**DATA SUMMARY**

說明：

使用的獼猴資料皆符合**6分鐘內且100m內且調查日在61~180內**之標準，也刪掉距離過近的猴群資料。

猴群於各縣市的分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 縣市 | 資料筆數 | | | | | 樣區數 | | | | | 樣點數 | | | | |
| 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 宜蘭縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 新北市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 桃園市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 新竹縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 苗栗縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台中市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 南投縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 雲林縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 嘉義縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台南市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 高雄市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 屏東縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 花蓮縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台東縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 合計 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

孤猴於各縣市的分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 縣市 | 資料筆數 | | | | | 樣區數 | | | | | 樣點數 | | | | |
| 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 宜蘭縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 新北市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 苗栗縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台中市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 南投縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 雲林縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 嘉義縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台南市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 高雄市 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 屏東縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 花蓮縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 台東縣 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 合計 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

樣點與猴群於森林類型之分布

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 年 | 旅次 | 總調查樣點數 | 樣點 | | | | | | 猴群 | | | | | |
| 森林 | | | | | 非森林 | 森林 | | | | | 非森林 |
| 闊葉林 | 針葉林 | 混淆林 | 竹林 | 合計 | 闊葉林 | 針葉林 | 混淆林 | 竹林 | 合計 |
| 2015 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2015 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2016 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2017 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2018 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2019 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |

2019年樣點資料回收尚未完全。

2015~2018年不同森林類型內資料筆數及猴群數

|  |  |  |  |
| --- | --- | --- | --- |
| 本計畫森林類型 | 第4次森林圖層 | 資料筆數 | 猴群數 |
| 闊葉林 | 闊葉樹林型 |  |  |
| 針葉林 | 針葉樹林型 |  |  |
| 混淆林 | 竹闊混淆林 |  |  |
| 針闊葉樹混淆林 |  |  |
| 竹針混淆林 |  |  |
| 竹林 | 竹林 |  |  |

2015~2018年不同森林類型內各距離段所記錄的猴群數

|  |  |  |  |
| --- | --- | --- | --- |
|  | A (<25m) | B (25~100) | 合計 |
| 闊葉林 | 58 | 50 | 108 |
| 針葉林 | 3 | 5 | 8 |
| 混淆林 | 11 | 14 | 25 |
| 竹林 | 6 | 11 | 17 |
| 非森林 | 2 | 1 | 3 |
| 合計 | 80 | 81 | 161 |

2015~2018年Data Summary

說明：

獼猴資料皆符合 **6分鐘內**且**100m內**且在**森林內**之標準。(畫圖、GLMM、rtrim的資料都是同一份)

****

**GLMM**

Full model:

m1 <- glmer(猴群數 ~ 森林類型 + 年 + 海拔 + 調查日 + 分區 + (1|Site\_N), family = binomial, data = df)

1. 年為連續變數：2015~2019 年。

2. 森林類型為類別變數：分別為闊葉林、針葉林、混淆林、竹林等4 種。

3. 海拔為連續變數：。

4. 調查日為連續變數：調查日期為當年度的第n天，範圍61~180。

5. 分區等為類別變數：分別為北部、中彰投、雲嘉南、高屏、花蓮、臺東等六區；

1. 北部為基隆市、臺北市、新北市、桃園市、新竹縣、苗栗縣、宜蘭縣；
2. 中彰投為臺中市、彰化縣、南投縣；
3. 雲嘉南為雲林縣、嘉義縣、嘉義市、臺南市；
4. 高屏為高雄市、屏東縣；
5. ；
6. 。

6. 樣區為隨機變數。

Model selection table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| (Intercept) | 海拔 | 調查日 | 分區 | 森林類型 | 年 | df | logLik | AICc | delta | weight |
| -6.598 | 0.4153 |  | + |  | 0.0928 | 9 | -970.945 | 1959.9 | 0 | 0.246 |
| -6.595 | 0.3814 | 0.08741 | + |  | 0.0916 | 10 | -970.346 | 1960.7 | 0.8 | 0.165 |
| -6.289 | 0.4075 |  | + |  |  | 8 | -972.565 | 1961.1 | 1.24 | 0.133 |
| -6.289 | 0.3726 | 0.09022 | + |  |  | 9 | -971.926 | 1961.9 | 1.96 | 0.092 |

>importance(d1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 分區 | 海拔 | 年 | 調查日 | 森林類型 |
| Sum of weights: | 1 | 0.87 | 0.64 | 0.42 | 0.25 |
| N containing models: | 16 | 16 | 16 | 16 | 16 |

Analysis of Deviance Table (Type II Wald chisquare tests)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Chisq | Df | P-value(>Chisq) |  |
| 森林類型 | 3.7039 | 3 | 0.2953 |  |
| 年 | 3.1200 | 1 | 0.0773 |  |
| 海拔 | 7.4689 | 1 | 0.0063 | \*\* |
| 調查日 | 1.2246 | 1 | 0.2685 |  |
| 分區 | 41.4049 | 5 | < 0.001 | \*\*\* |

> summary(glht(m1, linfct = mcp(Region = "Tukey")))

Multiple Comparisons of Means: Tukey Contrasts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Estimate | Std. Error | z value | P-value(>|z|) |  |
| 雲嘉南 - 中彰投 == 0 | 0.6274 | 0.5751 | 1.091 | 0.8823 |  |
| 花蓮 - 中彰投 == 0 | 1.8743 | 0.5254 | 3.568 | 0.0048 | \*\* |
| 臺東 - 中彰投 == 0 | 2.9118 | 0.7106 | 4.098 | < 0.001 | \*\*\* |
| 北部 - 中彰投 == 0 | -0.7494 | 0.5031 | -1.489 | 0.6652 |  |
| 高屏 - 中彰投 == 0 | 0.8364 | 0.6002 | 1.394 | 0.7256 |  |
| 花蓮 - 雲嘉南 == 0 | 1.2469 | 0.6054 | 2.06 | 0.3027 |  |
| 臺東 - 雲嘉南 == 0 | 2.2844 | 0.7781 | 2.936 | 0.0376 | \* |
| 北部 - 雲嘉南 == 0 | -1.3768 | 0.5803 | -2.373 | 0.1617 |  |
| 高屏 - 雲嘉南 == 0 | 0.209 | 0.6591 | 0.317 | 0.9996 |  |
| 臺東 - 花蓮 == 0 | 1.0376 | 0.7122 | 1.457 | 0.6861 |  |
| 北部 - 花蓮 == 0 | -2.6236 | 0.5239 | -5.008 | < 0.001 | \*\*\* |
| 高屏 - 花蓮 == 0 | -1.0378 | 0.6096 | -1.703 | 0.5233 |  |
| 北部 - 臺東 == 0 | -3.6612 | 0.7126 | -5.137 | <0.001 | \*\*\* |
| 高屏 - 臺東 == 0 | -2.0754 | 0.7762 | -2.674 | 0.0786 |  |
| 高屏 - 北部 == 0 | 1.5858 | 0.5916 | 2.68 | 0.0771 |  |

如果把森林類型從model中拿掉的話…

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Chisq | Df | Pr(>Chisq) |  |
| 海拔 | 4.8424 | 1 | 0.0278 |  |
| 年 | 3.149 | 1 | 0.0760 | . |
| 調查日 | 1.1983 | 1 | 0.2737 | \* |
| 分區 | 41.5147 | 5 | <0.001 | \*\*\* |

**Estimate**

森林總面積=21536.41(km2)

分層：森林類型4層\* 分區4層

|  |  |  |
| --- | --- | --- |
| 單位面積的半徑 | 25m | 100m |
| 密度Mean | 0.0053694 | 0.0163951 |
| SD | 0.0007462 | 0.0105148 |
| 相對密度(80% CI) | 0.004414242 ~ 0.006324642 | 0.00293623 ~ 0.02985399 |
| 相對密度(95% CI) | 0.003906842 ~ 0.006832042 | -0.004213801 ~ 0.03700402 |
| **群** | **58,893.75 群** | **11,239.25 群** |
| **猴群數(80% CI)** | **48,417.19 ~ 69,371.23 群** | **2,012.86 ~ 20,465.66 群** |
| **猴群數(95% CI)** | **42,851.82 ~ 74,936.59 群** | **0 ~ 25,367.19 群** |

**Rtrim**

Region:分為東部、中部、南部、北部，與GLMM同。

最小的scale：樣點

trim(df, count\_col = "number", site\_col = "SP", year\_col = "Year",

weights\_col = "weight", covar\_cols = "Region", model = 2,

changepoints = "all", overdisp = F, serialcor = F, autodelete = T,

stepwise = F)

Model : 2

Method : ML (Convergence reached after 7 iterations)

Coefficients:

covar cat from upto add se\_add mul se\_mul

1 baseline 0 2015 2017 -0.21697733 0.1831711 0.8049482 0.1474433

2 baseline 0 2017 2018 0.49733136 0.3353751 1.6443273 0.5514665

3 Region 2 2015 2017 0.15072668 0.2668305 1.1626788 0.3102382

4 Region 2 2017 2018 -0.02413176 0.463283 0.9761571 0.452237

5 Region 3 2015 2017 -1.6253166 1.0394405 0.1968493 0.2046132

6 Region 3 2017 2018 5.27788419 2.1980012 195.9548327 430.7089573

7 Region 4 2015 2017 0.73049803 0.3303696 2.0761143 0.685885

8 Region 4 2017 2018 -0.72006612 0.5408663 0.4867201 0.2632505

Goodness of fit:

Chi-square = 337.83, df=364, p=0.8339

Likelihood Ratio = 331.94, df=364, p=0.8849

AIC (up to a constant) = -396.06

> wald(m1)

Wald test for significance of covariates

Covariate W df p

Region 12.2644 6 0.05632363

Wald test for significance of changes in slope

Changepoint Wald\_test df p

2015 8.250308 4 0.08282763

2017 11.206205 4 0.02434173

> overall(m1,"imputed")

From upto add se\_add mul se\_mul p meaning

2015 2018 0.5080409 0.3436482 1.662032 0.5711544 0.2773864 Uncertain

