

Forest-Specific Insect Assemblages and Conservation Priorities: Indicador and Endangered Species in Costa Rica

LUIS ARTURO ARRIETA-ARRIETA¹ and J. ADILSON PINEDO-ESCAZEL²

¹Universidad Nacional de Costa Rica; ²Colección Nacional de Insectos, Instituto de Biología, UNAM

INTRODUCTION

Estimations show that nearly 57,000 insect extinctions will occur per million species on Earth in five decades, caused by loss of their habitat (Dunn 2005). Unfortunately, many conservation programs rarely contemplate insects, and reasons known are extensive species number, complex biology, and association within habitats are largely unknown (Cardoso et al. 2020).

One method to collect insect information as ecological indicators follows ephatization by Dufrêne & Legendre (1997).

In this study, a massive classification of 1,223,917 insects of different types of forest coverages and biomes and determined the most sensible habitats and the principal indicator species were analyzed using datasets retrieved. Additionally, we mapped endangered species and performed a dissimilarity index to compare different regions of Costa Rica.

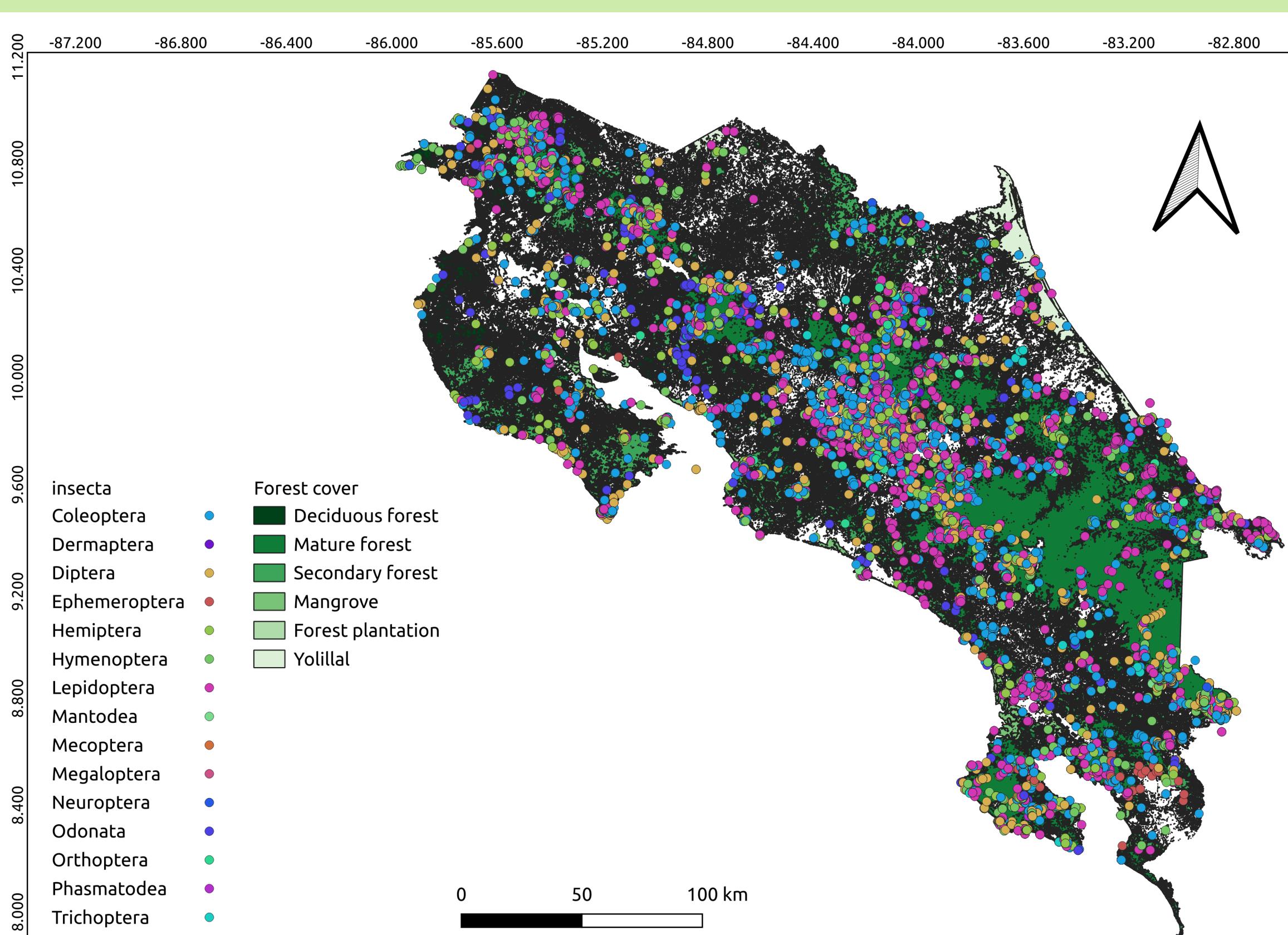


Figure 1. Distribution of Insects and Forest Cover Types in Costa Rica.

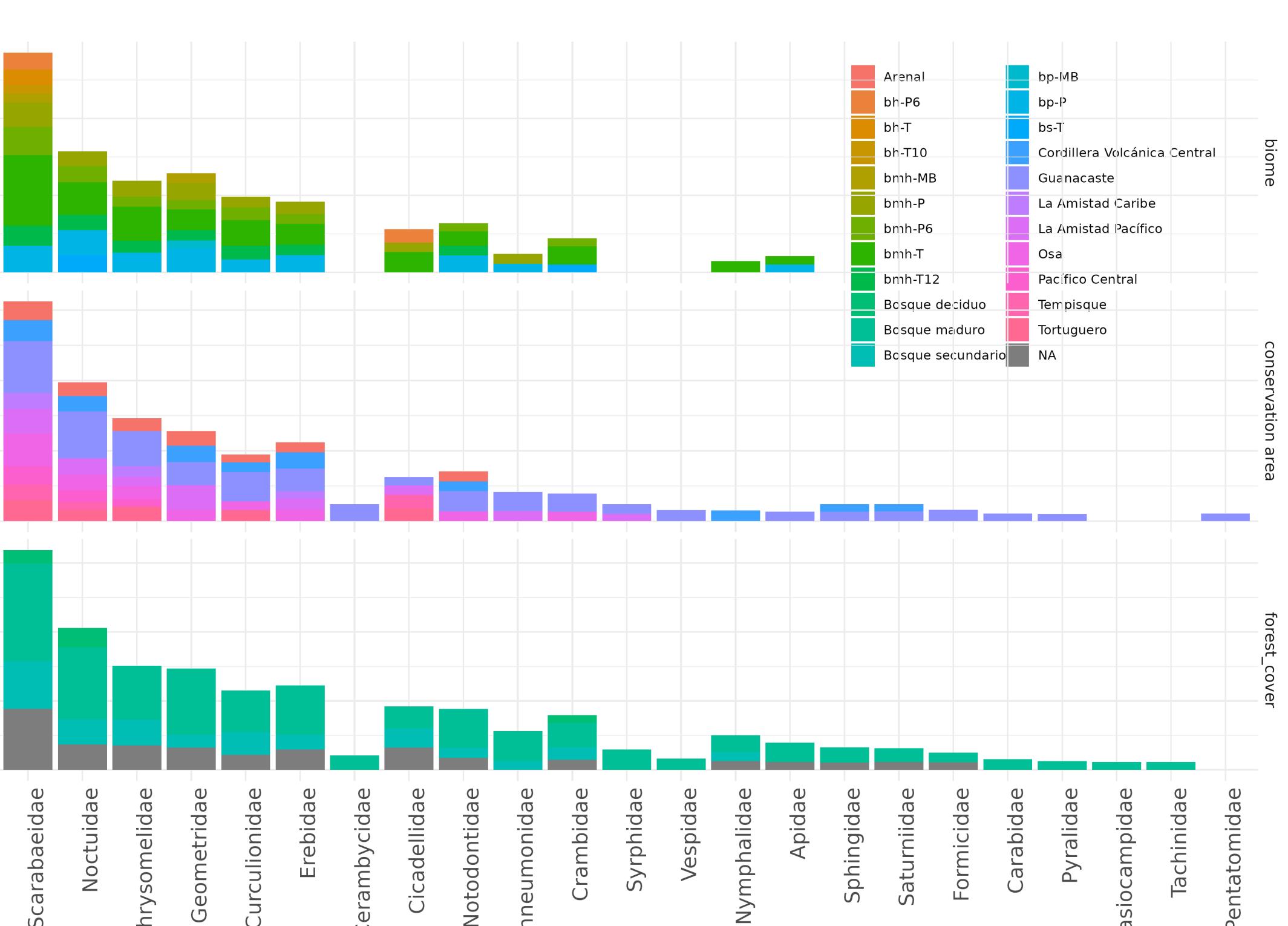


Figure 2. Insect Classification by Habitat Type, Biome and Conservation Zone.

REFERENCES:

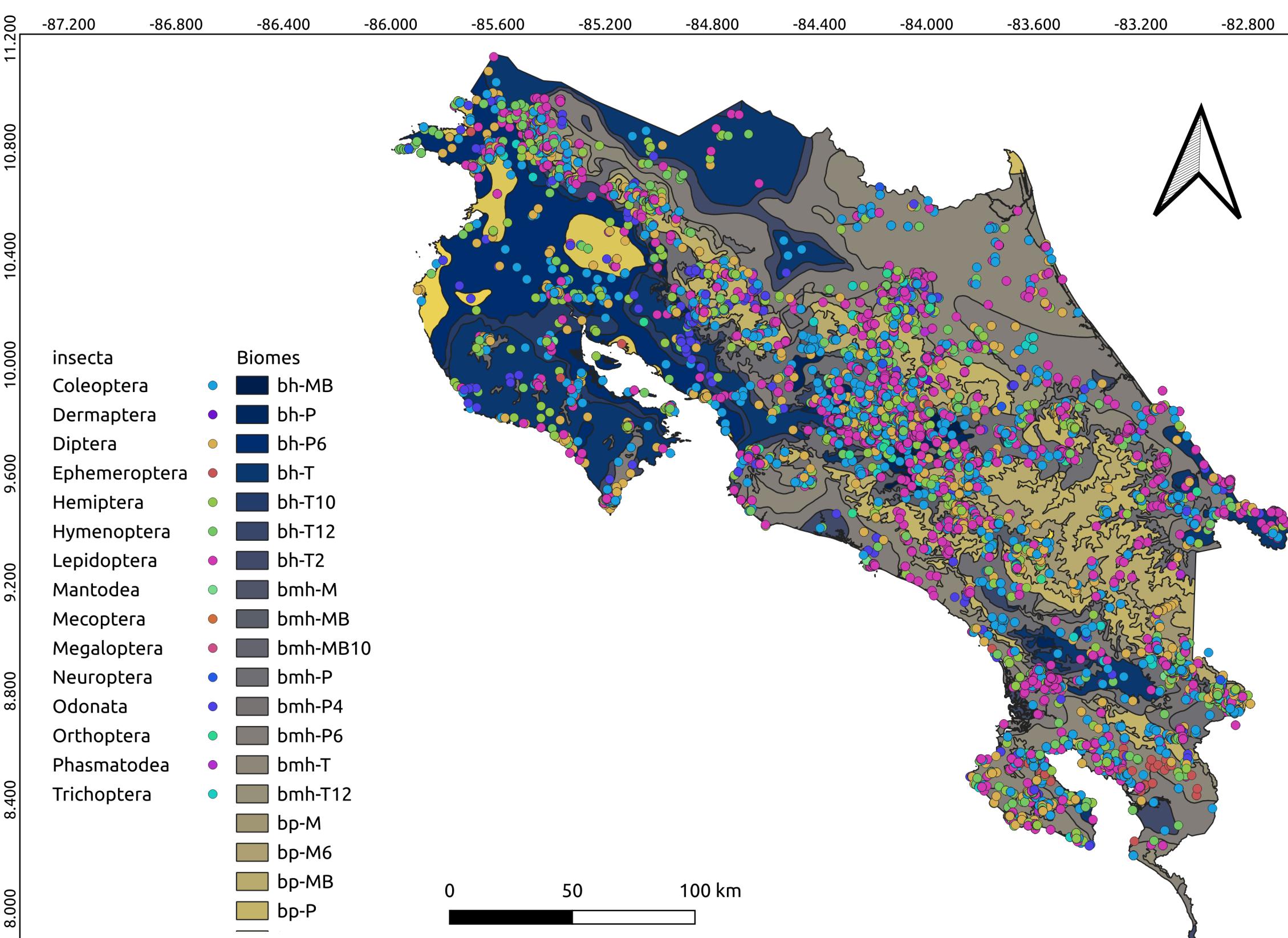


Figure 3. Spatial Distribution of Insect Species and Biomes in Costa Rica.

MATERIALS AND METHODS

The insect data was obtained from the Historia Natural collection at the Museo Nacional of Costa Rica (MNCR). The forest shapefile coverage, conservation zones, and biomes of Costa Rica were acquired from the Sistema Nacional de Información Territorial (SNIT) of CR. Geodataframe manipulation was done in Python 3.13.1, implementing GeoPandas module 1.0.1 and Bray-Curtis diversity analysis performed using scikit-bio 0.6.2. The species association analysis using R/4.3.3 with the package indicSpecies 1.7.15 was used. The distribution maps were generated in QGIS 3.40.2.

DISCUSSION

The coverage percentage of indicator species shows that Yolillal and Mangrove are habitats with the most specialized species. Diniz et al. (2022) mentioned that saline environment and tidal dynamics of the mangrove make that species occupy this habitat pass through strong environmental filters. Island biotas are characterized by presenting differentiated flora and fauna compared to continental ecosystems, as is the case observed in Figure 5, where Isla del Coco is very different compared to the rest of the conservation area (Cava et al. 2015).

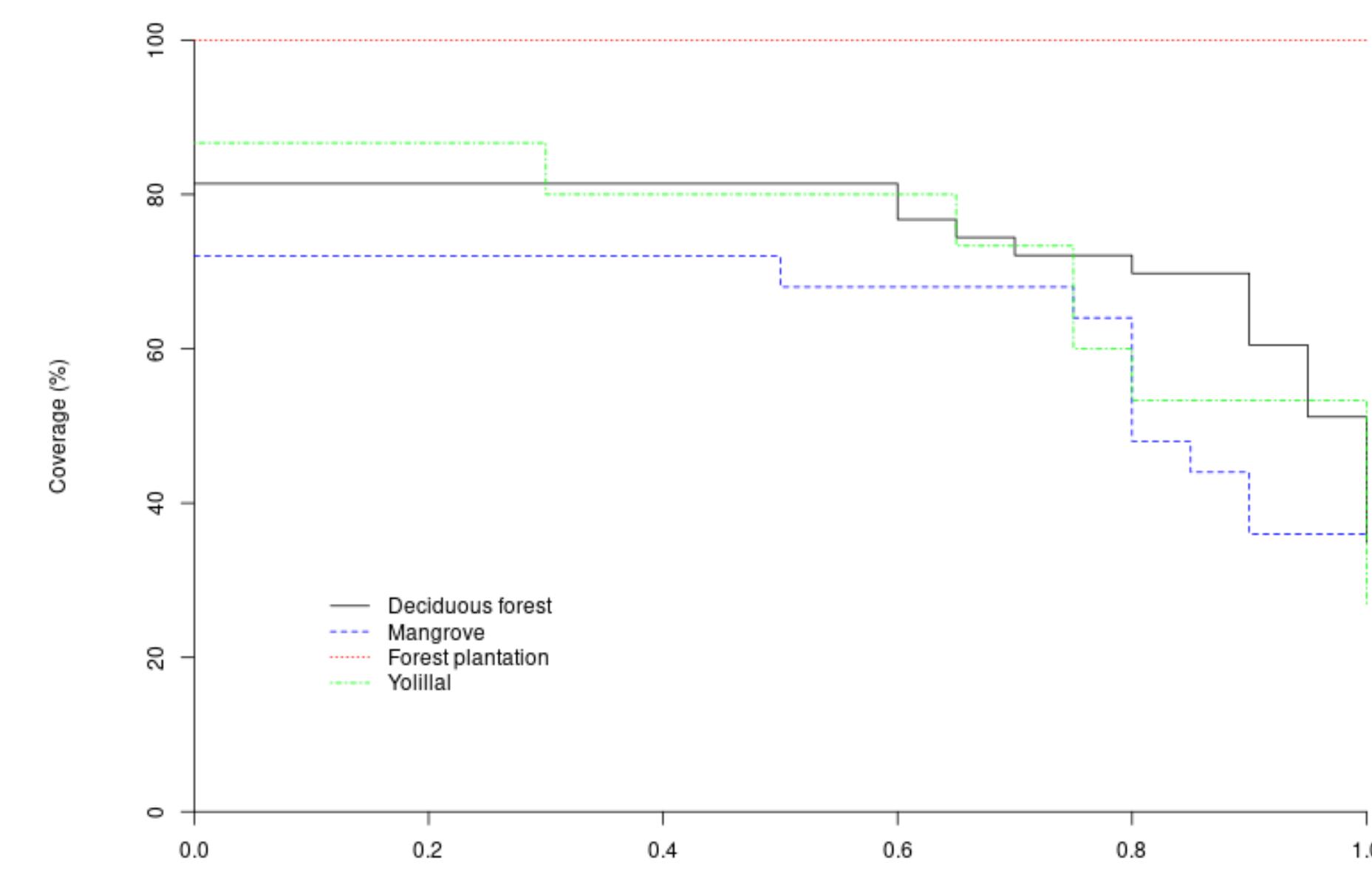


Figure 4. Coverage percentage of indicator species across four ecosystems using the IndVal method.

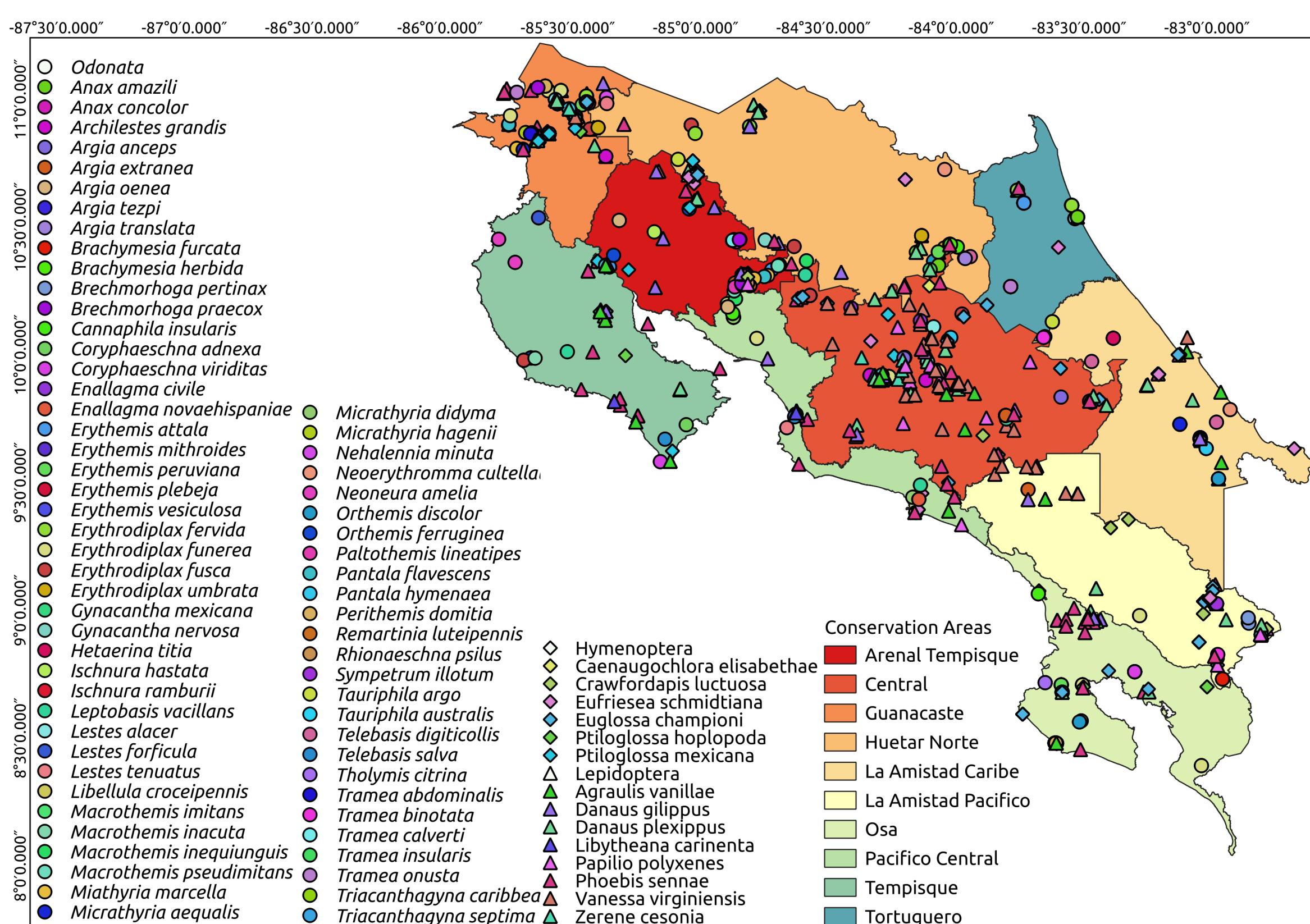


Figure 5. Bray-Curtis Index for Different Conservation Areas: Dissimilarity Matrix.

RESULTS

From a total of 1,223,917 insect records, 98.5% (1,213,057) were classified into different biomes: 951,881 spread on different forest coverages and 1,216,613 in conservation areas. A total of 20,700 species were included in the analysis, of which 559 species were selected for 555 coverage forest groups ($p>0.05$). The biomes "Indval" function returns a total of 21871 in 186 different groups ($p>0.05$). 82 species fall in category of endangered in both, at MNCR and RedList, and the species *Argia cuprea* and *Atlides halesus* are not reported for Costa Rica.