Supplementary Material

**Table S1** Description and source of abiotic covariates for occupancy models. All patches with area smaller than a hectare were removed in order to avoid error in remote sensing image interpretation when we calculated the distance to nearest built-up area, distance to nearest cropland and distance to nearest plantation land. All calculations and extractions of landscape covariates were performed in ArcGIS 10.6.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Occupancy parameter | Covariate | Range | Original resolution | Source |
| Occupancy | Tree density | 22344.55 –64427.45 | 1 \* 1 km | Extracted from the global map of tree density (Crowther et al., 2015) |
| Normalized Difference Vegetation Index (NDVI) | 0.24 – 0.51 | 30 \* 30 m | Calculated and Extracted from Digital image of Landsat 8 |
| Elevation | 823 – 1835 | 30 \* 30 m | Extracted from ASTER Global Digital Elevation Map |
| Slope | 0.0053 – 0.55 | 30 \* 30 m | Calculated and Extracted from ASTER Global Digital Elevation Map |
| Aspect | 0.015 – 0.99 | 30 \* 30 m | Calculated and Extracted from ASTER Global Digital Elevation Map |
| Topographic Position Index (TPI) | -7 – 8.56 | 30 \* 30 m | Calculated and Extracted from ASTER Global Digital Elevation Map |
| Distance to nearest road | 12.55 – 8951.57 | 30 \* 30 m | Calculated and Extracted from Road net data from Resource and Environment Science and Data Center (https://www.resdc.cn/) |
| Distance to nearest built-up area | 572.24 – 8646.29 | 30 \* 30 m | Calculated and Extracted from Land cover map provided by Animal Behavior and Changing Environment Research Group, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Science |
| Distance to nearest cropland | 0 – 5595.85 | 30 \* 30 m | Calculated and Extracted from Land cover map provided by Animal Behavior and Changing Environment Research Group, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Science |
| Distance to nearest plantation land | 0 – 8162.041 | 30 \* 30 m | Calculated and Extracted from Land cover map provided by Animal Behavior and Changing Environment Research Group, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Science |
| RAI of local people | 0 – 36.76 | - | Calculated from camera trap records |
| RAI of livestock | 0 – 448.8 | - | Calculated from camera trap records |
| Detection | Annual average temperature | 17.49 – 21.72 | 1 \* 1 km | Extracted from Temperature data of 1 km Monthly Precipitation and Temperatures Dataset for China from 1952 to 2019 (Gong et al., 2021) |

**Table S2**. The sum of squared errors, Freeman-Tukey chi-squared, and Pearson’s chi-squared tests were used to validate the model fit of single-species occupancy models. The p-values are greater than 0.05, which supports the good fit of models.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Species | Variables | Top model | Statistics | T0 | Mean  (t0 - t\_B) | SD  (t0 - t\_B) | P  (t\_B > t0) |
| WMD | Only covariates | ψ(Dem+Slope+Crop)  p(Tem) | SSE | 143 | 16.95 | 20 | 0.19 |
| Pearson’s Chi-square test | 3899 | 1004.6 | 1382.5 | 0.12 |
| Freeman-Tukey Chi-square test | 191 | 3.01 | 25.1 | 0.45 |
| Covariates+NRM | ψ(NRMrai+Dem)  p(Tem) | SSE | 148 | 22.06 | 20 | 0.14 |
| Pearson’s Chi-square test | 2569 | -410.5 | 1788.9 | 0.53 |
| Freeman-Tukey Chi-square test | 195 | 5.96 | 24.4 | 0.39 |
| Covariates+WB | ψ(Dem+Slope+Crop)  p(Tem) | SSE | 143 | 16.95 | 20 | 0.19 |
| Pearson’s Chi-square test | 3899 | 1004.6 | 1382.5 | 0.12 |
| Freeman-Tukey Chi-square test | 191 | 3.01 | 25.1 | 0.45 |
| Covariates+CS | ψ(Dem+Slope+Crop)  p(Tem) | SSE | 143 | 16.95 | 20 | 0.19 |
| Pearson’s Chi-square test | 3899 | 1004.6 | 1382.5 | 0.12 |
| Freeman-Tukey Chi-square test | 191 | 3.01 | 25.1 | 0.45 |
| Covariates+SB | ψ(Dem+Slope+Crop)  p(Tem) | SSE | 143 | 16.95 | 20 | 0.19 |
| Pearson’s Chi-square test | 3899 | 1004.6 | 1382.5 | 0.12 |
| Freeman-Tukey Chi-square test | 191 | 3.01 | 25.1 | 0.45 |
| CS | Only covariates | ψ(Tree+Slope+TPI+  Road+Build+Crop)  p(Tem) | SSE | 260 | 4.53 | 20.3 | 0.41 |
| Pearson’s Chi-square test | 2811 | -152.09 | 169.1 | 0.84 |
| Freeman-Tukey Chi-square test | 387 | -2.13 | 26.3 | 0.54 |
| SB | Only covariates | ψ(Tree+NDVI+Dem+  Slope+TPI+LPrai+LSrai)  p(Tem) | SSE | 168 | 8.77 | 17 | 0.29 |
| Pearson’s Chi-square test | 1986 | -463.02 | 1275.6 | 0.69 |
| Freeman-Tukey Chi-square test | 241 | 8.24 | 21.7 | 0.35 |

“Tem” is annual average temperature; “Tree” is tree density; “NDVI” is normalized difference vegetation index; “Dem” is elevation; “Road” is distance to nearest road; “Build” is distance to nearest built-up area; “Crop” is distance to nearest cropland; “LPrai” is RAI of local people; “LSrai” is RAI of livestock; “NRMrai” is RAI of northern red muntjac; “WBrai” is RAI of wild boar; “CSrai” is RAI of Chinese serow; “SBrai” RAI of sambar.

**Table S3.** The full model averaging results of single-species occupancy models.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Species | Variables | Parameter | Estimate | SE | Z | P |
| WMD | Only covariates | ψ(Tree) | 0.0037 | 0.052 | 0.072 | 0.94 |
| ψ(NDVI) | 0.0092 | 0.065 | 0.14 | 0.89 |
| ψ(Dem) | -1.26 | 0.36 | 3.52 | **< 0.001** |
| ψ(Slop) | -0.37 | 0.29 | 1.29 | 0.2 |
| ψ(Aspect) | 0.12 | 0.2 | 0.56 | 0.58 |
| ψ(TPI) | 0.023 | 0.11 | 0.21 | 0.84 |
| ψ(Road) | 0.0027 | 0.056 | 0.049 | 0.96 |
| ψ(Build) | 0.05 | 0.18 | 0.27 | 0.78 |
| ψ(Crop) | -0.48 | 0.34 | 1.39 | 0.16 |
| ψ(Plant) | -0.0029 | 0.085 | 0.034 | 0.97 |
| ψ(LPrai) | -0.09 | 0.25 | 0.36 | 0.72 |
| ψ(LSrai) | 0.0037 | 0.071 | 0.053 | 0.96 |
| p(Tem) | 0.69 | 0.11 | 6.14 | **< 0.001** |
| Covariates+NRM | ψ(NRMrai) | 0.4 | 0.22 | 1.84 | 0.066 |
| ψ(Tree) | 0.0037 | 0.059 | 0.062 | 0.95 |
| ψ(NDVI) | 0.048 | 0.14 | 0.33 | 0.74 |
| ψ(Dem) | -1.44 | 0.38 | 3.81 | **< 0.001** |
| ψ(Slop) | -0.16 | 0.25 | 0.63 | 0.53 |
| ψ(Aspect) | 0.059 | 0.16 | 0.38 | 0.7 |
| ψ(TPI) | 0.0043 | 0.055 | 0.078 | 0.94 |
| ψ(Road) | 0.0081 | 0.077 | 0.11 | 0.92 |
| ψ(Build) | 0.03 | 0.15 | 0.2 | 0.84 |
| ψ(Crop) | -0.28 | 0.34 | 0.82 | 0.41 |
| ψ(Plant) | -0.011 | 0.097 | 0.11 | 0.91 |
| ψ(LPrai) | -0.069 | 0.22 | 0.32 | 0.75 |
| ψ(LSrai) | 0.0088 | 0.093 | 0.094 | 0.93 |
| p(Tem) | 0.69 | 0.11 | 6.15 | **< 0.001** |
| Covariates+WB | ψ(WBrai) | 0.026 | 0.11 | 0.24 | 0.81 |
| ψ(Tree) | 0.0032 | 0.048 | 0.067 | 0.95 |
| ψ(NDVI) | 0.008 | 0.061 | 0.13 | 0.89 |
| ψ(Dem) | -1.26 | 0.36 | 3.52 | **< 0.001** |
| ψ(Slop) | -0.38 | 0.28 | 1.34 | 0.18 |
| ψ(Aspect) | 0.12 | 0.21 | 0.57 | 0.57 |
| ψ(TPI) | 0.02 | 0.1 | 0.19 | 0.85 |
| ψ(Road) | 0.0024 | 0.053 | 0.046 | 0.96 |
| ψ(Build) | 0.044 | 0.17 | 0.26 | 0.8 |
| ψ(Crop) | -0.49 | 0.34 | 1.44 | 0.15 |
| ψ(Plant) | -0.0025 | 0.079 | 0.032 | 0.97 |
| ψ(LPrai) | -0.12 | 0.27 | 0.39 | 0.69 |
| ψ(LSrai) | 0.0033 | 0.066 | 0.049 | 0.96 |
| p(Tem) | 0.69 | 0.11 | 6.14 | **< 0.001** |
| Covariates+CS | ψ(CSrai) | -0.5 | 0.68 | 0.73 | 0.46 |
| ψ(Tree) | 0.0036 | 0.048 | 0.074 | 0.94 |
| ψ(NDVI) | 0.013 | 0.077 | 0.17 | 0.87 |
| ψ(Dem) | -1.25 | 0.36 | 3.42 | **< 0.001** |
| ψ(Slop) | -0.24 | 0.29 | 0.85 | 0.4 |
| ψ(Aspect) | 0.12 | 0.21 | 0.57 | 0.57 |
| ψ(TPI) | 0.02 | 0.11 | 0.19 | 0.85 |
| ψ(Road) | 0.0041 | 0.056 | 0.073 | 0.94 |
| ψ(Build) | 0.067 | 0.21 | 0.32 | 0.75 |
| ψ(Crop) | -0.44 | 0.34 | 1.28 | 0.2 |
| ψ(Plant) | -0.0069 | 0.086 | 0.08 | 0.94 |
| ψ(LPrai) | -0.088 | 0.25 | 0.35 | 0.72 |
| ψ(LSrai) | 0.0016 | 0.046 | 0.034 | 0.97 |
| p(Tem) | 0.69 | 0.11 | 6.14 | **< 0.001** |
| Covariates+SB | ψ(SBrai) | 0.0046 | 0.057 | 0.08 | 0.94 |
| ψ(Tree) | 0.0036 | 0.051 | 0.071 | 0.94 |
| ψ(NDVI) | 0.0089 | 0.064 | 0.14 | 0.89 |
| ψ(Dem) | -1.26 | 0.36 | 3.52 | **< 0.001** |
| ψ(Slop) | -0.37 | 0.29 | 1.3 | 0.19 |
| ψ(Aspect) | 0.11 | 0.21 | 0.54 | 0.59 |
| ψ(TPI) | 0.022 | 0.11 | 0.2 | 0.84 |
| ψ(Road) | 0.0026 | 0.055 | 0.048 | 0.96 |
| ψ(Build) | 0.048 | 0.18 | 0.27 | 0.79 |
| ψ(Crop) | -0.48 | 0.34 | 1.4 | 0.16 |
| ψ(Plant) | -0.0028 | 0.083 | 0.034 | 0.97 |
| ψ(LPrai) | -0.086 | 0.25 | 0.35 | 0.73 |
| ψ(LSrai) | 0.0036 | 0.07 | 0.052 | 0.96 |
| p(Tem) | 0.69 | 0.11 | 6.14 | **< 0.001** |
| CS | Only covariates | ψ(Tree) | -0.13 | 0.2 | 0.65 | 0.52 |
| ψ(NDVI) | -0.0009 | 0.023 | 0.039 | 0.97 |
| ψ(Dem) | 0.21 | 0.26 | 0.79 | 0.43 |
| ψ(Slop) | 0.58 | 0.18 | 3.26 | **0.0011** |
| ψ(Aspect) | 0.023 | 0.085 | 0.28 | 0.78 |
| ψ(TPI) | 0.29 | 0.2 | 1.44 | 0.15 |
| ψ(Road) | -0.23 | 0.27 | 0.83 | 0.41 |
| ψ(Build) | 0.38 | 0.36 | 1.042 | 0.3 |
| ψ(Crop) | 0.2 | 0.21 | 0.94 | 0.35 |
| ψ(Plant) | -0.065 | 0.21 | 0.31 | 0.76 |
| ψ(LPrai) | 0.0047 | 0.05 | 0.096 | 0.92 |
| ψ(LSrai) | 0.00037 | 0.018 | 0.02 | 0.98 |
| p(Tem) | -0.24 | 0.081 | 2.92 | **0.0035** |
| SB | Only covariates | ψ(Tree) | 0.46 | 0.32 | 1.42 | 0.16 |
| ψ(NDVI) | 0.34 | 0.29 | 1.19 | 0.23 |
| ψ(Dem) | -1.22 | 0.41 | 2.96 | **0.0031** |
| ψ(Slop) | -0.66 | 0.27 | 2.47 | 0.013 |
| ψ(Aspect) | 0.12 | 0.23 | 0.52 | 0.61 |
| ψ(TPI) | -0.69 | 0.29 | 2.36 | 0.018 |
| ψ(Road) | 0.059 | 0.2 | 0.3 | 0.76 |
| ψ(Build) | -0.23 | 0.4 | 0.56 | 0.57 |
| ψ(Crop) | 0.1 | 0.23 | 0.44 | 0.66 |
| ψ(Plant) | 0.0002 | 0.074 | 0.003 | 1 |
| ψ(LPrai) | -0.68 | 0.47 | 1.43 | 0.15 |
| ψ(LSrai) | -22.19 | 14.42 | 1.54 | 0.12 |
| p(Tem) | 0.69 | 0.098 | 7.024 | **< 0.001** |

“Tem” is annual average temperature; “Tree” is tree density; “NDVI” is normalized difference vegetation index; “Dem” is elevation; “Road” is distance to nearest road; “Build” is distance to nearest built-up area; “Crop” is distance to nearest cropland; “Plant” is distance to nearest plantation land; “LPrai” is RAI of local people; “LSrai” is RAI of livestock; “NRMrai” is RAI of northern red muntjac; “WBrai” is RAI of wild boar; “CSrai” is RAI of Chinese serow; “SBrai” is RAI of sambar.

# References

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