

Ecology and Biodiversity

has the honor to invite you to the public defense of the PhD thesis of

Arimatéa DE CARVALHO XIMENES

to obtain the degree of Doctor of Sciences

Joint PhD with Université Libre de Bruxelles

Title of the PhD thesis:

Mangrove range limits and species diversity: A macroecological approach from regional to global scales

Promotors:

Prof. dr. Farid Dahdouh-Guebas
Prof. dr. Nico Koedam

The defence will take place on

Thursday March 28th, 2019 at 4:30 p.m.

in FORUM F on the ULB Campus Plaine

Members of the jury:

Prof. dr. Olivier Hardy (chairman, ULB)
Prof. dr. Ludwig Triest (secretary)
Prof. dr. Matthieu Kervyn
Prof. dr. Marjolein Visser (ULB)
Prof. dr. Marília Cunha-Lignon
(Univ. Estadual Paulista UNESP, BR)
Prof. dr. Richard Lucas
(Univ. of New South Wales,
AU & Aberystwyth Univ., UK)

Curriculum vitae

Arimatéa C. Ximenes (born in Rio de Janeiro, Brazil, 1980) is a biologist who obtained a Master degree in Remote Sensing from the National Institute for Space Research (INPE-Brazil). After his master degree, Ari worked for 3 years as a research fellow at INPE. In 2011, Ari was awarded a PhD scholarship from FNRS-Belgium for 3 years and after that a 2-year scholarship from CNPq-Brazil. Ari worked under guidance of Farid Dahdouh-Guebas (ULB and VUB) and Nico Koedam (VUB) in Belgium, Kenya and Brazil. Ari has participated in several international conferences and authored 3 peer-reviewed papers, 2 of which as a part of this PhD thesis. From the PhD thesis other manuscripts have been submitted for publication.

Abstract of the PhD research

The mangrove forest is an ecosystem distributed worldwide along tropical and subtropical coastlines. Its component tree species are dispersed over the seas. It has been one of the main goals of biogeography to understand the interaction of vectors and environmental factors in explaining distribution patterns. This PhD thesis aims at a better understanding of intriguing issues related to the role of climate and oceanographic processes in the dispersal and distribution of mangroves at a regional (with the latitudinal limit and the Brazilian mangroves) to global scales.

For the mangroves along Brazil's long coastline, two scales were used to comprehend the spatial ecological niche of mangrove tree species. First, the entire Brazilian mangrove-lined coast was considered, and several environmental variables were used to explain what determines mangrove tree species distribution. Second, a detailed analysis of daily Sea Surface Temperature (SST) data for the Brazilian mangrove forest at the southernmost mangrove range limit was done, and compared with a site beyond the range limit. The chilling events of SST data, their frequency and ocean current systems, show that *Laguncularia racemosa* is probably bounded by the southernmost Brazilian mangrove limit because of a dispersal constraint rather than by the frequency of chilling events. However, the species *Avicennia schaueriana* is probably associated with the chilling events of SST, which proves that mangrove range limits are not explained by a single cause.

This PhD thesis also has the objective to evaluate the influence of upwelling intensity on the distribution worldwide. The sea surface temperature (SST) had been identified as one of the key drivers of global mangrove distribution, given the coincidence of given isotherms with mangrove global limits. However, other factors play a role in the variability of SST. Cold waters from deep ocean layers rise to the surface (upwelling systems), a process which reduces the SST values and can trigger aridity. Although previous research has confirmed that mangrove distribution is driven by a variety of factors, this PhD thesis additionally demonstrates a significant influence of upwelling intensity, and hence provides elements for a better understanding of the factors driving mangrove expansion/retraction at a global scale. In addition, this work emphasizes climate and oceanographic processes influencing mangrove range limits and species richness patterns.

While contributing to a better understanding of some of the most intriguing questions on mangrove macroecology, this PhD thesis also raises new questions that should be studied by future research.