Supplementary Material

Nesting habitat selection of Mediterranean raptors in managed pinewoods: searching for common patterns to derive conservation recommendations

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Table S1. The results of the principal component analysis run prior to the development of the models for Short-toed Eagle in order to investigate the multicollinearity among independent variables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** | **PC 6** |
| **HEIGHT** | -0.148367 | 0.068457 | -0.120801 | -0.035366 | 0.006418 | 0.740833 |
| **DBH** | 0.091619 | 0.261729 | -0.094437 | 0.174508 | -0.049425 | 0.758938 |
| **TRACK** | 0.026971 | 0.127997 | 0.159243 | 0.256559 | -0.110609 | 0.309120 |
| **DBH-3** | 0.172356 | -0.152331 | 0.062264 | 0.089533 | 0.124572 | 0.756531 |
| **DIST-3** | 0.005731 | -0.251018 | -0.030143 | 0.834620 | 0.110559 | 0.163757 |
| **%BUSH** | -0.099227 | 0.119814 | -0.302202 | -0.381845 | 0.073028 | 0.393621 |
| **%TREE** | -0.192267 | -0.124315 | 0.057292 | -0.801664 | 0.026137 | -0.073711 |
| **DBH<30** | -0.025619 | 0.000895 | -0.056803 | -0.230104 | -0.840294 | -0.345235 |
| **DBH>30** | 0.197917 | 0.122002 | 0.032561 | 0.272846 | -0.714155 | 0.419638 |
| **FORE>20\_500** | 0.712779 | -0.615079 | -0.094971 | 0.093717 | -0.078243 | -0.077017 |
| **FORE 5-20\_500** | -0.958319 | -0.005699 | -0.124934 | -0.104771 | 0.022517 | -0.041556 |
| **FORE<5\_500** | 0.064661 | 0.843875 | -0.251215 | -0.052343 | 0.038441 | 0.217174 |
| **CULT\_500** | 0.016510 | 0.107485 | 0.887078 | 0.032704 | 0.066966 | -0.099205 |
| **ECOT\_500** | 0.011833 | 0.688439 | 0.335539 | 0.257195 | -0.240525 | 0.169596 |
| **CLAS\_500** | -0.092251 | 0.719262 | 0.349193 | 0.012468 | -0.081241 | 0.013714 |
| **FORE>20\_1500** | 0.730663 | -0.585289 | -0.062259 | 0.188079 | -0.046319 | -0.007080 |
| **FORE 5-20\_1500** | -0.959319 | -0.056652 | -0.117934 | -0.031631 | 0.025552 | -0.059812 |
| **FORE<5\_1500** | -0.073219 | 0.847844 | -0.231411 | -0.211310 | 0.051875 | 0.077507 |
| **CULT\_1500** | 0.118113 | 0.094829 | 0.886000 | -0.061110 | -0.021052 | -0.017049 |
| **ECOT\_1500** | 0.008892 | 0.765007 | 0.357597 | 0.173484 | -0.262560 | 0.125571 |
| **CLAS\_1500** | -0.385013 | 0.716735 | 0.194723 | -0.107944 | 0.148986 | -0.225639 |

Table S2. The results of the principal component analysis run prior to the development of the models for Goshawk in order to investigate the multicollinearity among independent variables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** | **PC 6** |
| **HEIGHT** | 0.014316 | -0.115381 | -0.021578 | -0.235391 | 0.752972 | 0.088925 |
| **DBH** | 0.131059 | -0.003719 | 0.021738 | 0.148917 | 0.779302 | 0.005560 |
| **TRACK** | 0.136600 | 0.141462 | 0.155649 | -0.053503 | 0.237528 | 0.418408 |
| **DBH-3** | 0.103400 | -0.035603 | 0.061344 | -0.143786 | 0.290850 | -0.794789 |
| **DIST-3** | 0.265938 | 0.137577 | 0.224532 | 0.507159 | -0.079440 | -0.323058 |
| **%BUSH** | -0.142904 | -0.158538 | -0.171150 | 0.719090 | 0.021655 | 0.157810 |
| **%TREE** | -0.235855 | -0.188724 | -0.019960 | -0.845201 | -0.128311 | 0.096792 |
| **DBH<30** | 0.090343 | 0.099073 | -0.119036 | -0.127647 | 0.163970 | 0.781944 |
| **DBH>30** | 0.272871 | 0.226565 | -0.024246 | 0.235482 | 0.741930 | -0.014499 |
| **FORE>20\_500** | 0.823053 | -0.407251 | -0.168099 | 0.097953 | 0.162849 | 0.103786 |
| **FORE 5-20\_500** | -0.931021 | -0.023040 | -0.162646 | -0.070909 | -0.107422 | -0.045575 |
| **FORE<5\_500** | -0.046403 | 0.829439 | -0.223910 | -0.071291 | -0.107738 | -0.066394 |
| **CULT\_500** | -0.024814 | 0.069485 | 0.922475 | -0.006273 | -0.049009 | -0.069139 |
| **ECOT\_500** | 0.094986 | 0.660717 | 0.327593 | 0.077805 | 0.244435 | 0.032552 |
| **CLAS\_500** | -0.217188 | 0.710805 | 0.384390 | 0.116067 | 0.003404 | 0.064750 |
| **FORE>20\_1500** | 0.830495 | -0.435505 | -0.150601 | 0.063390 | 0.156985 | -0.011381 |
| **FORE 5-20\_1500** | -0.929979 | -0.112756 | -0.159136 | -0.046852 | -0.126850 | -0.021032 |
| **FORE<5\_1500** | -0.161996 | 0.850180 | -0.103553 | -0.008977 | -0.112190 | 0.043336 |
| **CULT\_1500** | 0.087162 | 0.081509 | 0.906054 | -0.056581 | 0.038257 | -0.006926 |
| **ECOT\_1500** | 0.076641 | 0.713526 | 0.239481 | 0.062138 | 0.296733 | 0.262886 |
| **CLAS\_1500** | -0.361427 | 0.483391 | 0.112076 | 0.074814 | 0.000321 | 0.233101 |

Table S3. The results of the principal component analysis run prior to the development of the models for Sparrowhawk in order to investigate the multicollinearity among independent variables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** | **PC 6** |
| **HEIGHT** | -0.071383 | 0.004426 | 0.805246 | -0.058818 | -0.200623 | 0.005270 |
| **DBH** | 0.117657 | -0.071973 | 0.684190 | -0.218177 | 0.333498 | 0.153026 |
| **TRACK** | 0.097416 | -0.328534 | 0.233833 | -0.058490 | 0.096281 | 0.144227 |
| **DBH-3** | 0.043504 | 0.028658 | 0.805972 | 0.060279 | 0.193362 | -0.103698 |
| **DIST-3** | 0.068389 | -0.022299 | 0.173355 | 0.188136 | 0.849318 | -0.150400 |
| **%BUSH** | -0.091239 | 0.184140 | 0.082438 | -0.075951 | 0.025113 | 0.642738 |
| **%TREE** | -0.164818 | 0.129922 | -0.029566 | 0.067470 | -0.906769 | -0.102996 |
| **DBH<30** | 0.136123 | -0.172570 | -0.372873 | 0.143777 | -0.308283 | 0.687120 |
| **DBH>30** | 0.251322 | -0.211943 | 0.469265 | -0.101509 | 0.314709 | 0.560857 |
| **FORE>20\_500** | 0.769323 | 0.116197 | -0.038403 | 0.536886 | 0.098015 | 0.045892 |
| **FORE 5-20\_500** | -0.935558 | 0.182271 | -0.047882 | 0.090260 | -0.104765 | -0.025200 |
| **FORE<5\_500** | 0.003629 | 0.131749 | 0.178949 | -0.890174 | -0.027748 | 0.069435 |
| **CULT\_500** | 0.003327 | -0.859202 | -0.125835 | 0.043842 | -0.006114 | -0.161542 |
| **ECOT\_500** | 0.056292 | -0.596755 | 0.243130 | -0.531856 | 0.121203 | 0.156389 |
| **CLAS\_500** | -0.020863 | -0.491400 | -0.003118 | -0.659498 | 0.056712 | -0.052977 |
| **FORE>20\_1500** | 0.787577 | 0.123055 | 0.021574 | 0.524113 | 0.102594 | -0.004832 |
| **FORE 5-20\_1500** | -0.945355 | 0.203754 | -0.059525 | 0.089340 | -0.062642 | -0.000773 |
| **FORE<5\_1500** | -0.101930 | 0.079761 | 0.062915 | -0.905318 | -0.099054 | 0.051907 |
| **CULT\_1500** | 0.102544 | -0.876582 | -0.053113 | 0.025769 | 0.027444 | -0.077254 |
| **ECOT\_1500** | 0.053345 | -0.608997 | 0.182527 | -0.564030 | 0.125738 | 0.222870 |
| **CLAS\_1500** | -0.336350 | -0.280521 | -0.259195 | -0.612190 | -0.027956 | -0.169780 |

Table S4. The results of the principal component analysis run prior to the development of the models for Common Buzzard in order to investigate the multicollinearity among independent variables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** | **PC 6** |
| **HEIGHT** | 0.000542 | 0.098065 | 0.115316 | 0.115122 | 0.742932 | 0.064296 |
| **DBH** | 0.096298 | -0.094960 | 0.026197 | 0.047380 | 0.597024 | -0.290735 |
| **TRACK** | -0.077865 | -0.026894 | -0.283447 | -0.132357 | 0.512237 | -0.013152 |
| **DBH-3** | -0.006893 | 0.005512 | 0.276348 | 0.729478 | 0.258989 | -0.054000 |
| **DIST-3** | -0.219128 | 0.023439 | 0.064134 | 0.332429 | 0.101690 | -0.738923 |
| **%BUSH** | 0.077076 | 0.054847 | 0.324854 | -0.558893 | 0.129236 | -0.086239 |
| **%TREE** | -0.122875 | 0.314554 | 0.143561 | 0.217494 | -0.133340 | 0.772959 |
| **DBH<30** | -0.027002 | -0.131097 | 0.042286 | -0.809184 | 0.097408 | 0.089244 |
| **DBH>30** | 0.231861 | -0.315729 | 0.214197 | -0.079481 | 0.553697 | -0.179558 |
| **FORE>20\_500** | -0.578526 | -0.725130 | 0.193773 | -0.071896 | 0.033082 | 0.005045 |
| **FORE 5-20\_500** | -0.025630 | 0.937119 | 0.169570 | 0.054584 | -0.043729 | 0.147251 |
| **FORE<5\_500** | 0.862114 | 0.004819 | 0.248090 | -0.027732 | 0.046634 | -0.132048 |
| **CULT\_500** | 0.051610 | -0.017174 | -0.893963 | 0.064349 | -0.055985 | -0.044433 |
| **ECOT\_500** | 0.604910 | -0.089106 | -0.422590 | -0.081200 | 0.448561 | 0.045173 |
| **CLAS\_500** | 0.700210 | 0.054787 | -0.358380 | 0.036249 | 0.191651 | 0.167194 |
| **FORE>20\_1500** | -0.570785 | -0.749136 | 0.116183 | 0.010818 | 0.083399 | -0.004753 |
| **FORE 5-20\_1500** | -0.056892 | 0.944875 | 0.150854 | 0.025913 | -0.049629 | 0.089016 |
| **FORE<5\_1500** | 0.859024 | 0.061825 | 0.259445 | -0.046976 | -0.085312 | -0.074231 |
| **CULT\_1500** | 0.034223 | -0.090071 | -0.878879 | -0.010655 | 0.020526 | -0.032429 |
| **ECOT\_1500** | 0.602428 | -0.114734 | -0.421756 | -0.160242 | 0.479843 | 0.133887 |
| **CLAS\_1500** | 0.611995 | 0.293053 | -0.295719 | 0.032776 | -0.013406 | 0.180351 |

Table S5. The results of the principal component analysis run prior to the development of the models for Booted Eagle in order to investigate the multicollinearity among independent variables.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** | **PC 6** |
| **HEIGHT** | -0.024798 | 0.075226 | 0.048668 | -0.765435 | -0.036858 | 0.185869 |
| **DBH** | 0.144574 | 0.347105 | -0.107549 | -0.573140 | 0.154150 | 0.032892 |
| **TRACK** | -0.108835 | -0.091709 | 0.218844 | 0.063525 | 0.014728 | 0.674626 |
| **DBH-3** | -0.167275 | -0.017651 | -0.003799 | -0.737403 | 0.056386 | -0.192306 |
| **DIST-3** | -0.072250 | 0.129981 | 0.225209 | -0.208271 | 0.639333 | -0.126042 |
| **%BUSH** | -0.059406 | -0.060735 | -0.359338 | 0.327503 | 0.436258 | 0.018479 |
| **%TREE** | -0.058093 | -0.163834 | 0.068260 | 0.028931 | -0.889678 | -0.144337 |
| **DBH<30** | 0.183386 | 0.196266 | -0.176620 | 0.307095 | -0.299937 | 0.582022 |
| **DBH>30** | 0.058618 | 0.214789 | -0.144696 | -0.427498 | 0.223766 | 0.629141 |
| **FORE>20\_500** | -0.582181 | 0.704104 | -0.215302 | -0.082971 | 0.144586 | 0.022741 |
| **FORE 5-20\_500** | 0.141218 | -0.925883 | -0.182029 | 0.072629 | -0.109454 | -0.081578 |
| **FORE<5\_500** | 0.837469 | 0.036504 | -0.059709 | 0.058799 | -0.155296 | 0.028545 |
| **CULT\_500** | 0.093679 | -0.007811 | 0.909718 | -0.004806 | 0.051017 | 0.058847 |
| **ECOT\_500** | 0.531366 | 0.078129 | 0.267777 | -0.116350 | 0.019063 | 0.594643 |
| **CLAS\_500** | 0.731410 | -0.167735 | 0.377366 | -0.000528 | 0.100561 | 0.175857 |
| **FORE>20\_1500** | -0.662745 | 0.645181 | -0.191567 | -0.129347 | 0.053762 | -0.033842 |
| **FORE 5-20\_1500** | 0.073259 | -0.924217 | -0.160378 | 0.138257 | -0.090045 | -0.068020 |
| **FORE<5\_1500** | 0.879488 | -0.135245 | -0.057432 | 0.008390 | 0.011436 | -0.006405 |
| **CULT\_1500** | 0.178211 | 0.150787 | 0.849457 | 0.068767 | -0.001504 | 0.198476 |
| **ECOT\_1500** | 0.535580 | -0.007980 | 0.248013 | -0.098714 | 0.060623 | 0.680188 |
| **CLAS\_1500** | 0.559894 | -0.348476 | 0.159248 | 0.039048 | 0.070201 | 0.172408 |

Table S6. Mean (± SE) values for the variables studied to quantify nest-site habitat selection, and the results for the unpaired t-tests (every species *vs*. random trees). The vegetation and land use coverages were transformed using the arcsine-square-root transformation. Key: CG, Short-toed Eagle; AG, Goshawk; AN, Sparrowhawk; BB, Common Buzzard; AP, Booted Eagle. The figure shows the *P*-values of t-tests after Bonferroni step-down correction (Holm 1979). Asterisks mark the significance levels as follows: \*, *P* < 0.05; \*\*, *P* < 0.01; \*\*\*, *P* < 0.001. See Table 2 for variable definitions.











































**Reference**

Holm, S. (1979) A simple sequentially rejective Bonferroni test procedure. *Scand. J. Stat.* 6: 65-70