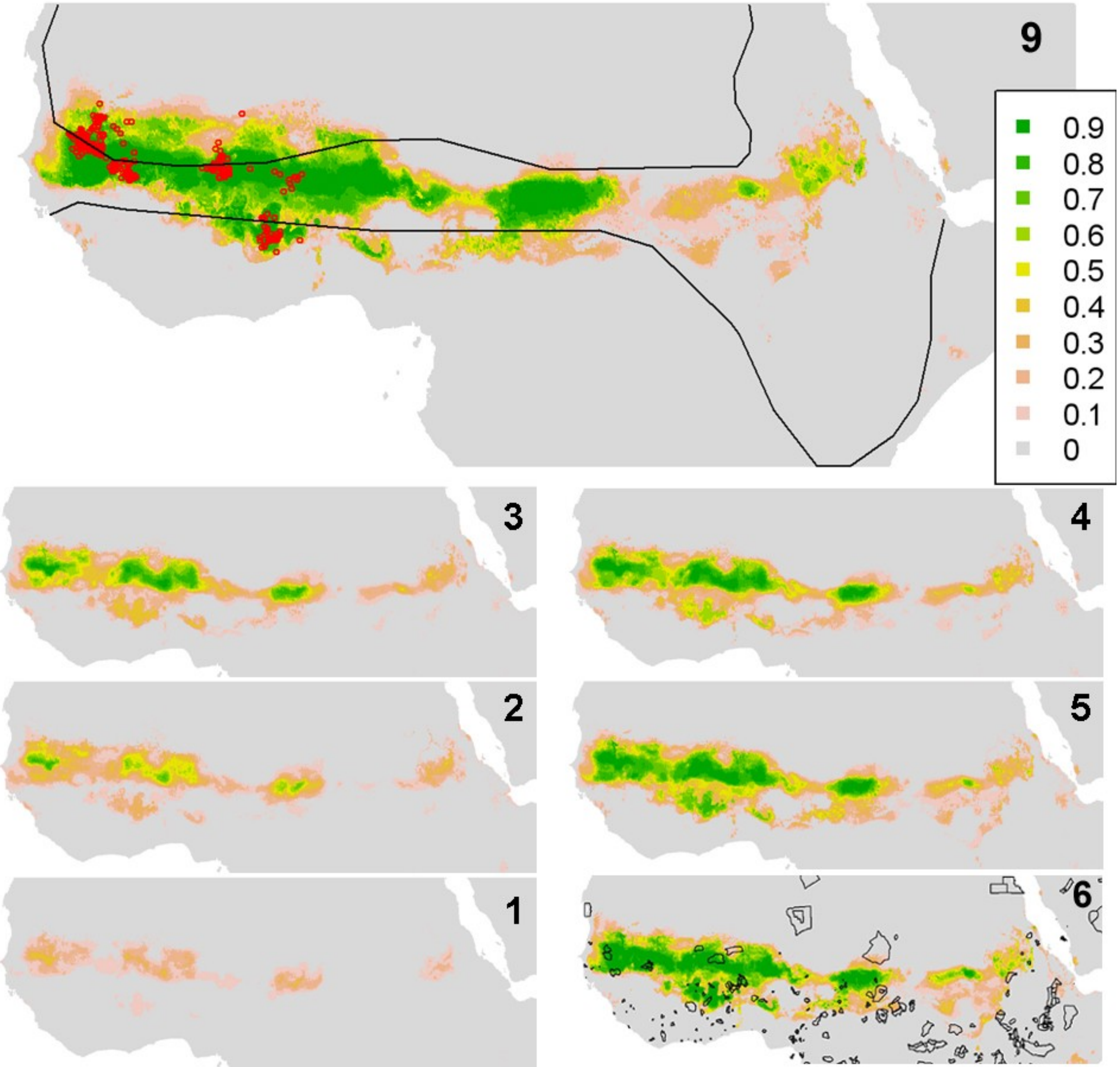
Mais aussi de mauvais modèles…



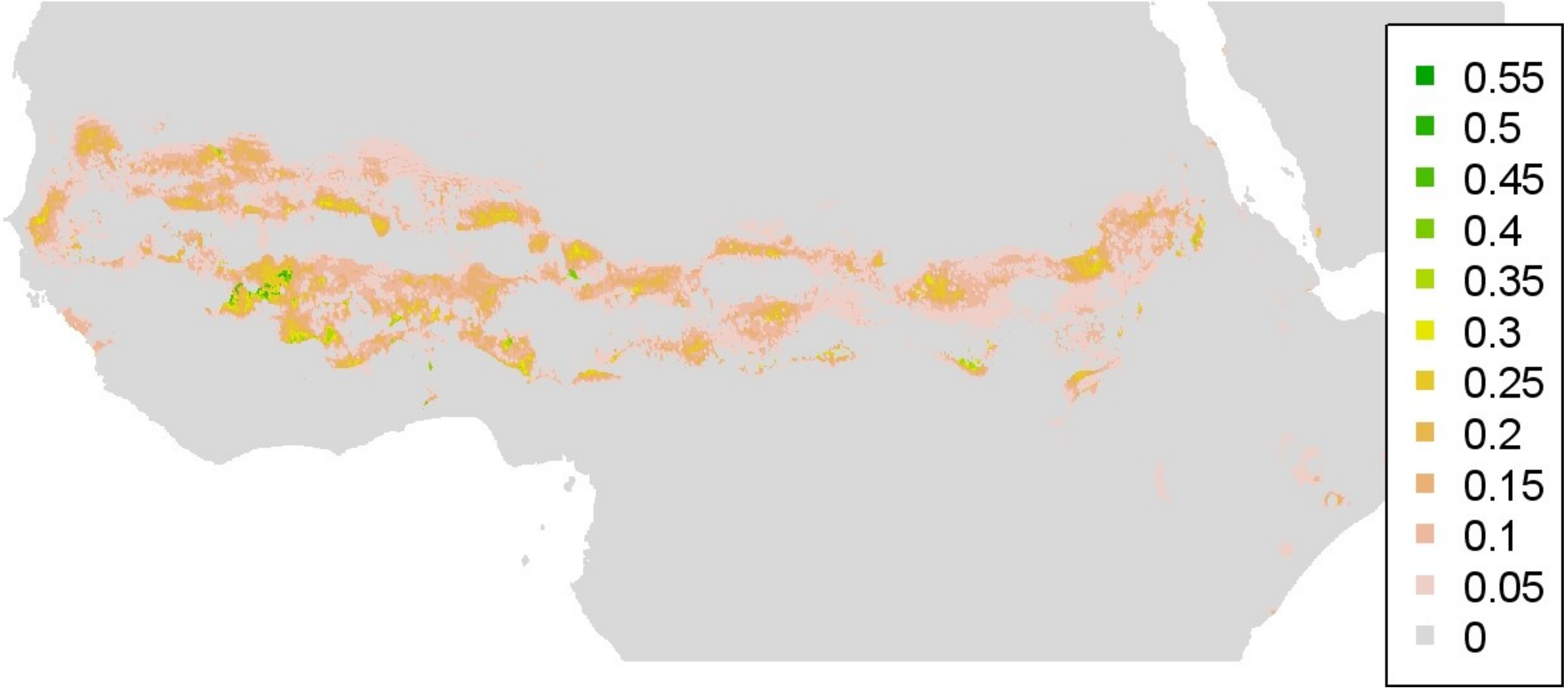
Cigogne noire en hiver






9
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3
4
2
5
1
6

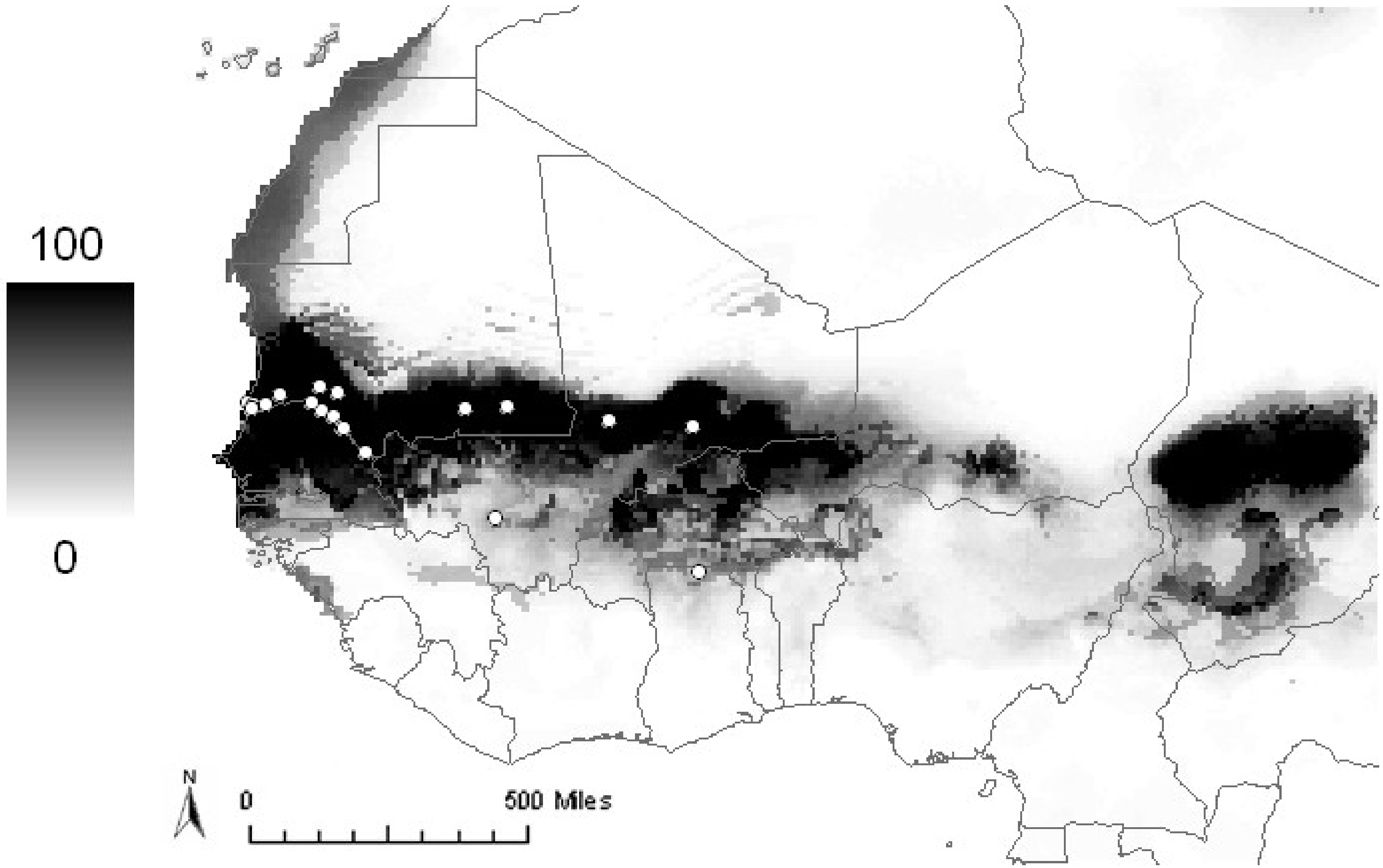
Carte des Erreurs



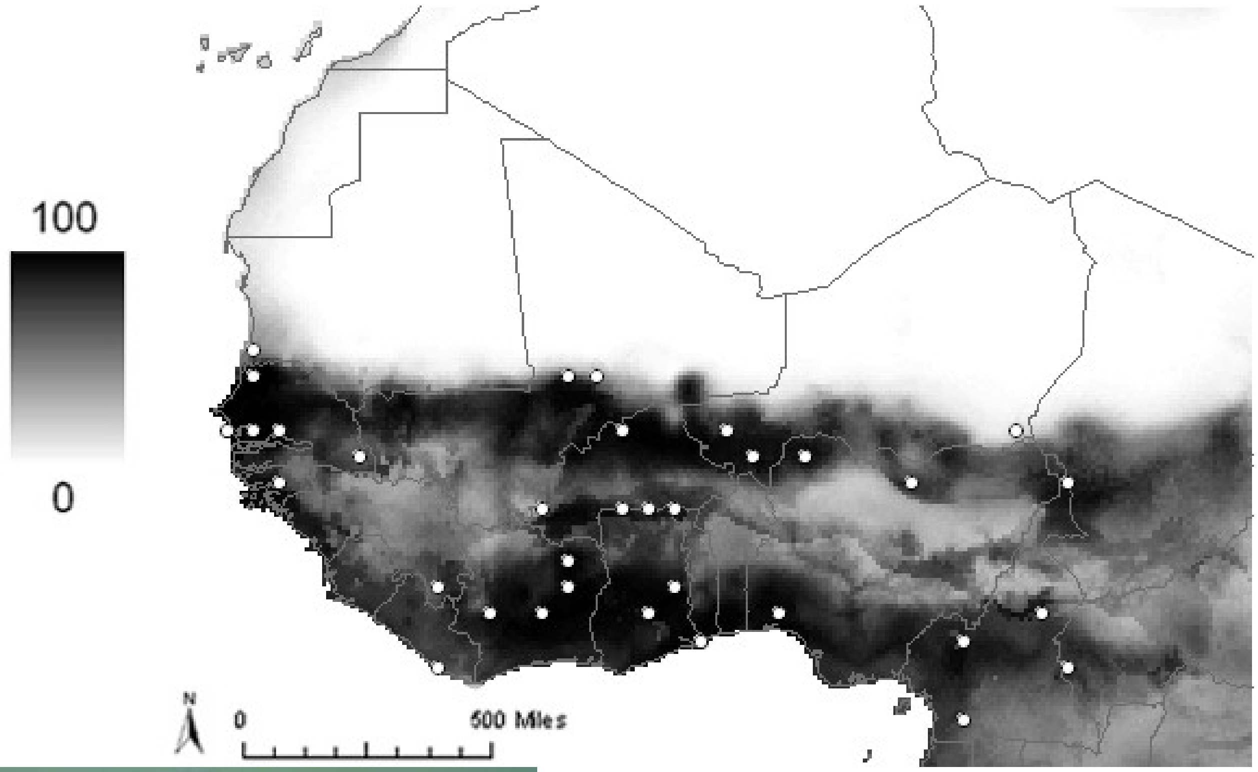
Prédire les zones d'hivernage inconnues du Phragmite aquatique ?

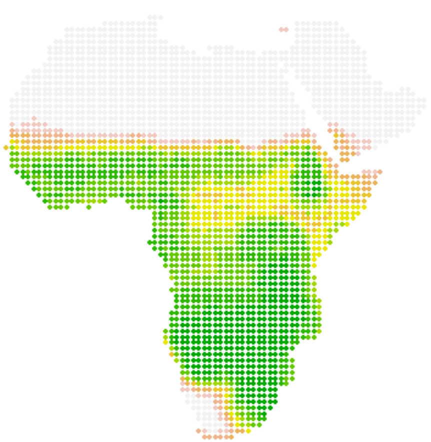
S'il cherche la même niche en été et en hiver

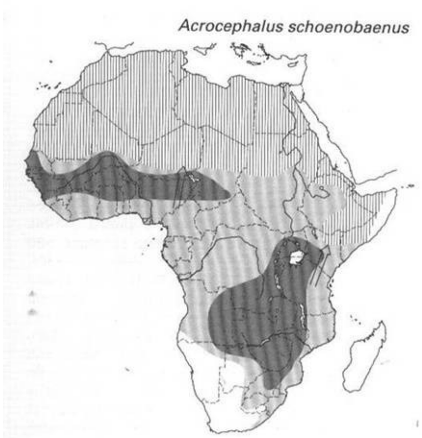
13 localités hivernales connues



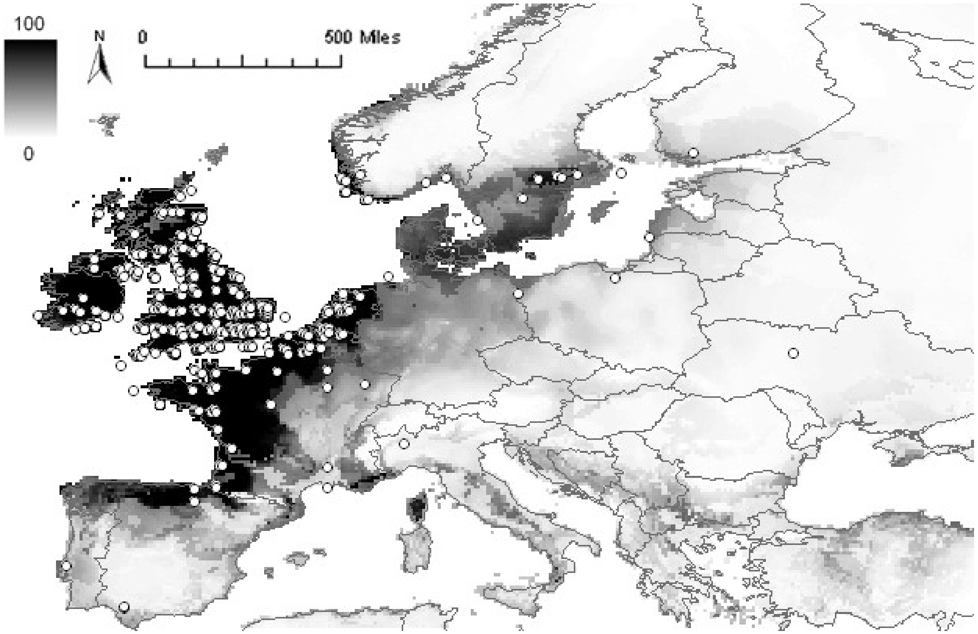
Phragmite des joncs

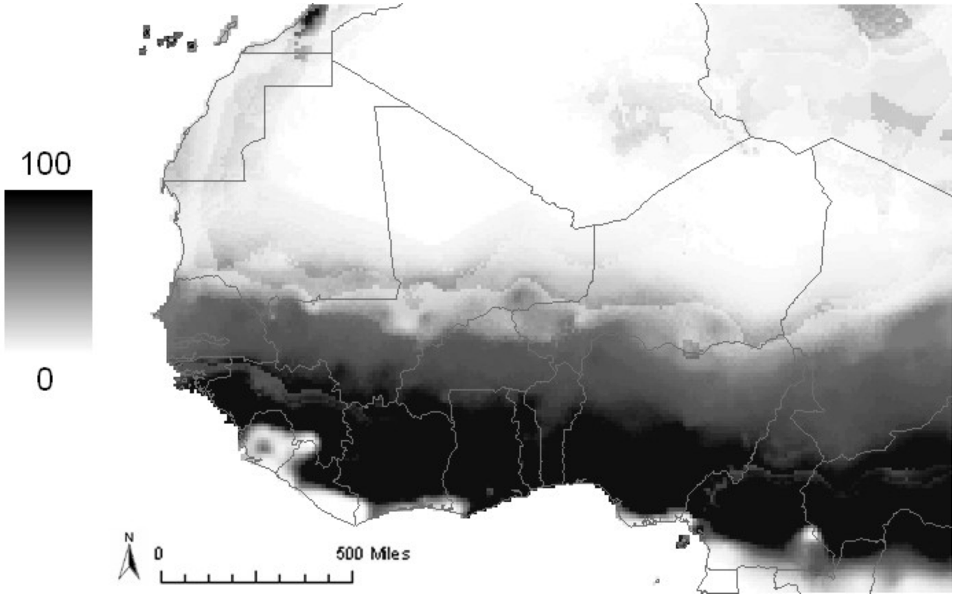




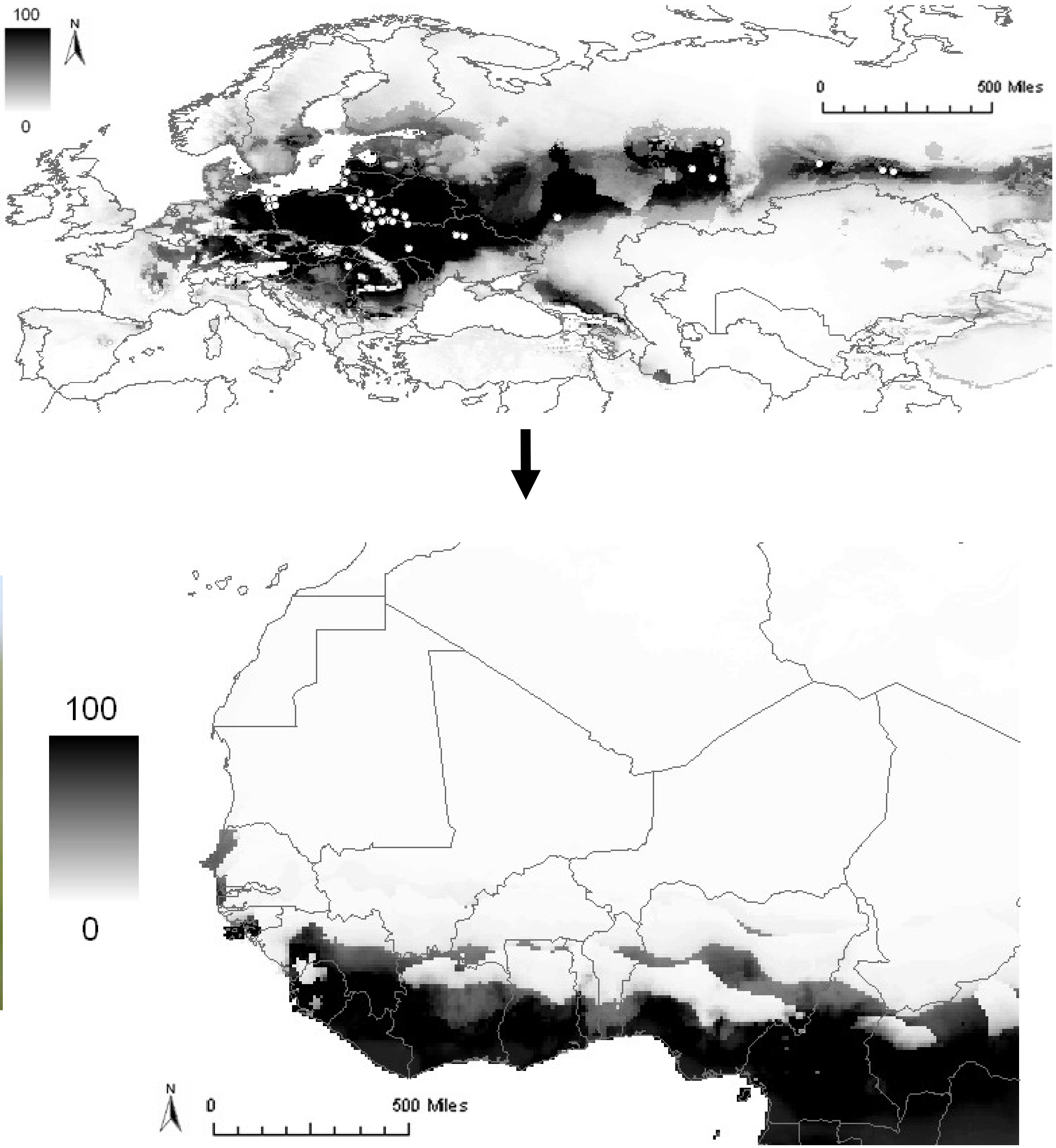


Phragmite des joncs

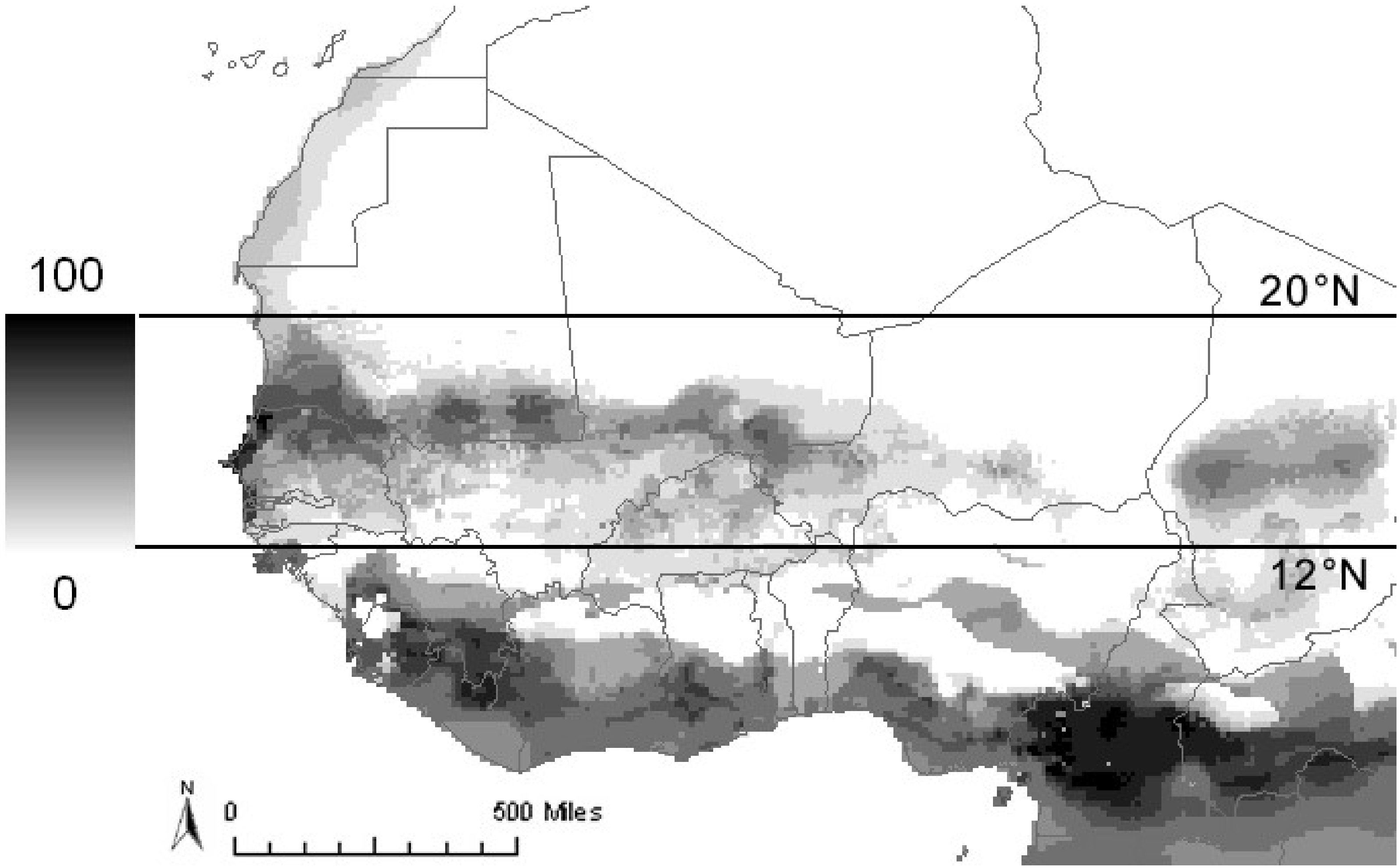


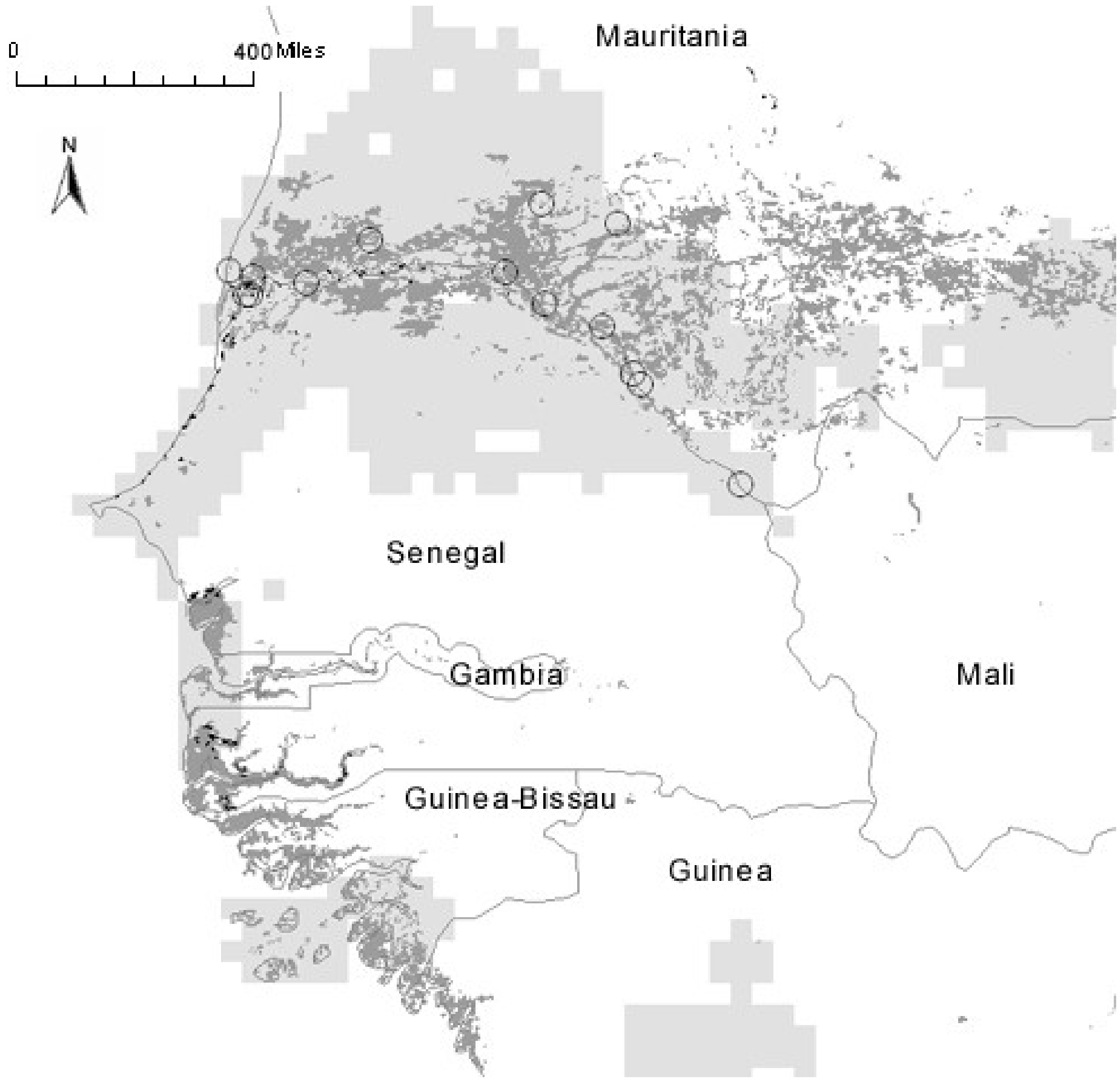


Phragmite aquatique



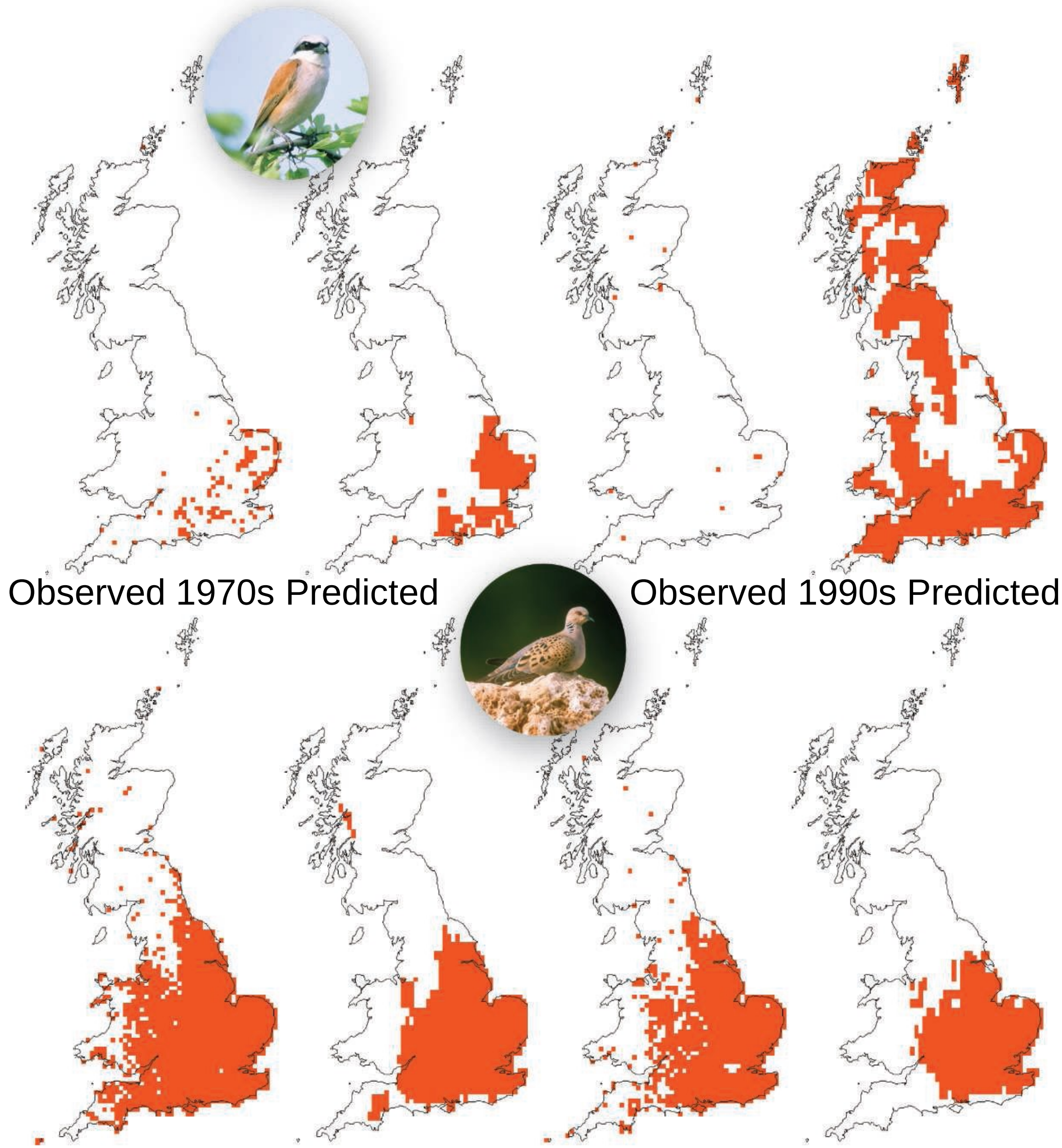
Phragmite aquatique ?





0
400 Miles
N
Mauritania
Senegal
Gambia
Mali
Guinea-Bissau
Guinea

Rétrodire - oiseaux

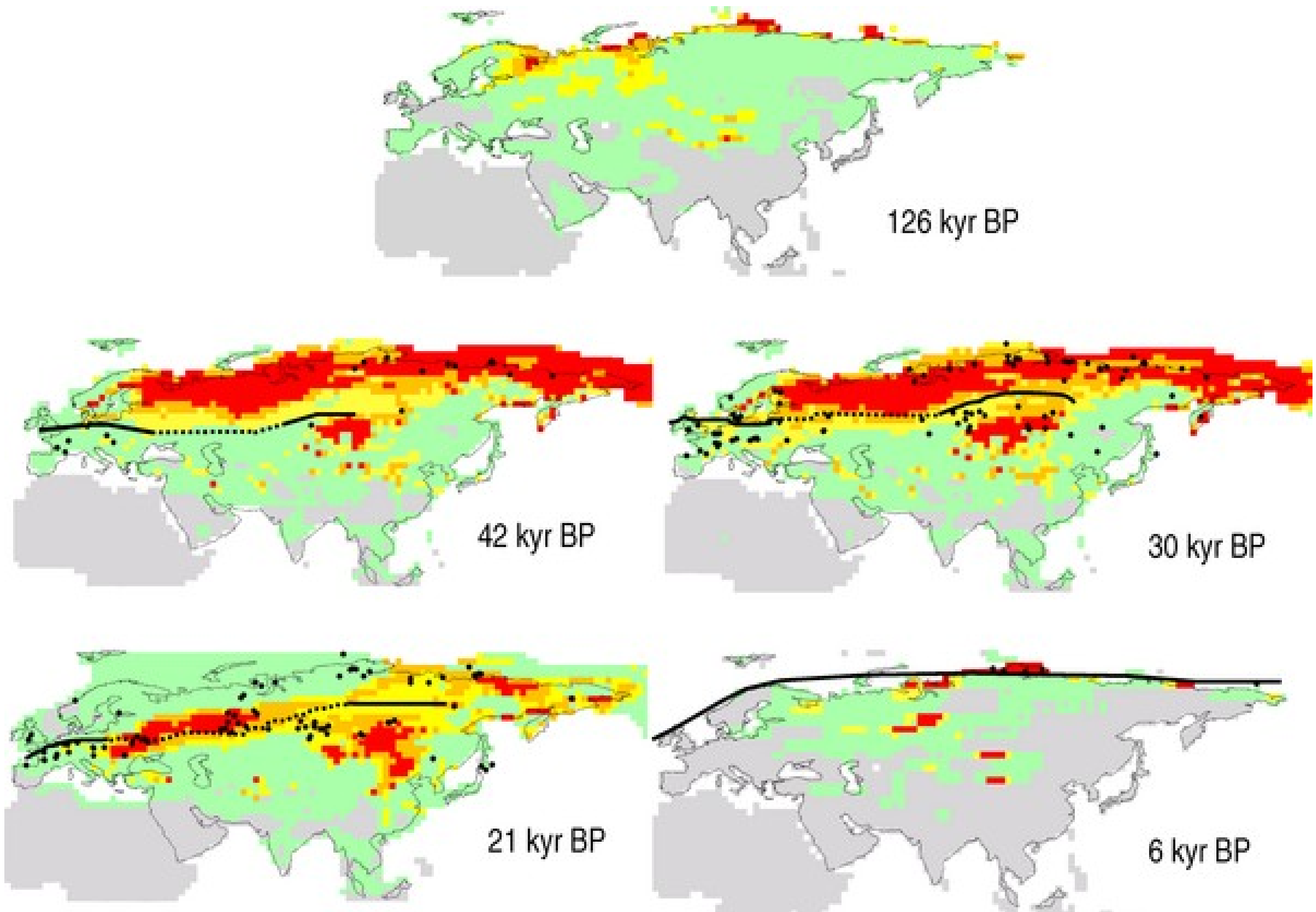


OPEN ACCESS Freely available online

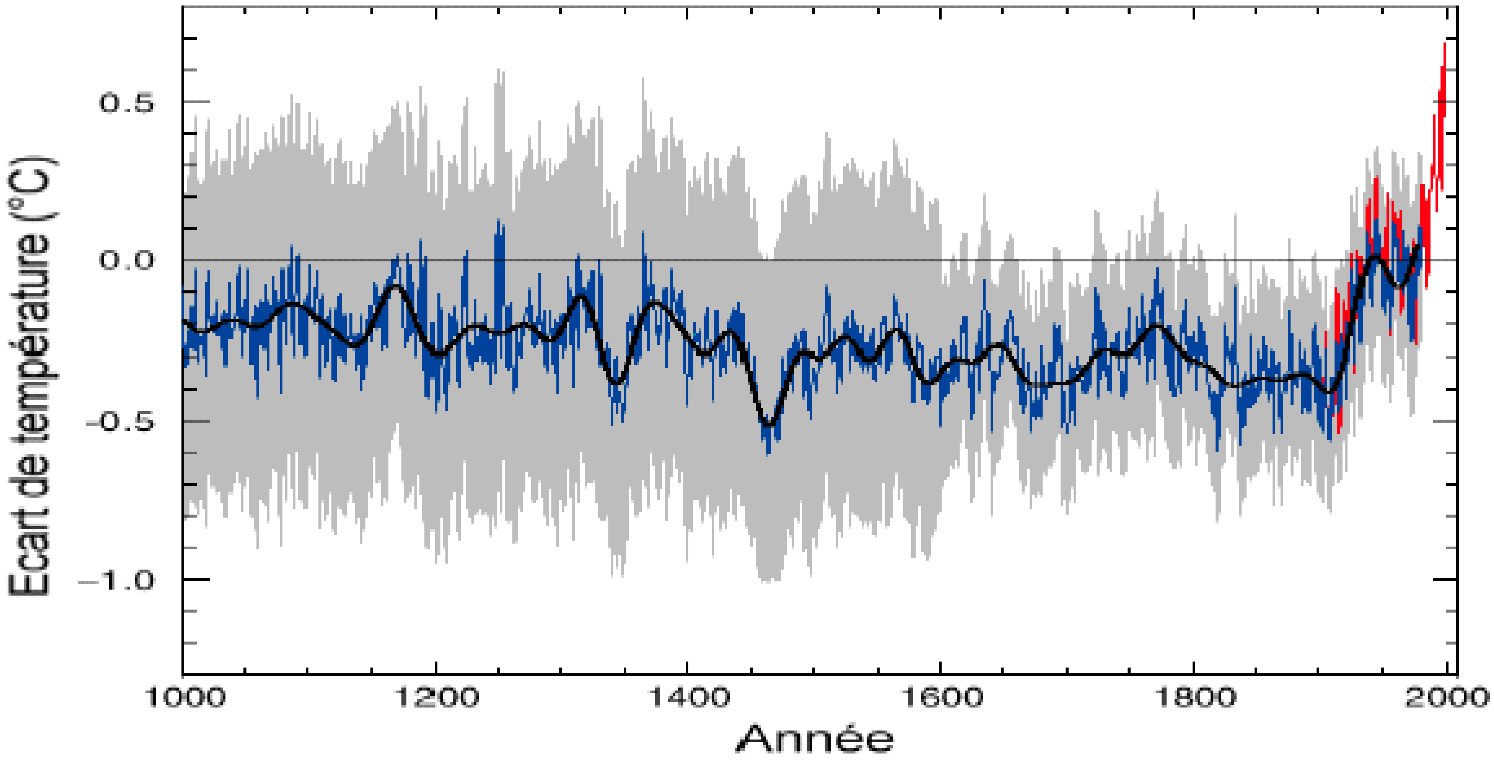
PLoS BIOLOGY

Climate Change, Humans, and the Extinction of the Woolly Mammoth

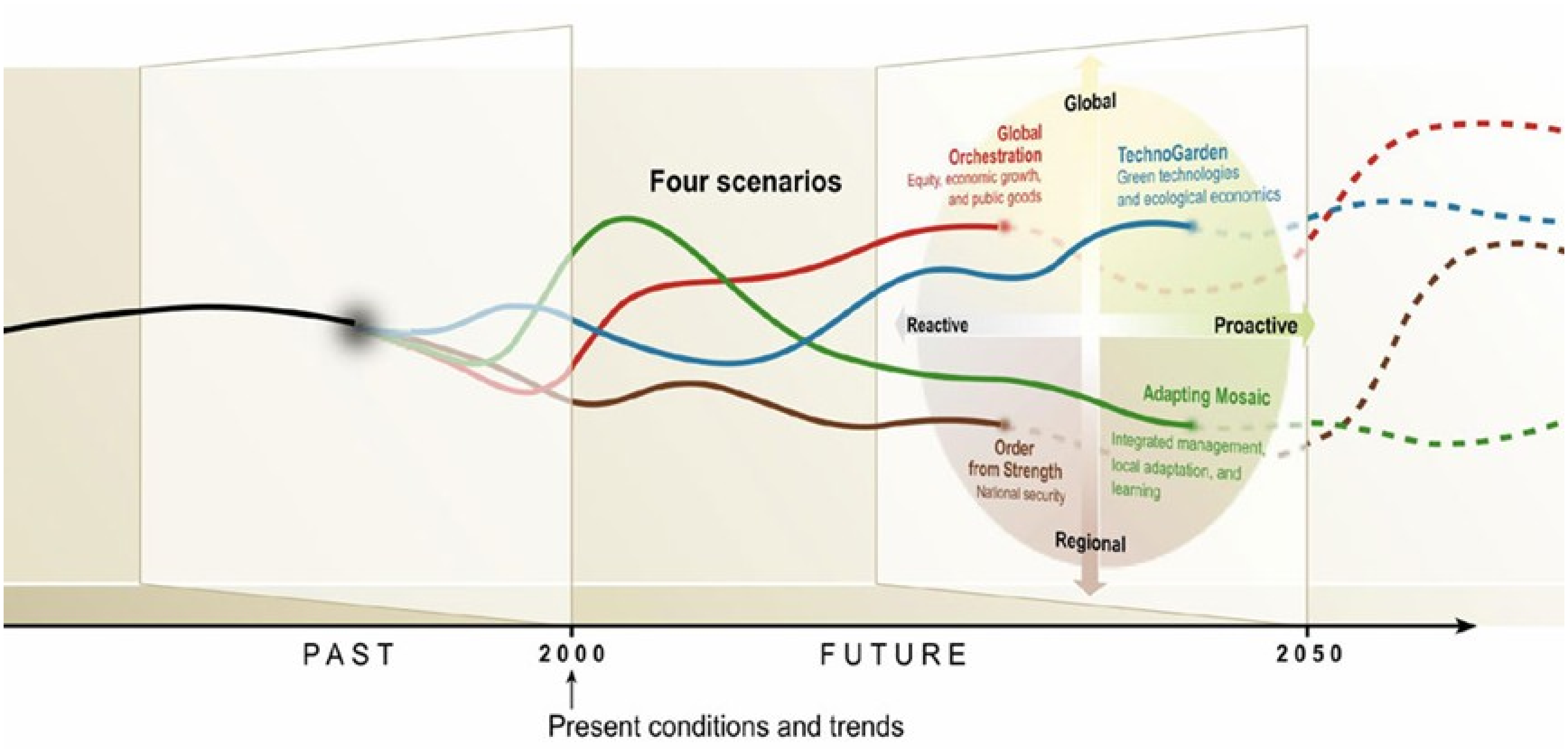
David Nogués-Bravo[1*], Jesús Rodríguez[2], Joaquín Hortal[3], Persaram Batra[4], Miguel B. Araújo[1]



Changements climatiques



Scénarios climatiques du GIEC



Extinction risk from climate change

Chris D. Thomas[1], Alison Cameron[1], Rhys E. Green[2], Michel Bakkenes[3], Linda J. Beaumont[4], Yvonne C. Collingham[5], Barend F. N. Erasmus[6], Marinez Ferreira de Siqueira[7], Alan Grainger[8], Lee Hannah[9], Lesley Hughes[4], Brian Huntley[5], Albert S. van Jaarsveld[10], Guy F. Midgley[11], Lera Miles[8]*, Miguel A. Ortega-Huerta[12], A. Townsend Peterson[13], Oliver L. Phillips[8] & Stephen E. Williams[14]

Vol 439|12 January 2006|doi:10.1038/nature04246 nature

ARTICLES

Widespread amphibian extinctions from epidemic disease driven by global warming

J. Alan Pounds[1], Martín R. Bustamante[2], Luis A. Coloma[2], Jamie A. Consuegra[3], Michael P. L. Fogden[1], Pru N. Foster[4]†, Enrique La Marca[5], Karen L. Masters[6], Andrés Merino-Viteri[2], Robert Puschendorf[7], Santiago R. Ron[2,8], G. Arturo Sánchez-Azofeifa[9], Christopher J. Still[10] & Bruce E. Young[11]

OPEN ACCESS Freely available online PLoS one

Potential Impacts of Climatic Change on European Breeding Birds

Brian Huntley[1]*, Yvonne C. Collingham[1], Stephen G. Willis[1], Rhys E. Green[2,3]*

1 Institute of Ecosystem Science, School of Biological and Biomedical Sciences, Durham University, Durham, United Kingdom, 2 Conservation Science Group, Department of Zoology, University of Cambridge, Cambridge, United Kingdom, 3 Conservation Science Department, Royal Society for the Protection of Birds, Sandy, United Kingdom

Background. Climatic change is expected to lead to changes in species' geographical ranges. Adaptation strategies for biodiversity conservation require quantitative estimates of the magnitude, direction and rates of these potential changes. Such estimates are of greatest value when they are made for large ensembles of species and for extensive (sub-continental or continental) regions. *Methodology/Principal Findings.* For six climate scenarios for 2070–99 changes have been estimated for 431 European breeding bird species using models relating species' distributions in Europe to climate. Mean range centroid potentially shifted 258–882 km in a direction between 341° (NNW) and 45° (NE), depending upon the climate scenario considered. Potential future range extent averaged 72–89% of the present range, and overlapped the present range by an average of 31–53% of the extent of the present range. Even if potential range changes were realised, the average number of species breeding per 50×50 km grid square would decrease by 6·8–23·2%. Many species endemic or near-endemic to Europe have little or no overlap between their present and potential future ranges; such species face an enhanced extinction risk as a consequence of climatic change. *Conclusions/Significance.* Although many human activities exert pressures upon wildlife, the magnitude of the potential impacts estimated for European breeding birds emphasises the importance of climatic change. The development of adaptation strategies for biodiversity conservation in the face of climatic change is an urgent need; such strategies must take into account quantitative evidence of potential climatic change impacts such as is presented here.

Citation: Huntley B, Collingham YC, Willis SG, Green RE (2008) Potential Impacts of Climatic Change on European Breeding Birds. PLoS ONE 3(1): e1439. doi:10.1371/journal.pone.0001439

PNAS

Climate change threats to plant diversity in Europe

Wilfried Thuiller*†‡§, Sandra Lavorel*¶, Miguel B. Araújo**‖, Martin T. Sykes**, and I. Colin Prentice††

*Centre d'Ecologie Fonctionnelle et Evolutive, Centre National de la Recherche Scientifique Unité Mixte de Recherche 5175, 1919 Route de Mende, 34293 Montpellier Cedex 5, France; †Climate Change Research Group, Kirstenbosch Research Center, National Botanical Institute, P/Bag x7, Claremont 7735, Cape Town, South Africa; ‡Macroecology and Conservation Unit, University of Evora, Estrada dos Leões, 7000-730 Evora, Portugal; ¶Laboratoire d'Ecologie Alpine, Centre National de la Recherche Scientifique-Unité Mixte de Recherche 5553, Université J. Fourier, B.P. 53X, 38041 Grenoble Cedex 9, France; ‖Biodiversity Research Group, School of Geography and the Environment, Oxford University, Mansfield Road, Oxford OX1 3TB, United Kingdom; **Geobiosphere Science Centre, Department of Physical Geography and Ecosystems Analysis, Lund University, Sölvegatan 12, 223 62 Lund, Sweden; and ††QUEST, Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, United Kingdom

Edited by Harold A. Mooney, Stanford University, Stanford, CA, and approved April 26, 2005 (received for review December 31, 2004)

Climate change has already triggered species distribution shifts in many parts of the world. Increasing impacts are expected for the future, yet few studies have aimed for a general understanding of the regional basis for species vulnerability. We projected late 21st century distributions for 1,350 European plants species under seven climate change scenarios. Application of the International

climate change. This principle has strong support from studies demonstrating the evolutionary conservatism of ecological niches and the phylogenetic inertia of species across time scales (15, 16) and comparative biogeographical studies (17, 18). However, this approach also assumes instantaneous species-range change, it ignores physiological CO_2 responses, and it does

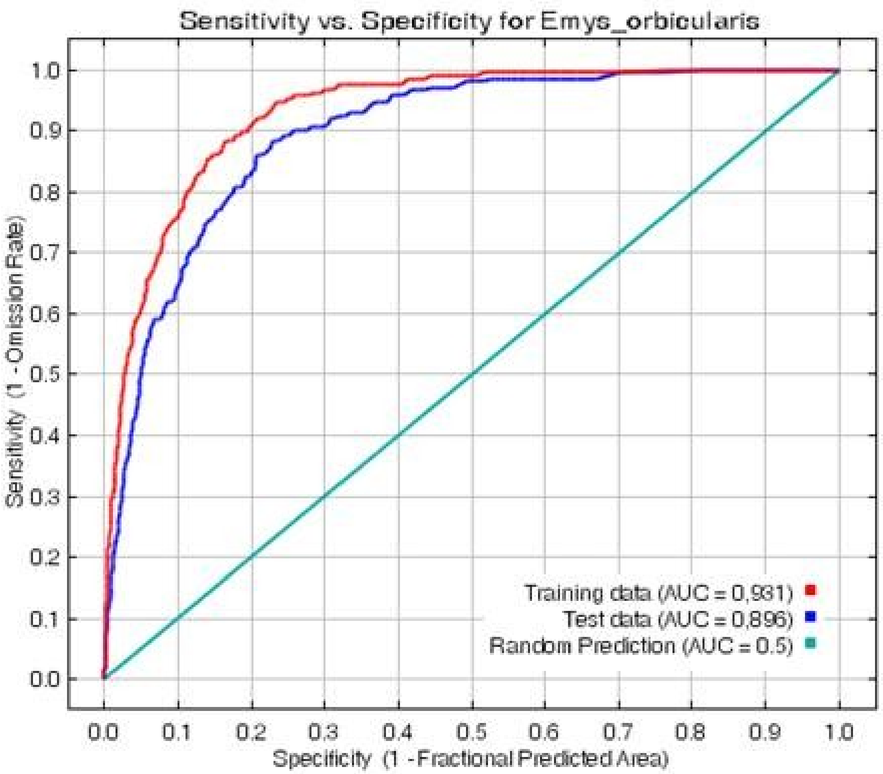
Global Change Biology (2006) 12, 424–440, doi: 10.1111/j.1365-2486.2006.01115.x

Vulnerability of African mammals to anthropogenic climate change under conservative land transformation assumptions

WILFRIED THUILLER*†, OLIVIER BROENNIMANN†‡, GREG HUGHES†, J. ROBERT M. ALKEMADE§, GUY. F. MIDGLEY† and FABIO CORSI¶

Evaluation du pouvoir prédictif des modèles

« Area Under a ROC Curve »



Journal of Biogeography (*J. Biogeogr.*) (2006) **33**, 1704–1711

SPECIAL ISSUE

Model-based uncertainty in species range prediction

Richard G. Pearson[1]*, Wilfried Thuiller[2], Miguel B. Araújo[3,4]†, Enrique Martinez-Meyer[5], Lluís Brotons[6], Colin McClean[7], Lera Miles[8], Pedro Segurado[9], Terence P. Dawson[10] and David C. Lees[11]

[1]*Department of Herpetology and Center for Biodiversity and Conservation, American Museum of Natural History, New York, NY, USA,* [2]*Laboratoire d'Ecologie Alpine UMR CNRS 5553 BP53, Grenoble Cedex 9, France,* [3]*Biodiversity Research Group, Oxford University Centre for the Environment, Oxford,* [4]*Biogeography and Conservation*

ABSTRACT

Aim Many attempts to predict the potential range of species rely on environmental niche (or 'bioclimate envelope') modelling, yet the effects of using different niche-based methodologies require further investigation. Here we investigate the impact that the choice of model can have on predictions, identify key reasons why model output may differ and discuss the implications that model uncertainty has for policy-guiding applications.

Global Ecology and Biogeography, (*Global Ecol. Biogeogr.*) (2008) **17**, 145–151

ECOLOGICAL SOUNDING

AUC: a misleading measure of the performance of predictive distribution models

Jorge M. Lobo[1]*, Alberto Jiménez-Valverde[1] and Raimundo Real[2]

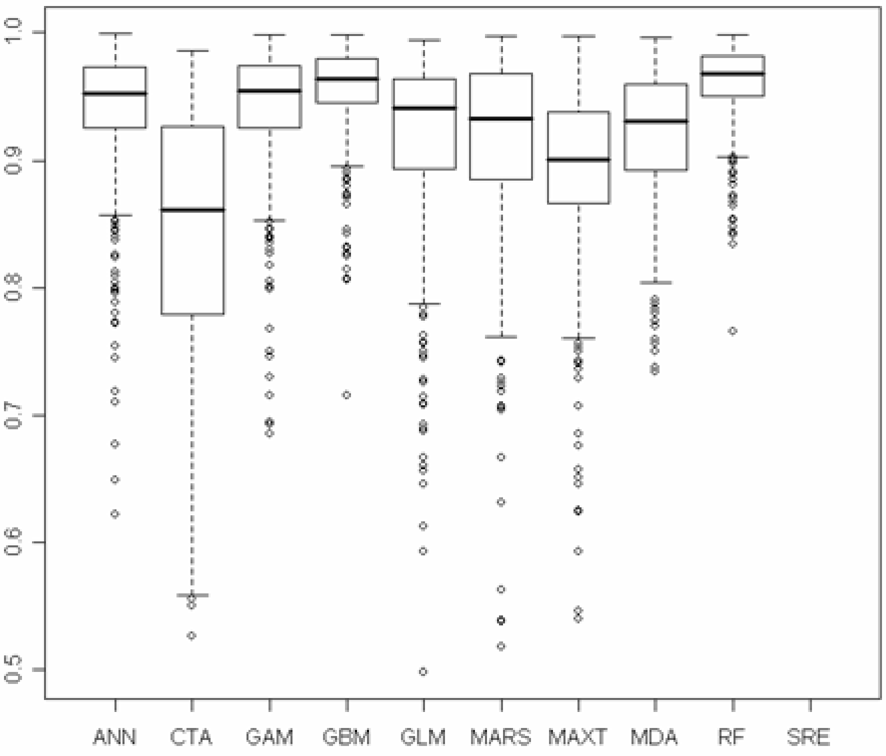
[1]*Departamento de Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain,* [2]*Laboratorio de Biogeografía, Diversidad y Conservación, Departamento de Biología Animal, Facultad de Ciencias, Universidad de Málaga, Spain*

ABSTRACT

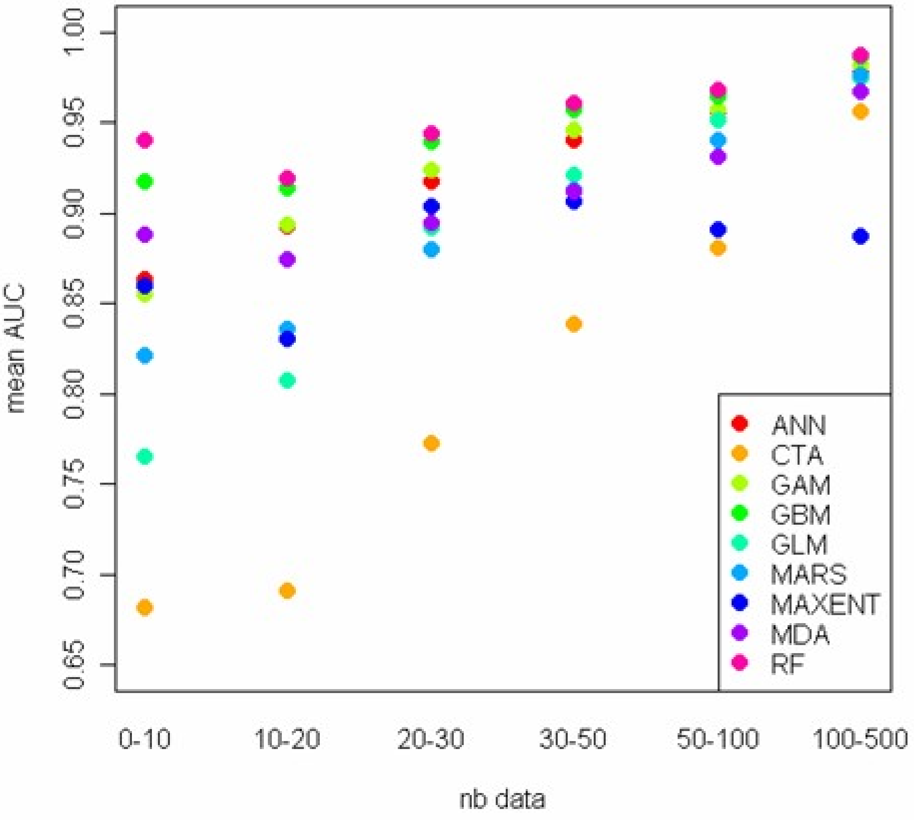
The area under the receiver operating characteristic (ROC) curve, known as the AUC, is currently considered to be the standard method to assess the accuracy of predictive distribution models. It avoids the supposed subjectivity in the threshold selection process, when continuous probability derived scores are converted to a binary presence–absence variable, by summarizing overall model performance over all possible thresholds. In this manuscript we review some of the features of this

Performance des différents algorithmes

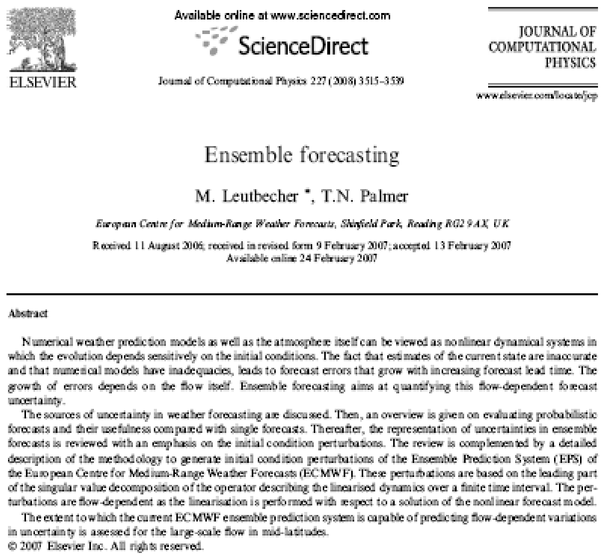
critère AUC



Taille d'échantillon



Méthode de consensus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Journal of Computational Physics 227 (2008) 3515–3539

JOURNAL OF COMPUTATIONAL PHYSICS

www.elsevier.com/locate/jcp

Ensemble forecasting

M. Leutbecher *, T.N. Palmer

European Centre for Medium-Range Weather Forecasts, Shinfield Park, Reading RG2 9AX, UK

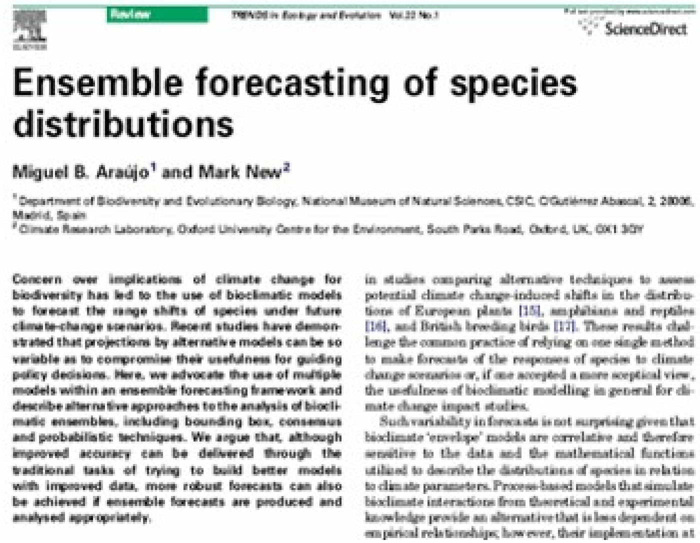
Received 11 August 2006; received in revised form 9 February 2007; accepted 13 February 2007
Available online 24 February 2007

Abstract

Numerical weather prediction models as well as the atmosphere itself can be viewed as nonlinear dynamical systems in which the evolution depends sensitively on the initial conditions. The fact that estimates of the current state are inaccurate and that numerical models have inadequacies, leads to forecast errors that grow with increasing forecast lead time. The growth of errors depends on the flow itself. Ensemble forecasting aims at quantifying this flow-dependent forecast uncertainty.

The sources of uncertainty in weather forecasting are discussed. Then, an overview is given on evaluating probabilistic forecasts and their usefulness compared with single forecasts. Thereafter, the representation of uncertainties in ensemble forecasts is reviewed with an emphasis on the initial condition perturbations. The review is complemented by a detailed description of the methodology to generate initial condition perturbations of the Ensemble Prediction System (EPS) of the European Centre for Medium-Range Weather Forecasts (ECMWF). These perturbations are based on the leading part of the singular value decomposition of the operator describing the linearised dynamics over a finite time interval. The perturbations are flow-dependent as the linearisation is performed with respect to a solution of the nonlinear forecast model.

The extent to which the current ECMWF ensemble prediction system is capable of predicting flow-dependent variations in uncertainty is assessed for the large-scale flow in mid-latitudes.


Review

ScienceDirect

Ensemble forecasting of species distributions

Miguel B. Araújo[1] and Mark New[2]

[1] Department of Biodiversity and Evolutionary Biology, National Museum of Natural Sciences, CSIC, C/Gutiérrez Abascal, 2, 28006, Madrid, Spain
[2] Climate Research Laboratory, Oxford University Centre for the Environment, South Parks Road, Oxford, UK, OX1 3QY

Concern over implications of climate change for biodiversity has led to the use of bioclimatic models to forecast the range shifts of species under future climate-change scenarios. Recent studies have demonstrated that projections by alternative models can be so variable as to compromise their usefulness for guiding policy decisions. Here, we advocate the use of multiple models within an ensemble forecasting framework and describe alternative approaches to the analysis of bioclimatic ensembles, including bounding box, consensus and probabilistic techniques. We argue that, although improved accuracy can be delivered through the traditional tasks of trying to build better models with improved data, more robust forecasts can also be achieved if ensemble forecasts are produced and analysed appropriately.

in studies comparing alternative techniques to assess potential climate change-induced shifts in the distributions of European plants [15], amphibians and reptiles [16], and British breeding birds [17]. These results challenge the common practice of relying on one single method to make forecasts of the responses of species to climate change scenarios or, if one accepted a more sceptical view, the usefulness of bioclimatic modelling in general for climate change impact studies.

Such variability in forecasts is not surprising given that bioclimate 'envelope' models are correlative and therefore sensitive to the data and the mathematical functions utilized to describe the distributions of species in relation to climate parameters. Process-based models that simulate bioclimate interactions from theoretical and experimental knowledge provide an alternative that is less dependent on empirical relationships; however, their implementation at

<u>Méthodes dites de prédictions d'ensemble :</u>

- Présence/absence selon un seuil
- Moyenne des probabilités
- Moyenne pondérée des probabilités (poids=AUC)

Impacts potentiels des changements climatiques sur les passereaux migrateurs trans-sahariens en Afrique

Morgane BARBET-MASSIN, Bruno WALTHER, Carsten RAHBECK, Wilfried THUILLER

Prédire les distributions

Pour chacune des 64 espèces (10.000 données)

5 Modèles de Circulation Générale

BCM2, ECHAM5, HADCM3, MIROMED, MK3

3 scénarios climatiques (émissions de carbone)

A1B (orchestration globale, croissance économique rapide, équilibre énergie fossile / non fossile)

A2 (ordre par la force, monde fragmenté)

B1 (techno-jardin, convergence avec nécessités environnementales)

>> 15 jeux de données de scénarios climatiques

10 ‘algorithmes’ de modélisation

GLM, GAM, ANN, CTA, GBM, MDA, RF, SRE, MARS, MAXENT

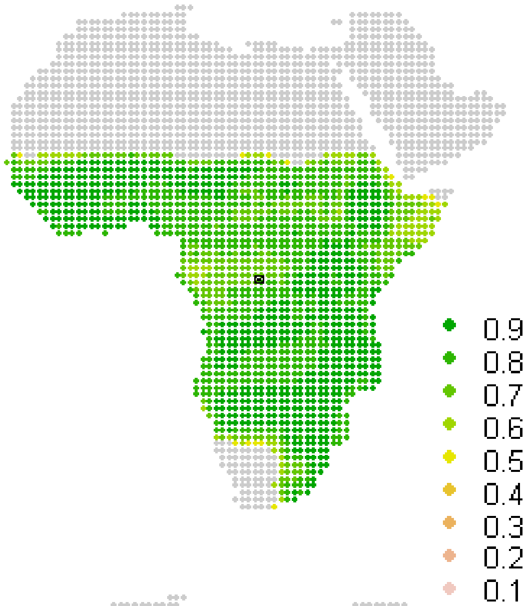
~ 150 prédictions

pour 4 périodes de temps

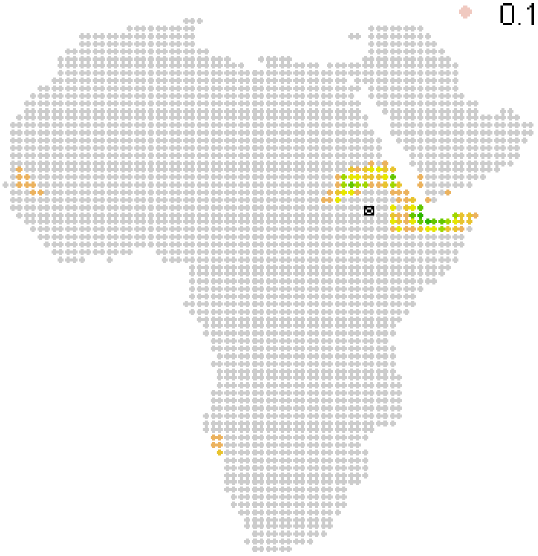
(1960-1990, 2011-2030, 2046-2065, 2080-2099)

Validations a posteriori : **cartes du « Birds of Africa »**

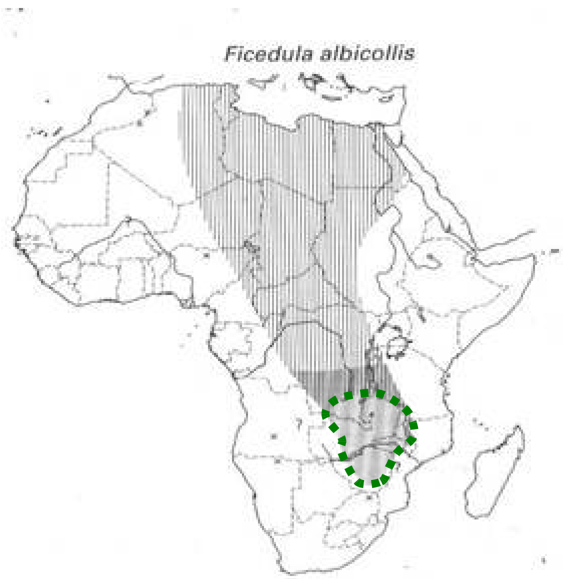
Bergeronnette printanière

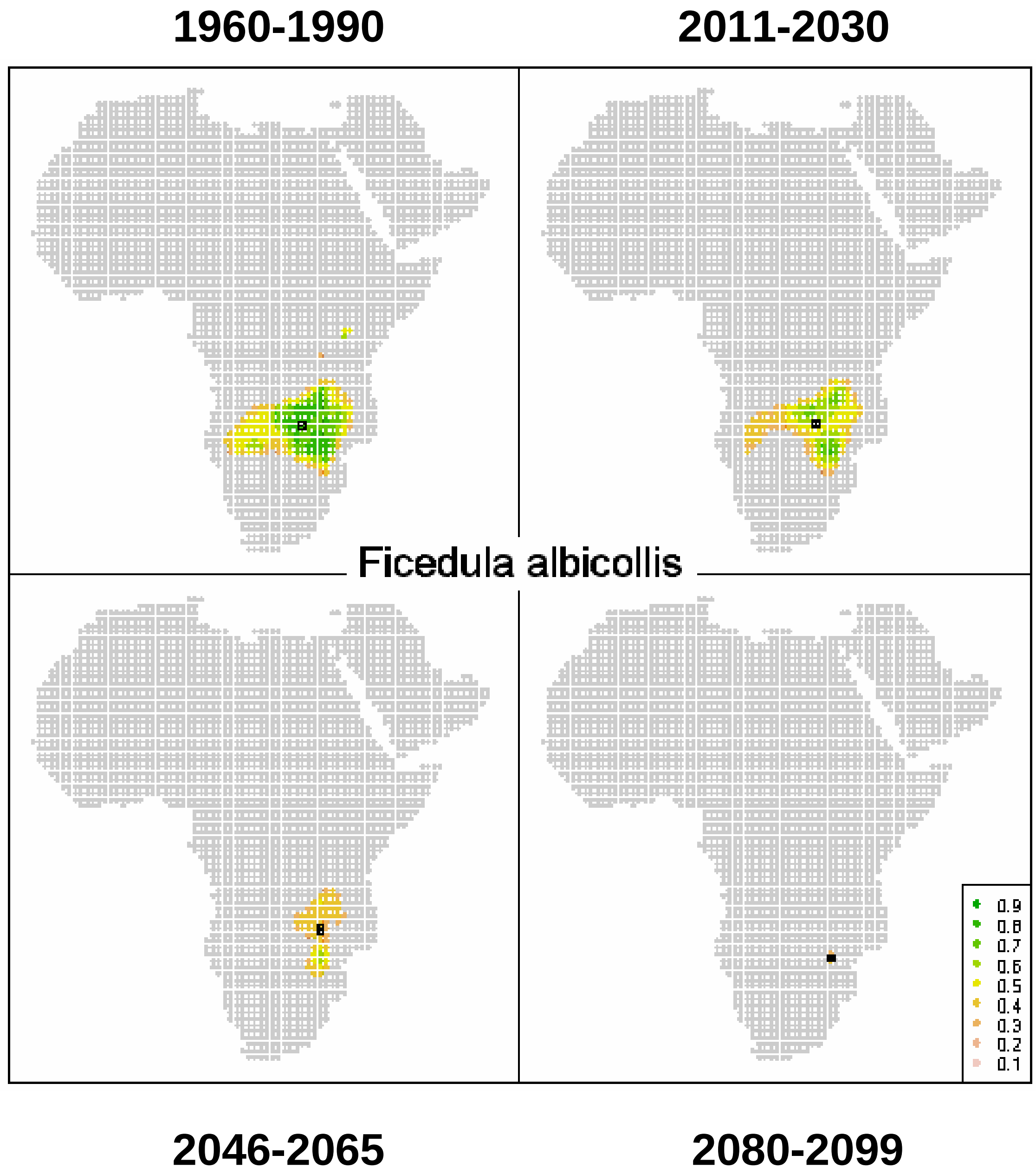


Fauvette de Ménétries



Gobemouche à collier





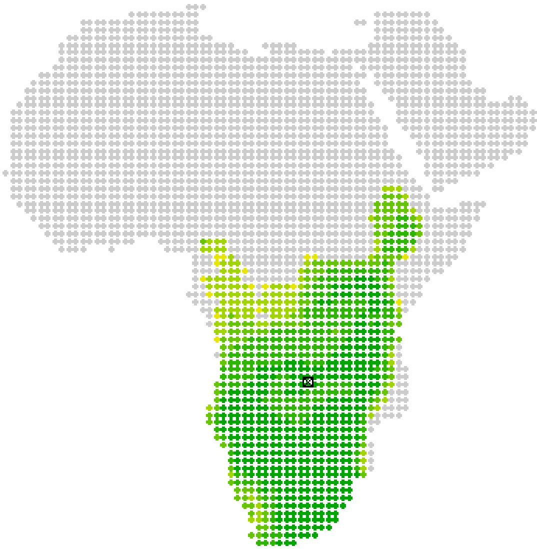
Diminution

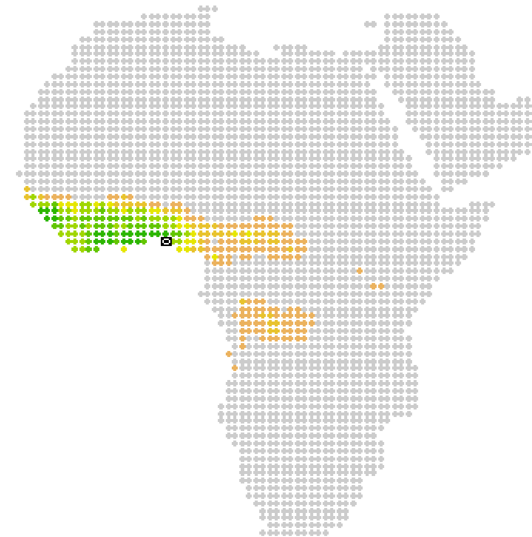
Augmentation

Lanius collurio

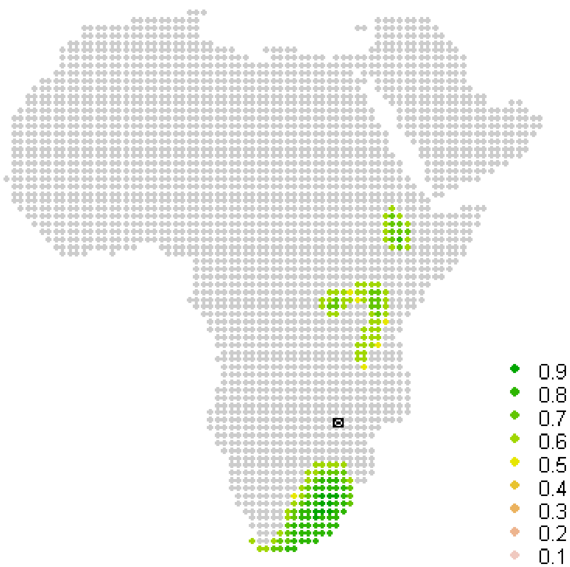
Ficedula hypoleuca

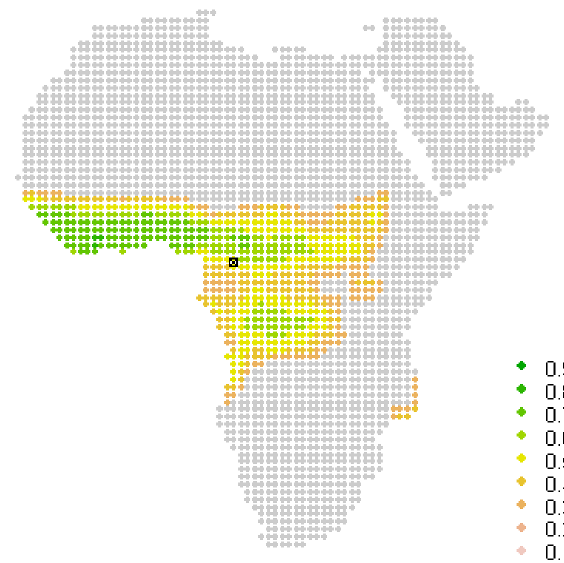
1960-1990





2080-2099



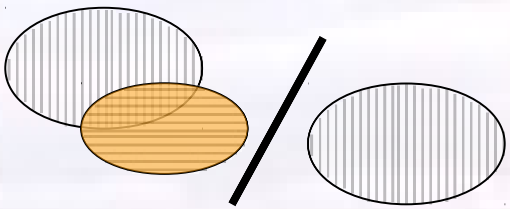


Estimer les changements

Pour chacune des 64 espèces :

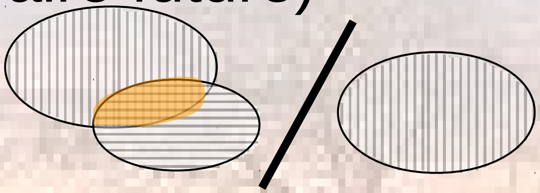
- Changement de taille de l'aire

(log aire future prédite / actuelle prédite)
= hypothèse de dispersion totale



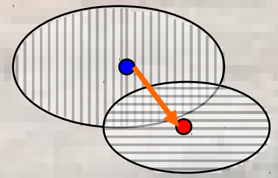
- Chevauchement des aires

(proportion de l'aire actuelle incluse dans l'aire future)
= hypothèse de dispersion nulle



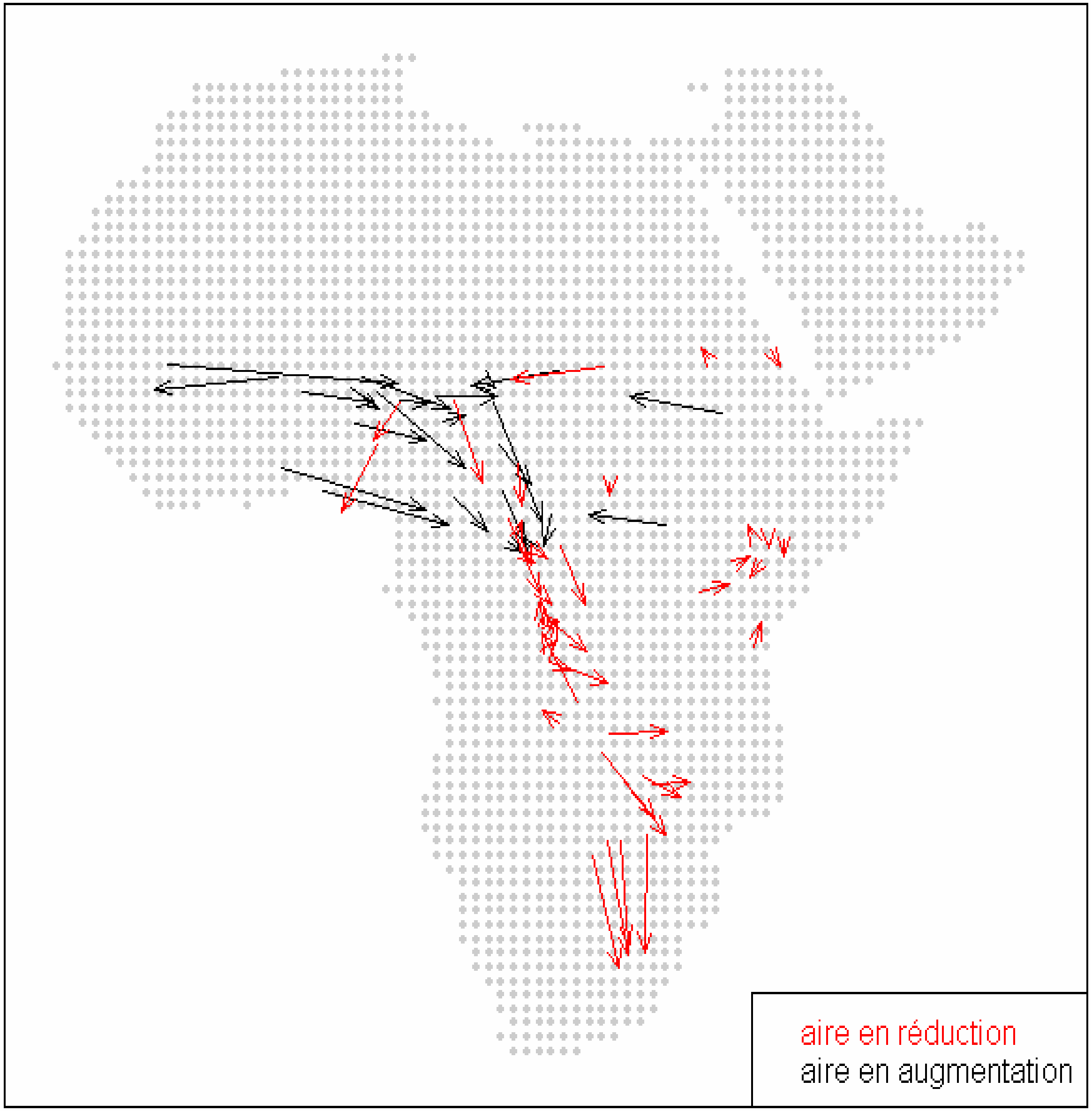
- Déplacement de l'aire

(distance entre les centres des deux aires)



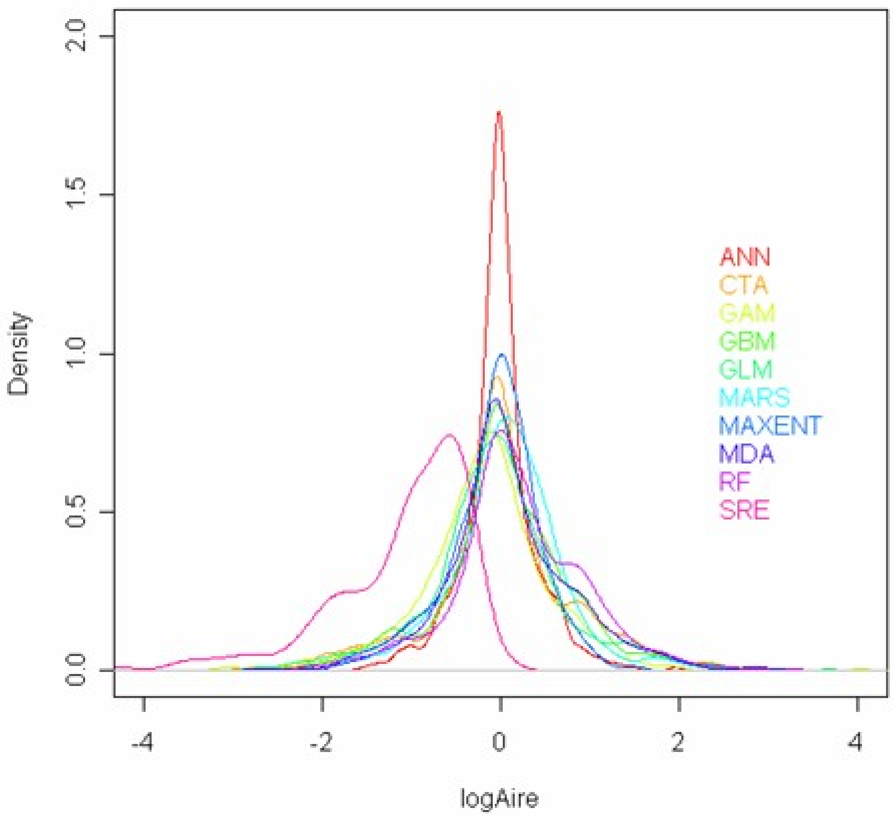
Entre 1960-1990 et 2080-2099

► forte structure spatiale

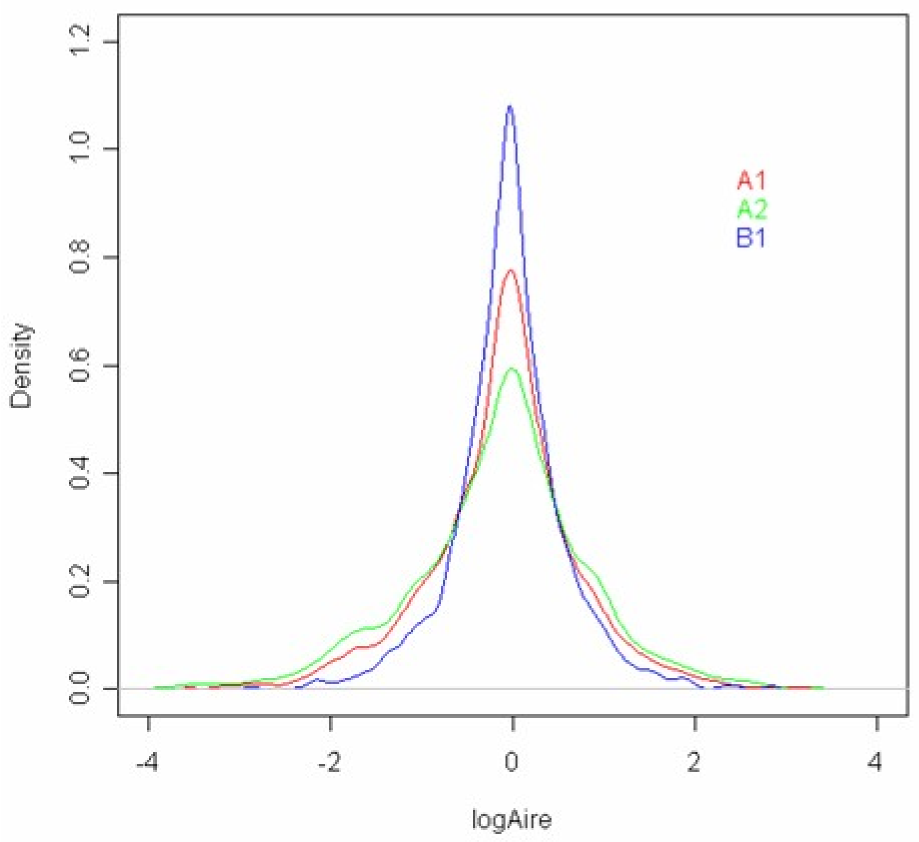


Variations des prédictions

Modèles de niche



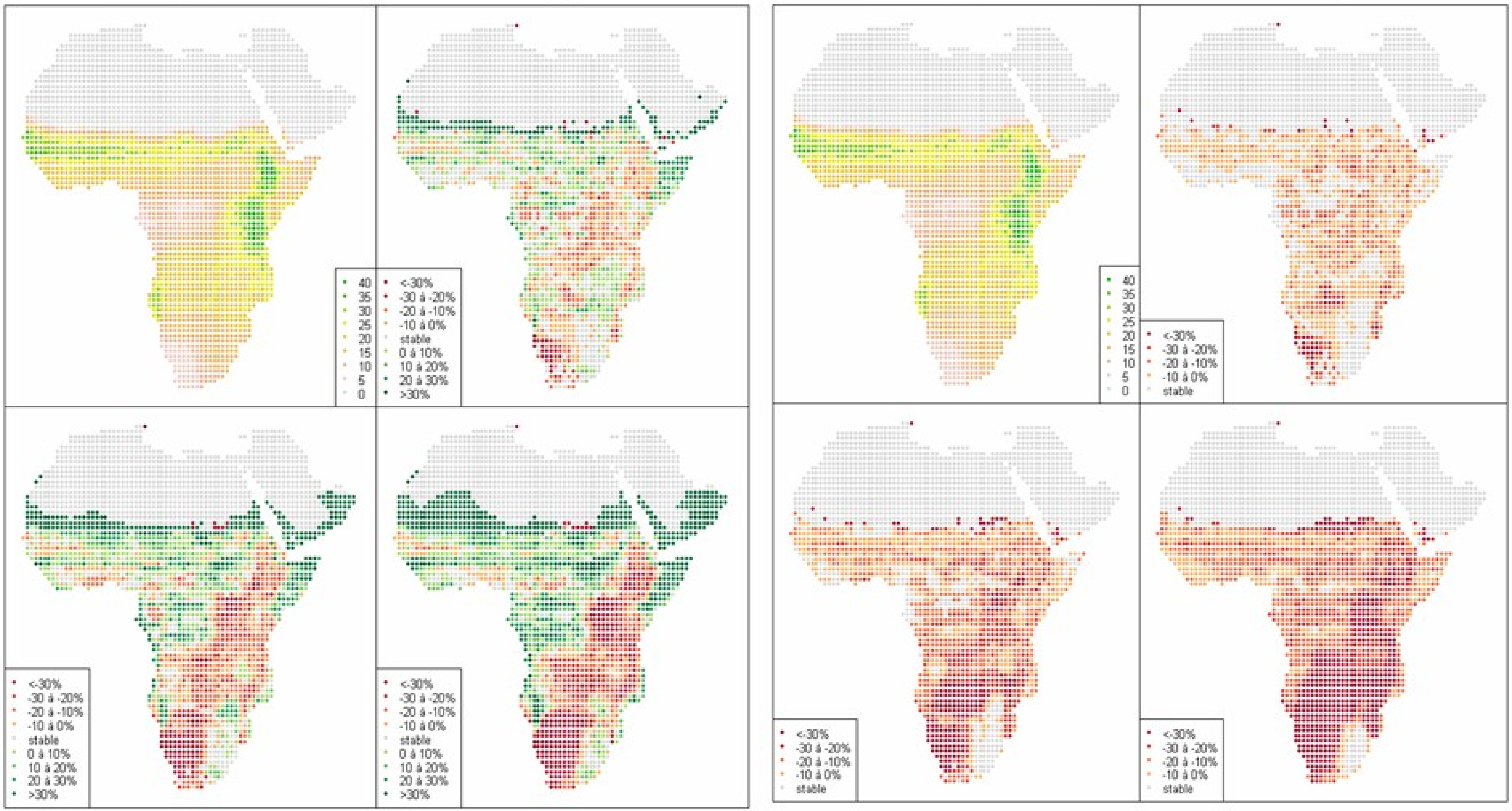
Scénarios climatiques



Nombre total d’espèces (sur 64)

Dispersion totale | **Dispersion nulle**

1960-1990 **2011-2030** | **1960-1990** **2011-2030**



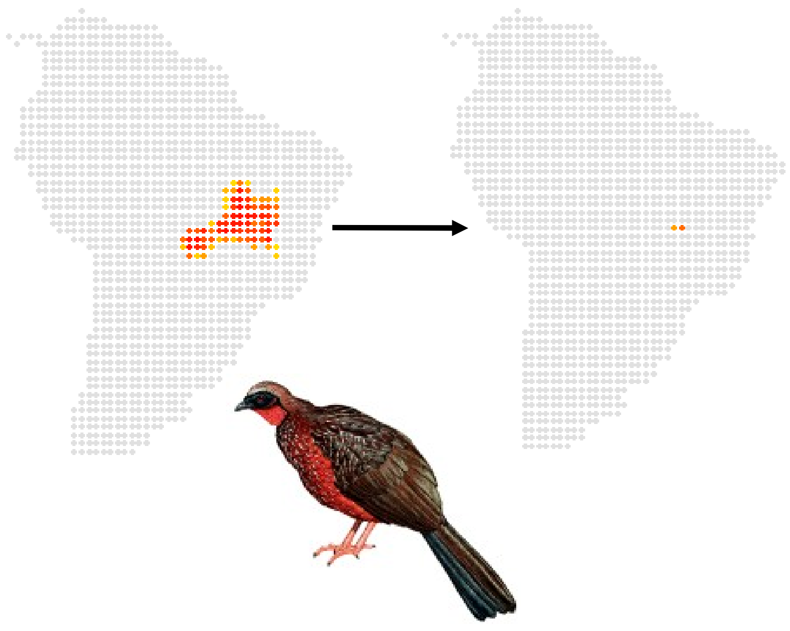
2046-2065 **2080-2099** | **2046-2065** **2080-2099**

Autres lieux, autres espèces, mêmes outils

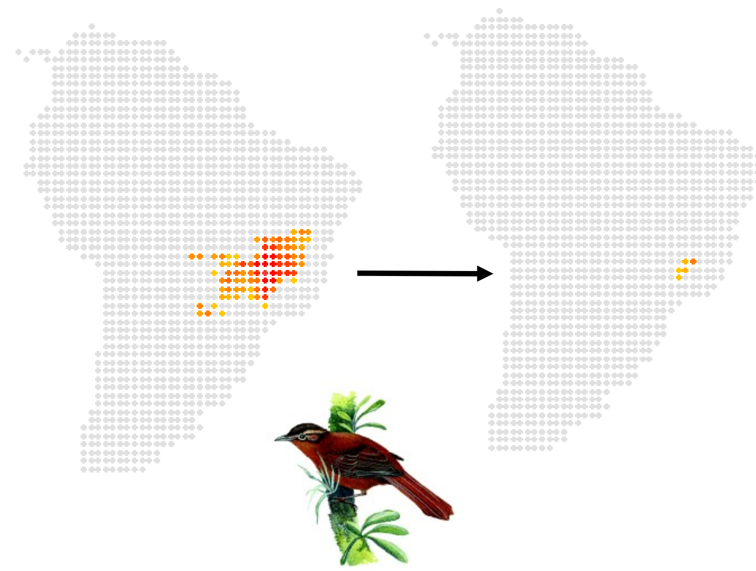
Risque d’extinction d’espèces endémiques de la Cerrado, savane du Brésil

Professeur Miguel Ângelo Marini
Université de Brasilia

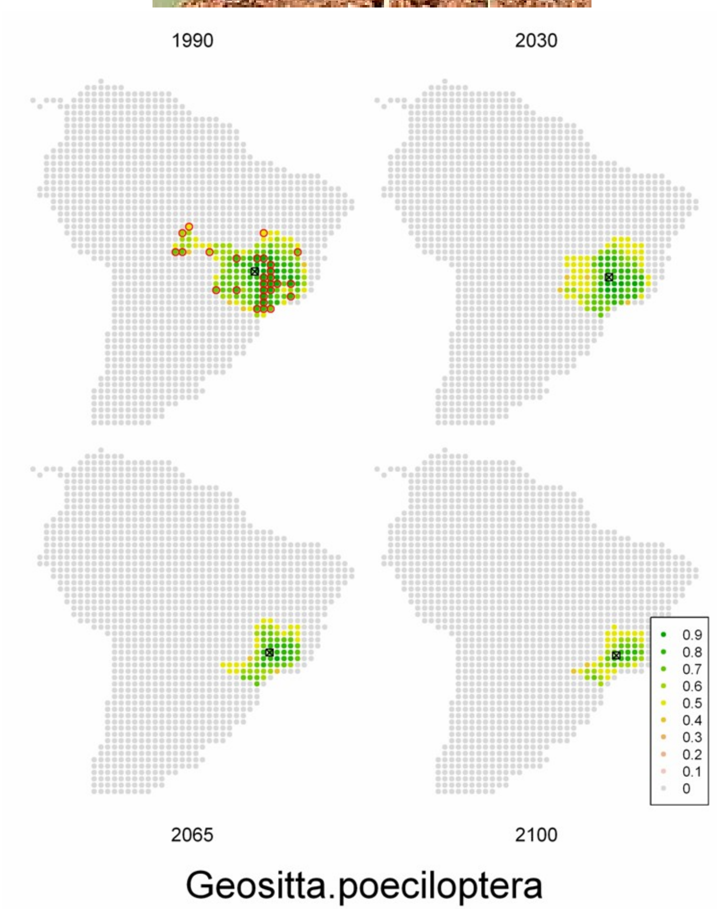
Penelope ochrogaster

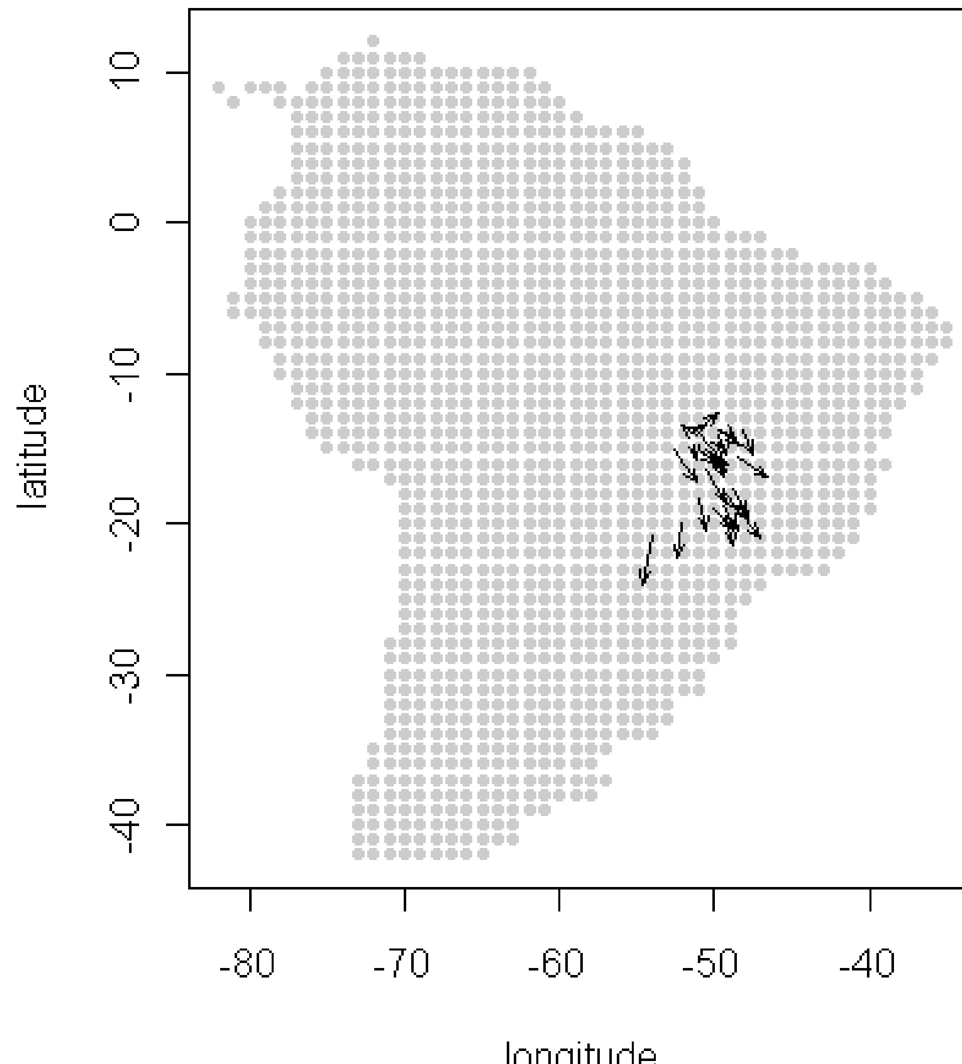


Philydor dimidiatus



26 espèces de la savane néo-tropicale



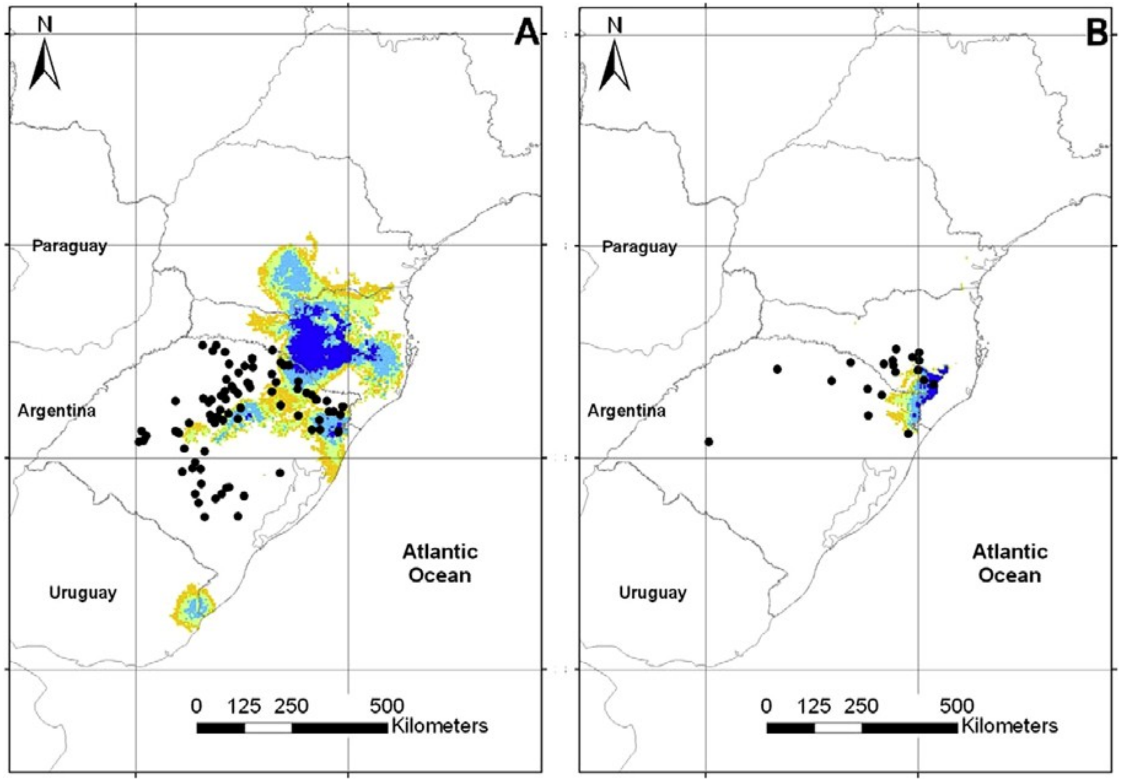


Prédire les distributions saisonnières futures de **l'Amazone à front rouge** *Amazona petrei*

Liste Rouge UICN : VULNERABLE (16,000 individus)

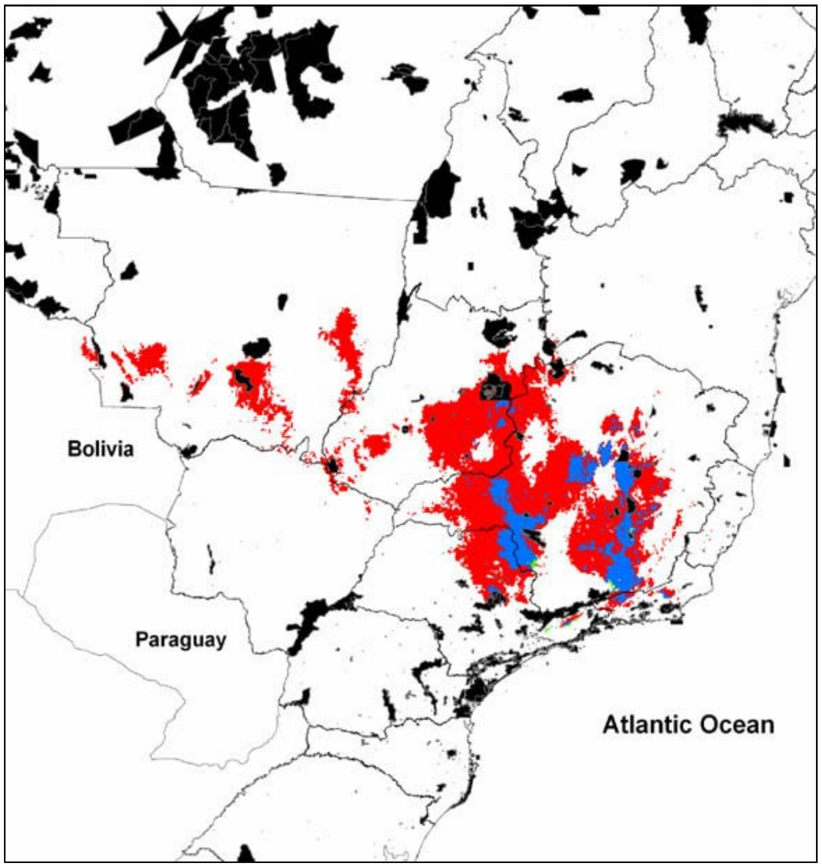
Eté

Hiver

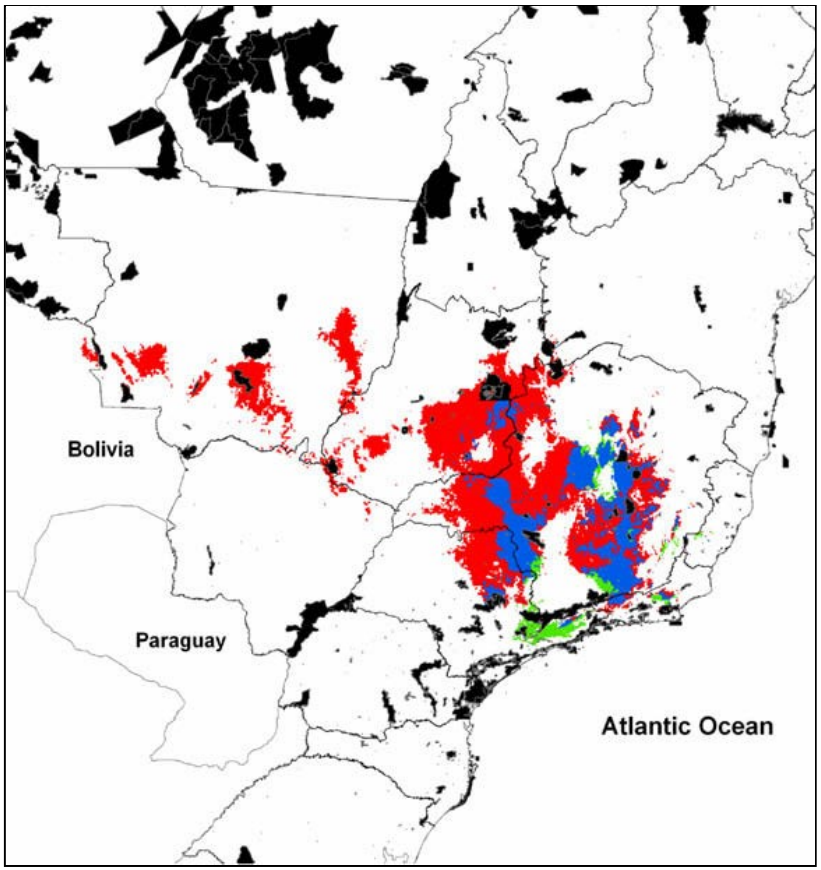


Prédire les distributions futures des oiseaux menacés et les espaces protégés au Brésil

Dispersion nulle

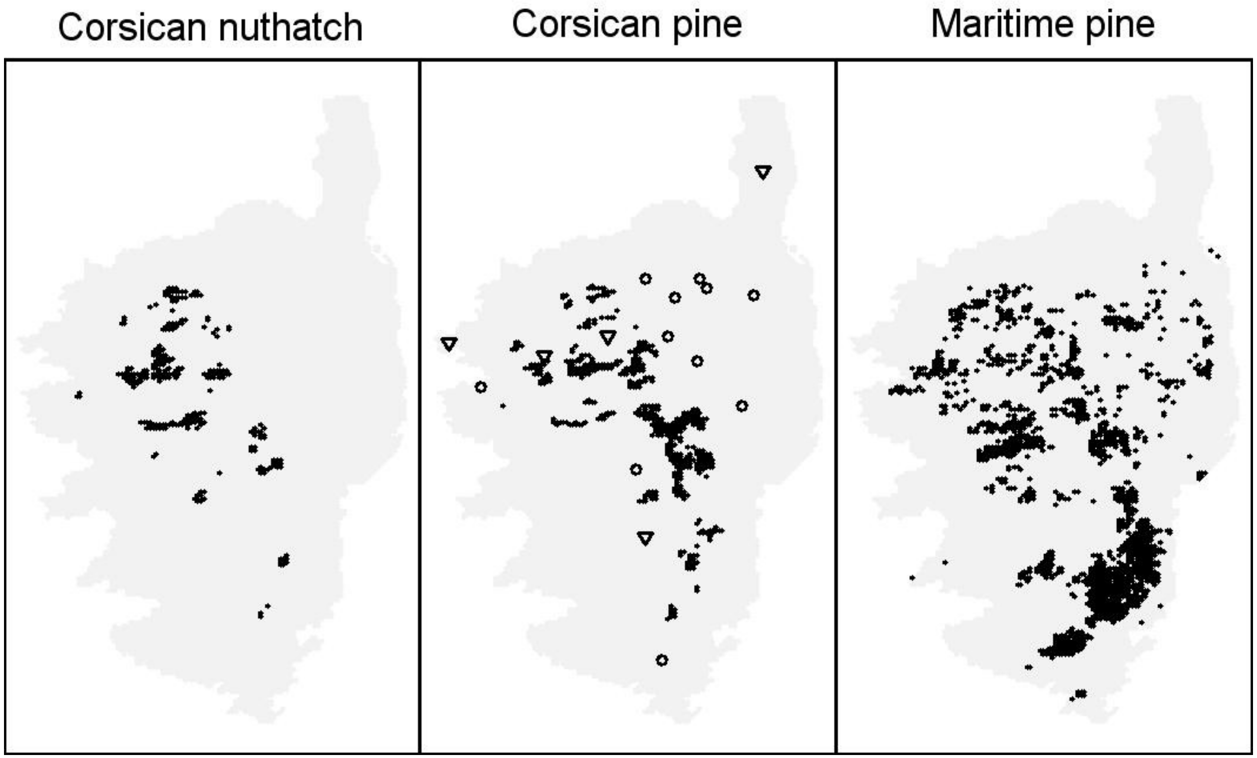


Dispersion totale

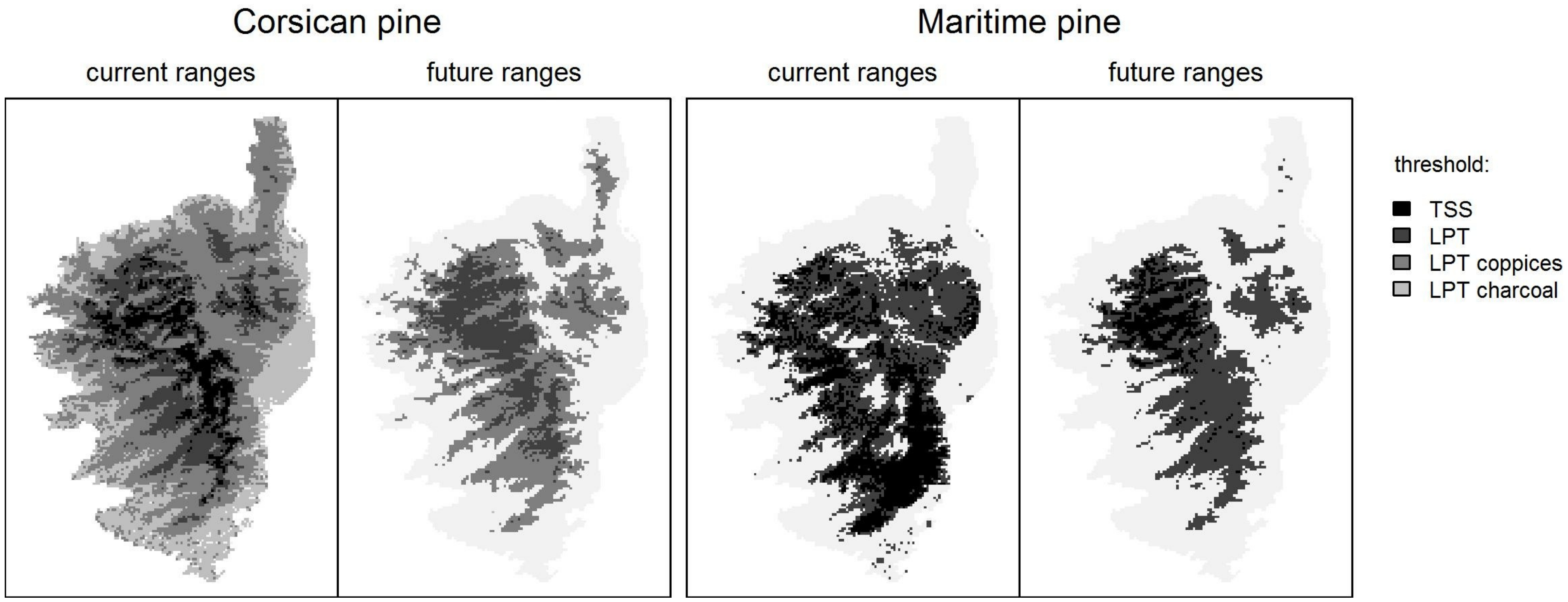


38 espèces – rouge = **perdu**, vert = **gagné**, bleu = **identique**

Un futur pour la Sittelle corse ?

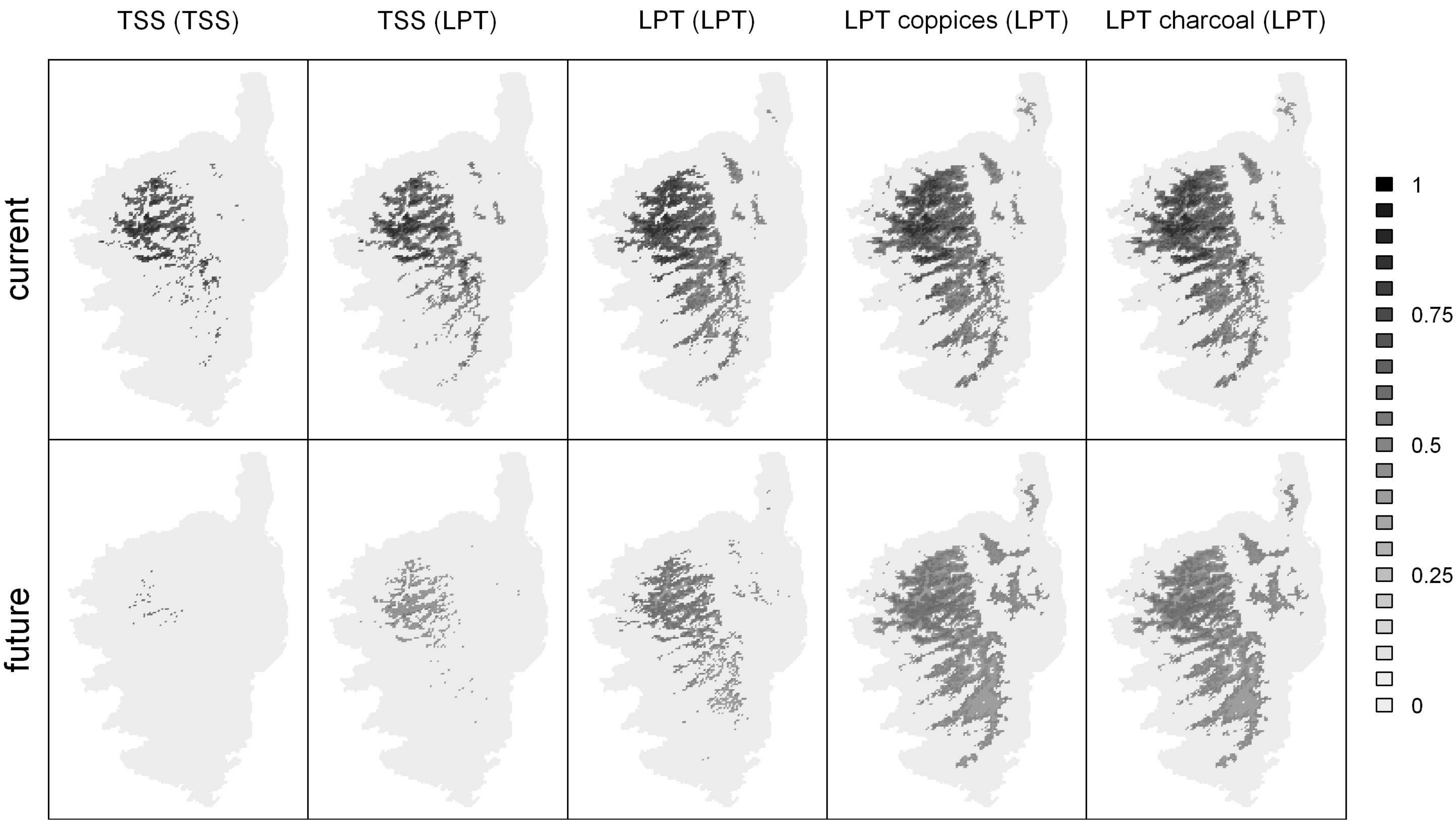


Les pins…



Corsican pine
current ranges
future ranges
Maritime pine
current ranges
future ranges
threshold:
TSS
LPT
LPT coppices
LPT charcoal

L'oiseau…


TSS (TSS)
TSS (LPT)
LPT (LPT)
LPT coppices (LPT)
LPT charcoal (LPT)
current
future
1
0.75
0.5
0.25
0

Sibériens perdus en migration…