Article

Developing an Integrated Remote Sensing Based Biodiversity Index for Predicting Animal Species Richness

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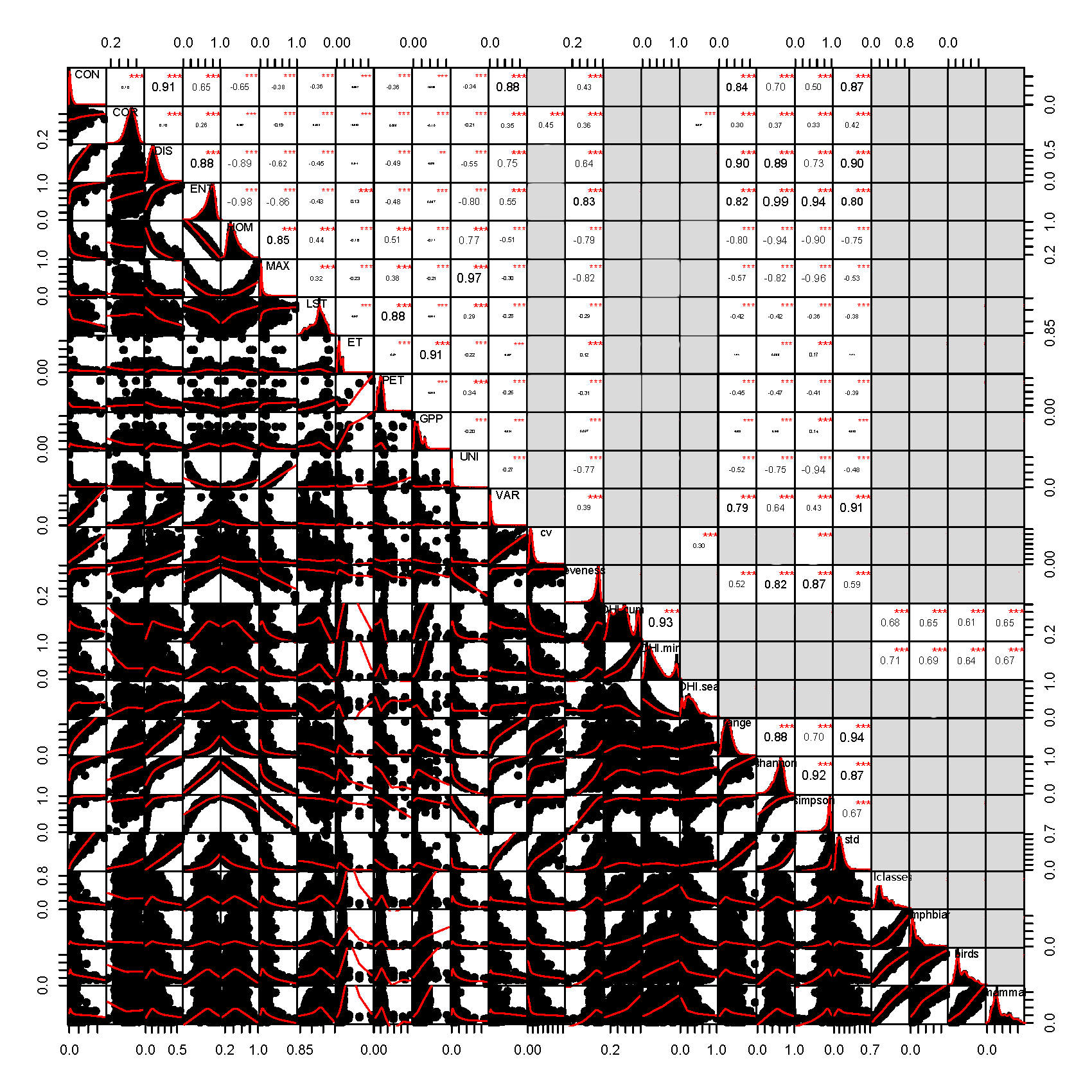
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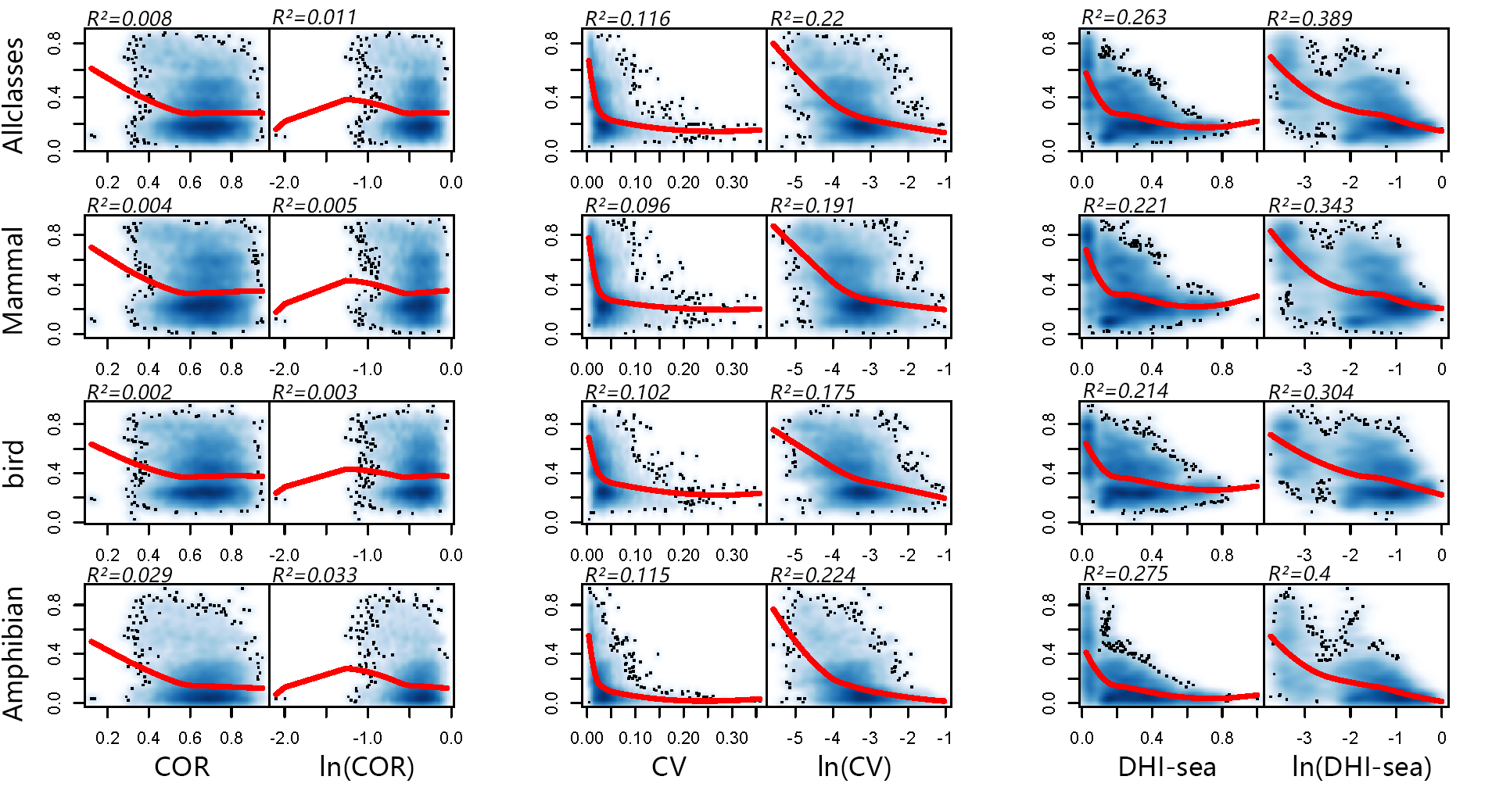
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**Supplementary Materials:** Figure S1: Correlations of all remote sensing metrics; Figure S2: Scatterplots between species richness and power-law metrics; Figure S3: Correlation between predicted species richness and in situ species richness; Table S1: The explained variance of remote sensing metrics in different biomes.

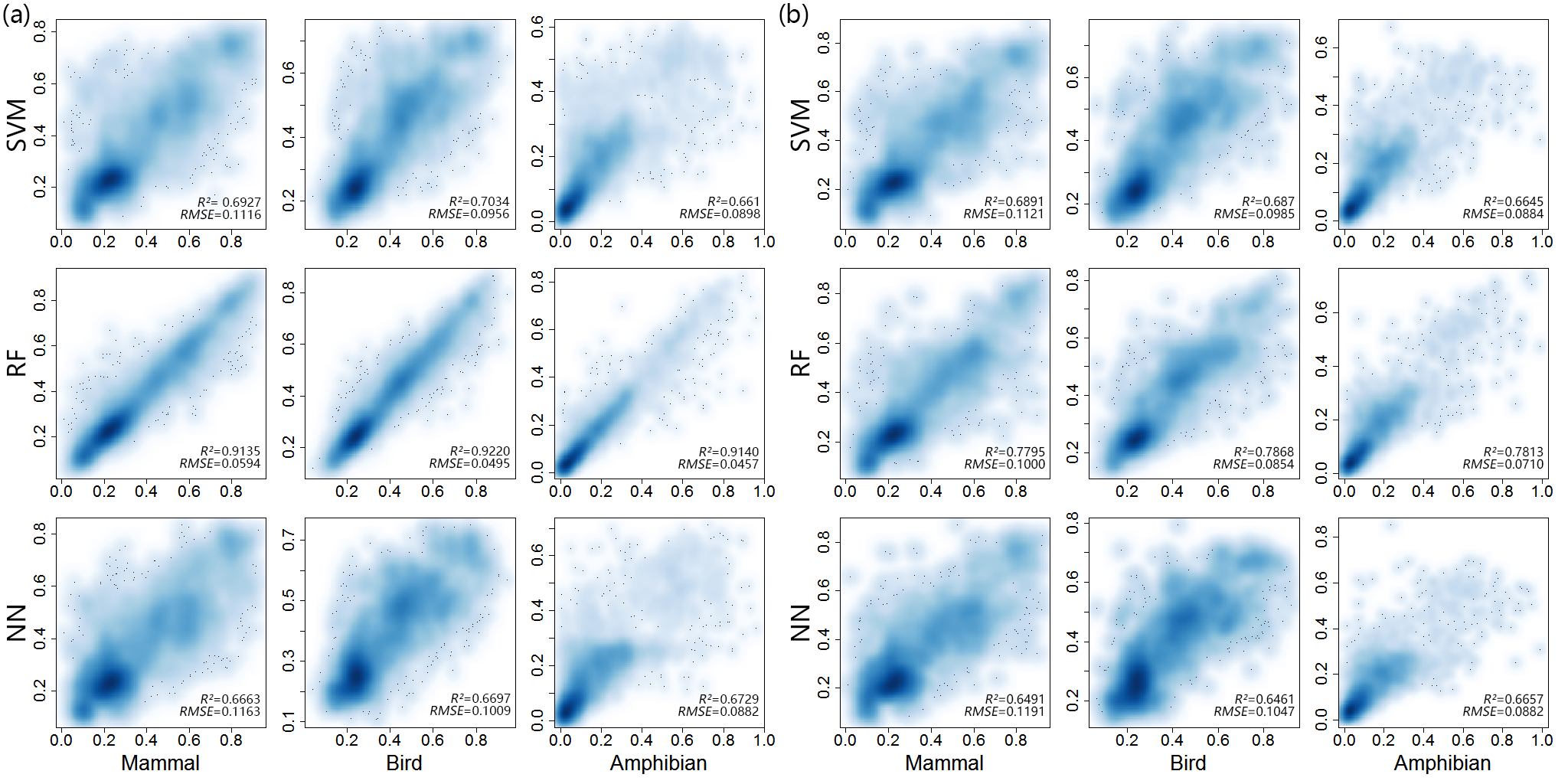
**Supplementary Figures**



**Figure S1.** Correlations of all remote sensing metrics with animal species richness. The coefficients of correlation for all the remote sensing metrics with species richness were calculated from the measured values obtained for 10,000 0.1-degree pixels randomly selected from terrestrial areas of the globe. The lower triangle of the matrix shows scatterplots for pairs of metrics and red lines are locally weighted regression (LOWESS) lines. The upper triangle shows the absolute value of Pearson’s correlation coefficients between the measures of texture. The larger fonts indicate larger values of the correlation coefficients and the grey boxes indicate that the relationships between pairs of metrics are nonlinear. The full names of abbreviations can be found in the Table 1.



**Figure S2.** Scatterplots between species richness and, COR, CV, and DHI-sea. The relationship between animal species richness and metrics shows power law pattern. In order to compare all metrics used, we took a logarithmic transform for COR, CV and DHI-sea, and then calculated the correlation between these metrics and animal species richness using univariate linear regression model. The red lines are locally weighted regression (LOESS) lines and r-squared is the explained variance. The measured values were obtained for 10,000 0.1-degree pixels randomly selected from terrestrial areas of the globe. The logarithm of COR, the logarithm of CV, and the logarithm of DHI-sea show clear linear relationships with species richness. The full names of abbreviations can be found in the Table 1.



**Figure S3.** Correlation between predicted species richness and in-situ species richness. (**a**) Training dataset. (**b**) Prediction dataset. The measure values were obtained for 10,000 0.1-degree pixels randomly selected from terrestrial areas of the globe. 7000 pixels were selected randomly for training and 3000 pixels were randomly selected for prediction.

**Supplementary Table**

**Table S1.** The explained variance of remote sensing metrics in different biomes. The species richness data is the sum richness of three animal classes (‘Allclasses’). The measured values were obtained for 10,000 0.1-degree pixels randomly selected from the terrestrial areas of the globe. The “samples” indicates the number of measured values in the 10000 samples. Explained variance values that are larger than 20%, are marked in yellow. The full names of abbreviations can be found in the Table 1. Biomes: 1. Tropical and Subtropical Moist Broadleaf Forests. 2. Tropical and Subtropical Dry Broadleaf Forests. 3. Tropical and Subtropical Coniferous Forests. 4. Temperate Broadleaf and Mixed Forests. 5. Temperate Coniferous Forests. 6. Boreal Forests/Taiga. 7. Tropical and subtropical grasslands, savannas, and shrublands. 8. Temperate Grasslands, Savannas, and Shrub lands. 9. Flooded Grasslands and Savannas. 10. Montane Grasslands and Shrub lands. 12. Mediterranean Forests, Woodlands, and Scrub. 13. Deserts and Xeric Shrub lands. 14. Mangroves

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Allclasses** | | | | | | | | | | | | | | | | | | | | | | |
| biomes | CON | COR | DIS | ENT | HOM | MAX | UNI | VAR | cv | eveness | range | Shannon | Simpson | Std | DHI-sea | DHI-cum | DHI-min | PET | ET | LST | GPP | samples |
| 1 | 10.27% | 10.98% | 14.38% | 18.04% | 15.11% | 20.77% | 21.31% | 10.13% | 20.53% | 14.85% | 14.26% | 18.71% | 20.26% | 16.39% | 31.42% | 26.99% | 28.09% | 3.55% | 23.99% | 8.07% | 20.86% | 2084 |
| 2 | 7.74% | 1.30% | 9.20% | 10.51% | 9.84% | 9.70% | 9.87% | 6.93% | 25.05% | 4.05% | 9.50% | 10.42% | 10.85% | 7.94% | 25.68% | 31.18% | 27.78% | 1.91% | 19.86% | 13.97% | 20.36% | 309 |
| 3 | 11.37% | 0.44% | 14.79% | 12.57% | 12.12% | 11.06% | 12.48% | 10.40% | 5.25% | 5.38% | 13.68% | 11.88% | 11.81% | 12.73% | 21.74% | 41.72% | 33.66% | 13.58% | 40.88% | 16.00% | 45.80% | 98 |
| 4 | 8.07% | 0.20% | 7.37% | 4.01% | 4.48% | 2.16% | 3.39% | 4.91% | 5.56% | 0.52% | 5.19% | 4.04% | 3.01% | 4.99% | 6.23% | 10.98% | 8.74% | 9.81% | 27.31% | 5.52% | 12.01% | 1503 |
| 5 | 4.77% | 0.12% | 4.17% | 0.81% | 1.22% | 0.52% | 0.54% | 2.67% | 5.55% | 0.22% | 2.90% | 1.58% | 0.49% | 2.43% | 10.62% | 7.94% | 13.93% | 27.57% | 23.17% | 15.56% | 14.65% | 494 |
| 6 | 11.27% | 3.31% | 14.24% | 20.99% | 17.04% | 22.04% | 22.55% | 13.67% | 0.49% | 22.20% | 5.34% | 18.35% | 21.08% | 14.99% | 9.06% | 1.89% | 1.50% | 36.49% | 7.97% | 18.91% | 4.90% | 324 |
| 7 | 15.63% | 1.29% | 20.14% | 21.03% | 21.71% | 19.43% | 19.50% | 13.39% | 0.00% | 10.49% | 18.45% | 19.74% | 19.20% | 16.97% | 8.52% | 33.62% | 22.34% | 19.19% | 30.73% | 31.66% | 37.07% | 2132 |
| 8 | 14.06% | 0.01% | 26.79% | 30.19% | 32.45% | 30.40% | 29.72% | 8.70% | 0.23% | 21.21% | 21.96% | 28.53% | 28.61% | 19.31% | 0.00% | 45.45% | 25.36% | 0.02% | 31.08% | 5.19% | 44.04% | 1014 |
| 9 | 28.31% | 10.02% | 26.93% | 15.85% | 25.96% | 11.20% | 10.41% | 12.57% | 6.46% | 1.15% | 21.30% | 12.11% | 8.72% | 13.52% | 48.01% | 37.93% | 44.65% | 48.21% | 21.54% | 40.79% | 42.95% | 108 |
| 10 | 1.97% | 0.24% | 4.89% | 8.36% | 9.68% | 5.93% | 5.91% | 1.68% | 21.39% | 6.09% | 2.28% | 7.69% | 3.53% | 1.90% | 18.57% | 55.01% | 49.65% | 9.10% | 30.82% | 7.05% | 70.09% | 286 |
| 12 | 6.06% | 1.61% | 8.90% | 11.17% | 10.77% | 11.06% | 11.09% | 6.06% | 3.29% | 7.56% | 9.16% | 11.08% | 11.07% | 9.22% | 2.03% | 8.68% | 6.01% | 18.32% | 17.32% | 14.76% | 11.26% | 374 |
| 13 | 6.70% | 1.70% | 25.82% | 28.26% | 30.56% | 29.40% | 26.06% | 5.96% | 0.72% | 16.78% | 25.99% | 25.98% | 27.31% | 21.54% | 9.69% | 45.87% | 28.73% | 13.08% | 57.62% | 7.36% | 53.01% | 1244 |
| 14 | 47.43% | 1.00% | 42.35% | 28.47% | 29.75% | 23.03% | 19.86% | 23.09% | 18.12% | 4.26% | 39.32% | 30.93% | 17.67% | 35.62% | 4.70% | 3.46% | 4.48% | 0.33% | 20.38% | 15.93% | 12.30% | 15 |