Online Resource 1

Contents

Related article

Article title : Bird seasonal beta-diversity in the contiguous United States

Journal name : Journal of Ornithology

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Goal

This online resource acts as an additional result to *Bird seasonal beta-diversity in the contiguous United States*, exploring the gamma:alpha ratio, as it was an important contributor to differences in beta-diversity along species pool size changes in Kraft et al. (2011).

In our study, gamma diversity is total number of species for a state in a 10-year period. Alpha diversity is the average number of species per week per state in a 10-year period.

Data source is the same as in the related article (eBird frequency histograms from 2006 to 2016).

Data loading and preparation

```
library(tidyverse)
db <- read_csv("../data/distances.csv") %>%
  filter(complete.cases(.)) %>%
  select(alpha, gamma, latitude, location) %>%
  gather(key = metric, value = diversity, alpha, gamma)
```

Database excerpt

```
db
```

```
# A tibble: 96 × 4
   latitude location metric diversity
      <dbl>    <chr>  <chr>     <dbl>
1   32.5901       AL  alpha  237.2500
2   34.7336       AR  alpha  219.0000
3   34.2192       AZ  alpha  366.5417
4   36.5341       CA  alpha  469.3125
5   38.6777       CO  alpha  288.3958
6   41.5928       CT  alpha  225.2708
7   38.6777       DE  alpha  217.1667
8   27.8744       FL  alpha  349.8333
9   32.3329       GA  alpha  255.1042
10  41.9358       IA  alpha  188.5417
# ... with 86 more rows
```

Graphical representation of the relationship

Compare with Fig. 1A in Kraft et al. 2011

```
db %>%
  ggplot(aes(x = latitude, y = diversity, col = metric, shape = metric)) +
  geom_point(size = 3) +
  geom_smooth(method = "lm", se = FALSE) +
  theme_minimal() +
  labs(x = "Latitude", y = "Diversity") +
  scale_color_manual(values = c("alpha" = "tomato", "gamma" = "royalblue"))
```
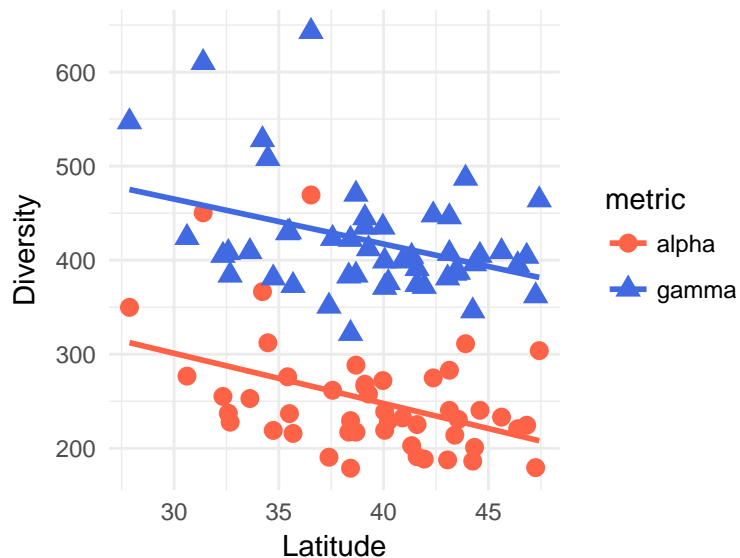
Comparing models with and without slope differences

```r
m1 <- lm(diversity~latitude * metric, data = db)
m2 <- lm(diversity~latitude + metric, data = db)
AIC(m1,m2) # Lower AIC = better model, i.e. no slope difference

   df      AIC
m1  5 1054.911
m2  4 1052.963

summary(m2)


Call:
lm(formula = diversity ~ latitude + metric, data = db)

Residuals:
    Min      1Q  Median      3Q     Max
-102.99  -39.18  -11.06   18.47  208.48

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  450.081     49.294   9.131 1.41e-14 ***
latitude      -5.056      1.235  -4.095 9.01e-05 ***
metricgamma  169.157     11.593  14.591  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 56.8 on 93 degrees of freedom
Multiple R-squared:  0.7118,    Adjusted R-squared:  0.7056
F-statistic: 114.8 on 2 and 93 DF,  p-value: < 2.2e-16
```

References

Kraft NJ, Comita LS, Chase JM, et al (2011) Disentangling the Drivers of Beta Diversity Along Latidunial and Elevational Gradients. Science (80) 333:1755–1758. doi: 10.1007/s13398-014-0173-7.2