Spatial Analysis of the Distribution of the Native Vegetation Species Copaifera Langsdorffii in a Forest Fragment of the Atlantic Forest Biome

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Abbreviated abstract: Currently, only about 11% to 16% of the Atlantic Forest is left. Biome fragmentation caused by intensive exploitation can cause impacts on species related to biotic and abiotic factors. This study aims to use point process methods to characterize the spatial distribution pattern of the species Copaifera langsdorffii. Through the analysis, a variation of intensities was observed along the study area and a clustered pattern was detected.

Related publications:

– W. Oliveira *et al*, conference proceedings XLI CNMAC (2022)
– W. Oliveira *et al*, conference proceedings XXII SEMAT e XII SEMEST (2022)

Presentation of the problem

spatial point
pattern of the work

Efeitos de Primeira ordem

$$\lambda(\boldsymbol{s}) = \lim_{|d\boldsymbol{s}|\to 0}\left\{\frac{\mathbb{E}\left[N(d\boldsymbol{s})\right]}{|d\boldsymbol{s}|}\right\}$$

Homogeneus **Inhomogeneus**

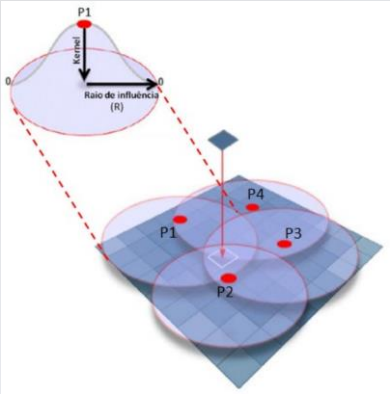
Efeitos de segunda ordem

$$\lambda_2(\boldsymbol{s}_i,\boldsymbol{s}_j) = \lim_{|d\boldsymbol{s}_i|,|d\boldsymbol{s}_j|\to 0}\left\{\frac{\mathbb{E}\left[N(d\boldsymbol{s}_i)\times N(d\boldsymbol{s}_j)\right]}{|d\boldsymbol{s}_i||d\boldsymbol{s}_j|}\right\}$$

- **Regular**
- **Random**
- **Clustered**

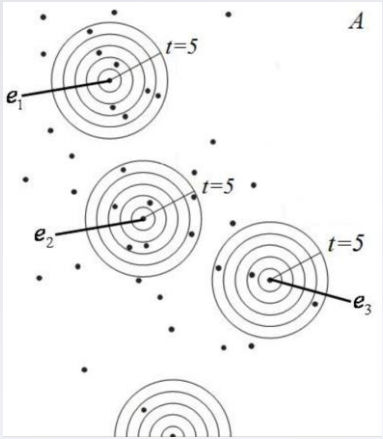
Techniques and Methods

Kernel Method



Fit a two-dimensional function over the data creating a location-weighted surface of occurrences depending only on the radius of influence.

Ripley's K method



Ripley's K function analyzes the average number of points found within a defined distance of a given event.

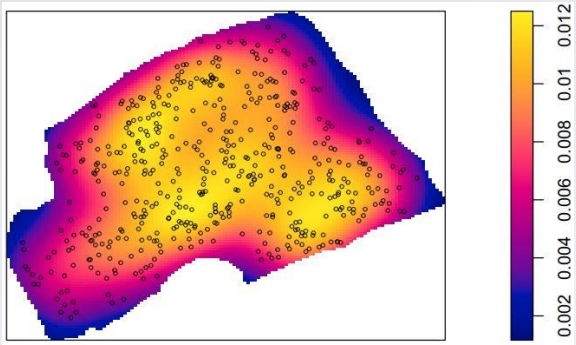
Equations:

$$\hat{\lambda}_\tau(\boldsymbol{x}) = \frac{1}{\tau^2}\sum_{i=1}^{n} k\left(\frac{d(\boldsymbol{s}_i,\boldsymbol{x})}{\tau}\right), \qquad d(\boldsymbol{s}_i,\boldsymbol{x}) \le \tau$$

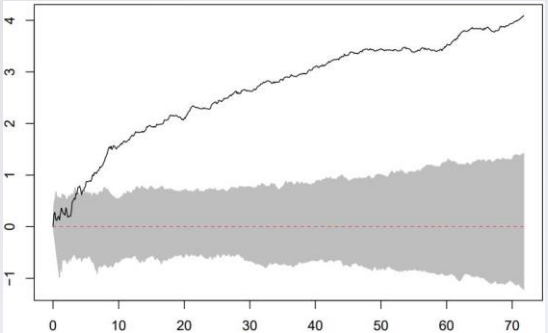
$$\hat{K}(t) = \frac{|A|}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}\frac{I_t(t_{ij})}{w_{ij}}, \qquad t > 0,$$

Results and Conclusions

Full visualization of the difference in intensity of event occurrences along the study area by Kernel smoothing



$\tau = 25.63$ obtained by the formula of Campbell



Envelopes of Ripley's K function obtained by performing 1000 Monte Carlo simulations

Evidence of an aggregate pattern for distances greater than approximately 5 meters.

Conclusion: The causes of the aggregate pattern obtained may be diverse, and may be related to the population density of the species, environmental heterogeneity, limitation in seed dispersal, requirements of specific microenvironmental conditions, among others.