S-114.4202 Special Course in Computational Engineering II: Work Course on Point Patterns

Cross River gorillas
Report phase 1

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1 Data description

Cross River gorilla (*Gorilla gorilla diehli*) is the rarest of all gorilla subspecies[**bergl**]. Quite little is known of its ecological behaviour[1]. Gorillas are usually tracked and counted by the nests they leave behind[2] as they build a new nest almost every day[3]. Each gorilla over three years old has their own nest[4], either on ground or in a tree[5].

The data set `gorillas`[**wcs_R_help_for_gorillas**] provided in the spatstat[**spatstat**] library for R[**R_language**] contains the nest site locations of Cross River gorillas in the Kagwene Gorilla Sanctuary in Cameroon. The site locations were collected over a period of over three years and 647 sightings were made altogether.

There were two groups of gorillas in the area, minor and major. Each site with less than seven nests was marked minor and other sites major. The date of each sighting was added into the mark. Based on the month of the sighting, the site was also marked as either belonging to the dry or the wet season.

There are also seven covariates available:

- elevation,
- slope degree,
- slope position (from valley to ridge),
- slope aspect (facing direction),
- heat index (probably regarding moisture and exposure to sun),
- vegetation class (grassland, primary forest etc.) and
- distance from closest river.

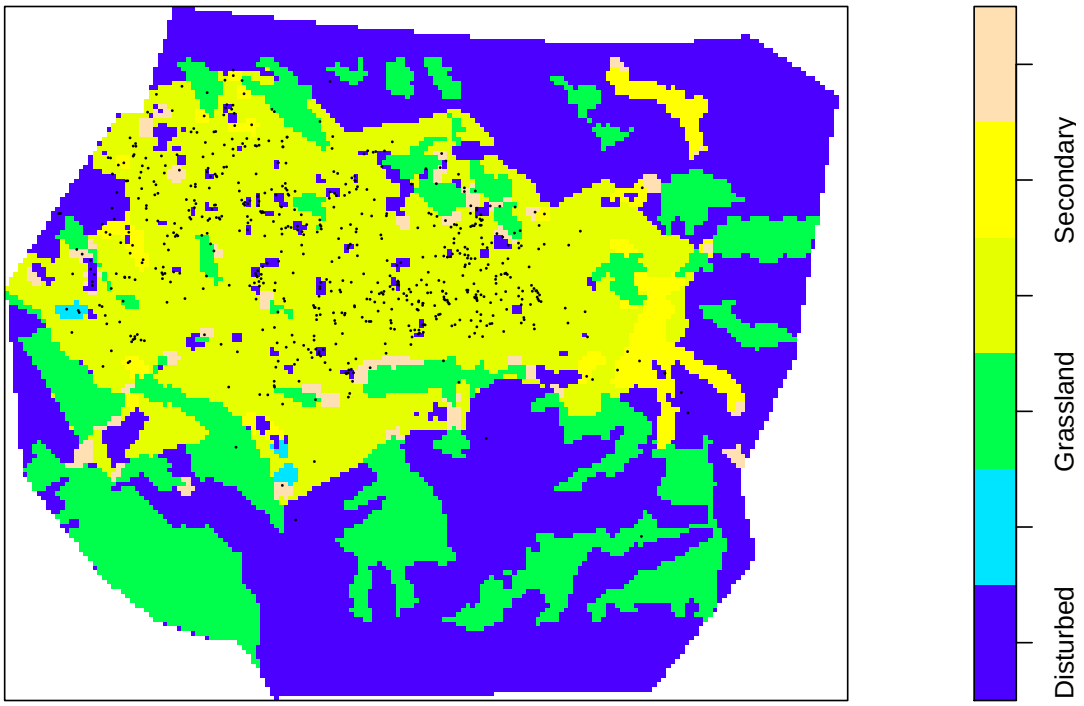

Figure 1: All nest site locations regardless of marks plotted on the vegetation class covariate.

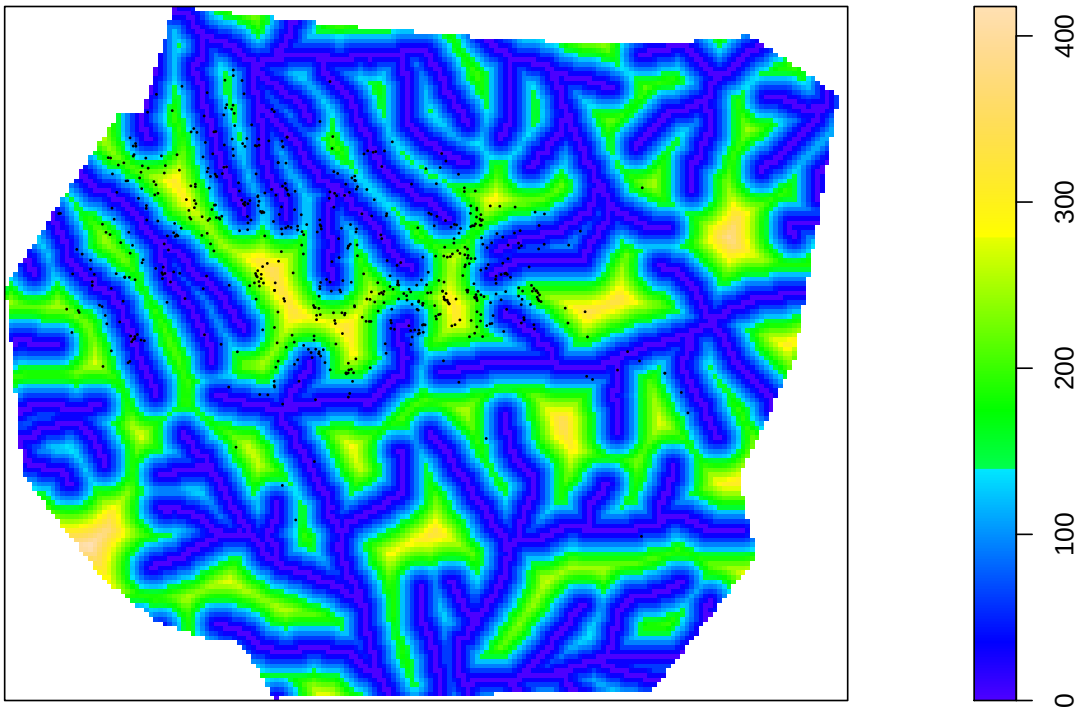

Figure 2: All nest site locations regardless of marks plotted on the water distance covariate.

2 Notes on data

By looking at Figure 1, it is obvious that the nest sites are scattered inhomogenously. They are in one big, asymmetric cluster.

The vegetation class might explain some of the pattern, because gorillas need a lot of fruit to survive[**who_goes_here**]. Gorillas also prefer some nest materials to others but can use what is available[5]. Also looking at Figure 1 makes it clear that the gorillas avoid areas with evidence of high human disturbance.

The area seems to have many small rivers as can be seen in Figure 2. There are actually so many that finding the closest one might not be an issue for the gorillas.

3 Analysis ideas

Funwi-Gabga and Mateu made their analysis using an Area-Interaction model which can be used for either clustered or regular point patterns[1]. Myllymäki suggested to first replicate their results and then try Geyer's saturation model. If time permits, the log-Gaussian Cox process might be suitable as well.

First we need to estimate intensity and only then try to find any interaction conditional on the intensity estimate. Looking at the results of a tessellation method and Gaussian kernel method of finding a smooth intensity estimate, we'd choose the latter.

The inhomogenous L estimate seems like the first summary statistic we will try.

It would be interesting to test what effect covariates have on the intensity.

What to do with the marks? It's a bit silly that the data has a separate mark for rain seasons when it is simply derived from the date. Perhaps local weather conditions would have been more useful. It's hard to believe that they were not available.

Funwi-Gabga and Mateu found some interaction between the two groups of gorillas. That mark should be investigated. Funwi-Gabga and Mateu did not use the date data to my current knowledge. Perhaps a spatio-temporal model could be used with data imputation for the missing nest sites?

4 Hours used

By the end of 2012-01-31 about 20 hours have been spent on the course.

References

[1] N. Funwi-Gabga and J. Mateu. "Understanding the nesting spatial behaviour of gorillas in the Kagwene Sanctuary, Cameroon". In: *Stochastic Environmental Research and Risk Assessment* (Nov. 2011). ISSN: 1436-3240, 1436-3259. DOI: 10.1007/s00477-011-0541-1. URL: http://www.springerlink.com/content/j75p14757676247r/.

[2] Crickette Sanz et al. “Distinguishing between the nests of sympatric chimpanzees and gorillas”. In: *Journal of Applied Ecology* 44.2 (Apr. 2007), pp. 263–272. ISSN: 1365-2664. DOI: 10.1111/j.1365-2664.2007.01278.x. URL: http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2007.01278.x/abstract.

[3] Yuji Iwata and Chieko Ando. “Bed and bed-site reuse by western lowland gorillas (Gorilla g. gorilla) in Moukalaba-Doudou National Park, Gabon”. In: *Primates* 48.1 (Nov. 2006), pp. 77–80. ISSN: 0032-8332, 1610-7365. DOI: 10.1007/s10329-006-0003-4. URL: http://www.springerlink.com/content/y270j67x4n191rh6/.

[4] Richard Despard Estes. *The Behavior Guide to African Mammals: Including Hoofed Mammals, Carnivores, Primates*. University of California Press, Dec. 1992. ISBN: 0520080858.

[5] Caroline E. G. Tutin et al. “Nest building by lowland gorillas in the Lopé Reserve, Gabon: Environmental influences and implications for censusing”. In: *International Journal of Primatology* 16.2 (Apr. 1995), pp. 53–76. ISSN: 0164-0291, 1573-8604. DOI: 10.1007/BF02700153. URL: http://www.springerlink.com/content/23j646x2382138q5/.