

Article

Relevance of the cell neighborhood size in landscape metrics evaluation and FOSS implementations - list of papers for the literature review

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¹ Papers examined during the literature review

² Table 1 lists the papers citing each software used for the evaluation of landscape metrics. Note ³ that papers [1] and [62] cite both FRAGSTATS and other software.

Software	Number of citing papers	Citing papers
FRAGSTATS	70	[1–70]
QGIS (LecoS)	16	[71–86]
GRASS (r.li/r.le)	4	[87–90]
Other	3	[1,62,91]
New software	2	[92,93]

Table 1. Number and reference of papers in the analyzed set by cited software.

⁴ See Literature_review.pdf for a breakdown of the landscape metrics cited by each paper.

⁵ References

- ⁶ 1. Penghua, Q.; Songjun, X.; Genzong, X.; Benan, T.; Hua, B.; Longshi, Y. Analysis of the ecological ⁷ vulnerability of the western Hainan Island based on its landscape pattern and ecosystem sensitivity. *Acta Ecologica Sinica* **2007**, *27*, 1257–1264. doi:10.1016/S1872-2032(07)60026-2.

- 9 2. Li, E.; Endter-Wada, J.; Li, S. Dynamics of Utah's agricultural landscapes in response to urbanization: A
10 comparison between irrigated and non-irrigated agricultural lands. *Applied Geography* **2019**, *105*, 58–72.
11 doi:10.1016/j.apgeog.2019.02.006.
- 12 3. Bartesaghi Koc, C.; Osmond, P.; Peters, A. Evaluating the cooling effects of green infrastructure:
13 A systematic review of methods, indicators and data sources. *Solar Energy* **2018**, *166*, 486–508.
14 doi:10.1016/j.solener.2018.03.008.
- 15 4. Zang, Z.; Zou, X.; Zuo, P.; Song, Q.; Wang, C.; Wang, J. Impact of landscape patterns on ecological
16 vulnerability and ecosystem service values: An empirical analysis of Yancheng Nature Reserve in China.
17 *Ecological Indicators* **2017**, *72*, 142–152. doi:10.1016/j.ecolind.2016.08.019.
- 18 5. Dumas, E.; Jappiot, M.; Taton, T. Mediterranean urban-forest interface classification (MUFIC): A
19 quantitative method combining SPOT5 imagery and landscape ecology indices. *Landscape and Urban
20 Planning* **2008**, *84*, 183–190. doi:10.1016/j.landurbplan.2007.12.002.
- 21 6. Keane, R.E.; McKenzie, D.; Falk, D.A.; Smithwick, E.A.; Miller, C.; Kellogg, L.K.B. Representing climate,
22 disturbance, and vegetation interactions in landscape models. *Ecological Modelling* **2015**, *309–310*, 33–47.
23 doi:10.1016/j.ecolmodel.2015.04.009.
- 24 7. Roy, D.; Lees, M.H.; Palavalli, B.; Pfeffer, K.; Sloot, M.A. The emergence of slums: A contemporary view on
25 simulation models. *Environmental Modelling and Software* **2014**, *59*, 76–90. doi:10.1016/j.envsoft.2014.05.004.
- 26 8. Mallinis, G.; Emmanoloudis, D.; Giannakopoulos, V.; Maris, F.; Koutsias, N. Mapping and interpreting
27 historical land cover/land use changes in a Natura 2000 site using earth observational data: The case of
28 Nestos delta, Greece. *Applied Geography* **2011**, *31*, 312–320. doi:10.1016/j.apgeog.2010.07.002.
- 29 9. Baldwin, D.J.; Weaver, K.; Schnekenburger, F.; Perera, A.H. Sensitivity of landscape pattern indices to
30 input data characteristics on real landscapes: Implications for their use in natural disturbance emulation.
31 *Landscape Ecology* **2004**, *19*, 255–271. doi:10.1023/B:LAND.0000030442.96122.ef.
- 32 10. Fischer, J.; Lindenmayer, D.L. Beyond fragmentation: The continuum model for fauna
33 research and conservation in human-modified landscapes. *Oikos* **2006**, *112*, 473–480.
34 doi:10.1111/j.0030-1299.2006.14148.x.
- 35 11. Buyantuyev, A.; Wu, J. Effects of thematic resolution on landscape pattern analysis. *Landscape Ecology* **2007**,
36 *22*, 7–13. doi:10.1007/s10980-006-9010-5.
- 37 12. Gao, J.; Li, S. Detecting spatially non-stationary and scale-dependent relationships between urban
38 landscape fragmentation and related factors using Geographically Weighted Regression. *Applied Geography*
39 **2011**, *31*, 292–302. doi:10.1016/j.apgeog.2010.06.003.
- 40 13. Wu, J. Effects of changing scale on landscape pattern analysis: Scaling relations. *Landscape Ecology* **2004**,
41 *19*, 125–138. doi:10.1023/B:LAND.0000021711.40074.ae.
- 42 14. Zhang, S.; Yang, H.; Singh, L. The behavior of landscape metrics commonly used in the study of habitat
43 fragmentation. *Landscape Ecology* **1998**, *1225*, 41–42, [arXiv:arXiv:astro-ph/0005074v1]. doi:10.1023/A.
- 44 15. Šimová, P.; Gdulová, K. Landscape indices behavior: A review of scale effects. *Applied Geography* **2012**,
45 *34*, 385–394. doi:10.1016/j.apgeog.2012.01.003.
- 46 16. Evelin, U.; Marc, A.; Juri, R.; Riho, M.; M. Landscape Metrics and Indices: An Overview of Their Use in
47 Landscape Research. *Living Reviews in Landscape Research* **2009**, *3*, 1–28.
- 48 17. Moser, D.; Zechmeister, H.G.; Plutzar, C.; Sauberer, N.; Wrbka, T.; Grabherr, G. Landscape patch shape
49 complexity as an effective measure for plant species richness in rural landscapes. *Landscape Ecology* **2002**,
50 *17*, 657–669. doi:10.1023/A:1021513729205.
- 51 18. Kelly, M.; Tuxen, K.A.; Stralberg, D. Mapping changes to vegetation pattern in a restoring wetland: Finding
52 pattern metrics that are consistent across spatial scale and time. *Ecological Indicators* **2011**, *11*, 263–273.
53 doi:10.1016/j.ecolind.2010.05.003.
- 54 19. Buyantuyev, A.; Wu, J.; Gries, C. Multiscale analysis of the urbanization pattern of the Phoenix metropolitan
55 landscape of USA: Time, space and thematic resolution. *Landscape and Urban Planning* **2010**, *94*, 206–217.
56 doi:10.1016/j.landurbplan.2009.10.005.
- 57 20. Cushman, S.; States, U.; Service, F.; Mount, R. Behavior of class-level landscape metrics across gradients of
58 class aggregation and area . *Landscape Ecology* **2015**, pp. 435–455. doi:10.1023/B.
- 59 21. Lee, S.W.; Lee, M.B.; Lee, Y.G.; Won, M.S.; Kim, J.J.; kwon Hong, S. Relationship between landscape
60 structure and burn severity at the landscape and class levels in Samchuck, South Korea. *Forest Ecology and
Management* **2009**, *258*, 1594–1604. doi:10.1016/j.foreco.2009.07.017.

- 62 22. Pôcas, I.; Cunha, M.; Pereira, L.S. Remote sensing based indicators of changes in a mountain rural
63 landscape of Northeast Portugal. *Applied Geography* **2011**, *31*, 871–880. doi:10.1016/j.apgeog.2011.01.014.
- 64 23. Uuemaa, E.; Roosaare, J.; Mander, Ü. Scale dependence of landscape metrics and their indicator value for nutrient and organic matter losses from catchments. *Ecological Indicators* **2005**, *5*, 350–369.
65 doi:10.1016/j.ecolind.2005.03.009.
- 66 24. Saura, S.; Castro, S. Scaling functions for landscape pattern metrics derived from remotely sensed data: Are their subpixel estimates really accurate? *ISPRS Journal of Photogrammetry and Remote Sensing* **2007**,
67 *62*, 201–216. doi:10.1016/j.isprsjprs.2007.03.004.
- 70 25. Shen, W.; Jenerette, G.D.; Wu, J.; Gardner, R.H. Evaluating empirical scaling relations of pattern metrics with simulated landscapes. *Ecography* **2004**, *27*, 459–469. doi:10.1111/j.0906-7590.2004.03799.x.
- 72 26. Bailey, D.; Herzog, F.; Augenstein, I.; Aviron, S.; Billeter, R.; Szerencsits, E.; Baudry, J. Thematic resolution matters: Indicators of landscape pattern for European agro-ecosystems. *Ecological Indicators* **2007**, *7*, 692–709.
74 doi:10.1016/j.ecolind.2006.08.001.
- 75 27. Tanner, E.P.; Fuhlendorf, S.D. Impact of an agri-environmental scheme on landscape patterns. *Ecological Indicators* **2018**, *85*, 956–965. doi:10.1016/j.ecolind.2017.11.043.
- 77 28. Cushman, S.A.; McGarigal, K.; Neel, M.C. Parsimony in landscape metrics: Strength, universality, and consistency. *Ecological Indicators* **2008**, *8*, 691–703. doi:10.1016/j.ecolind.2007.12.002.
- 79 29. Kim, H.W.; Park, Y. Urban green infrastructure and local flooding: The impact of landscape patterns on peak runoff in four Texas MSAs. *Applied Geography* **2016**, *77*, 72–81. doi:10.1016/j.apgeog.2016.10.008.
- 81 30. Grilli, M.P. An area-wide model approach for the management of a disease vector planthopper in an extensive agricultural system. *Ecological Modelling* **2008**, *213*, 308–318. doi:10.1016/j.ecolmodel.2007.12.004.
- 83 31. Luck, M.; Wu, J. A gradient analysis of urban landscape pattern: A case study from the Phoenix metropolitan region, Arizona, USA. *Landscape Ecology* **2002**, *17*, 327–339. doi:10.1023/A:1020512723753.
- 85 32. Agner, H.E.H.W. Spatial analysis of landscapes: concepts and statistics. *Ecology* **2005**, *86*, 1975–1987.
- 86 33. Yeh, C.T.; Huang, S.L. Investigating spatiotemporal patterns of landscape diversity in response to urbanization. *Landscape and Urban Planning* **2009**, *93*, 151–162. doi:10.1016/j.landurbplan.2009.07.002.
- 88 34. Mears, M.; Brindley, P.; Jorgensen, A.; Ersoy, E.; Maheswaran, R. Greenspace spatial characteristics and human health in an urban environment: An epidemiological study using landscape metrics in Sheffield, UK. *Ecological Indicators* **2019**, *106*, 105464. doi:10.1016/j.ecolind.2019.105464.
- 91 35. Zhang, W.; He, Q.; Wang, H.; Cao, K.; He, S. Factor analysis for aerosol optical depth and its prediction from the perspective of land-use change. *Ecological Indicators* **2018**, *93*, 458–469. doi:10.1016/j.ecolind.2018.05.026.
- 93 36. Sowińska-Świerkosz, B.N.; Soszyński, D. Landscape structure versus the effectiveness of nature conservation: Roztocze region case study (Poland). *Ecological Indicators* **2014**, *43*, 143–153.
95 doi:10.1016/j.ecolind.2014.02.018.
- 96 37. Cheung, A.K.L.; Brierley, G.; O'Sullivan, D. Landscape structure and dynamics on the Qinghai-Tibetan Plateau. *Ecological Modelling* **2016**, *339*, 7–22. doi:10.1016/j.ecolmodel.2016.07.015.
- 98 38. Zhou Gong, J.; sui Liu, Y.; cheng Xia, B.; wei Zhao, G. Urban ecological security assessment and forecasting, based on a cellular automata model: A case study of Guangzhou, China. *Ecological Modelling* **2009**,
100 *220*, 3612–3620. doi:10.1016/j.ecolmodel.2009.10.018.
- 101 39. Abadie, A.; Gobert, S.; Bonacorsi, M.; Lejeune, P.; Pergent, G.; Pergent-Martini, C. Marine space ecology and seagrasses. Does patch type matter in *Posidonia oceanica* seascapes? *Ecological Indicators* **2015**, *57*, 435–446.
102 doi:10.1016/j.ecolind.2015.05.020.
- 104 40. Peringer, A.; Buttler, A.; Gillet, F.; Pătru-Stupariu, I.; Schulze, K.A.; Stupariu, M.S.; Rosenthal, G. Disturbance-grazer-vegetation interactions maintain habitat diversity in mountain pasture-woodlands. *Ecological Modelling* **2017**, *359*, 301–310. doi:10.1016/j.ecolmodel.2017.06.012.
- 107 41. Lausch, A.; Herzog, F. Applicability of landscape metrics for the monitoring of landscape change: Issues of scale, resolution and interpretability. *Ecological Indicators* **2002**, *2*, 3–15. doi:10.1016/S1470-160X(02)00053-5.
- 109 42. Pierik, M.E.; Dell'acqua, M.; Confalonieri, R.; Bocchi, S.; Gomarasca, S. Designing ecological corridors in a fragmented landscape: A fuzzy approach to circuit connectivity analysis. *Ecological Indicators* **2016**,
110 *67*, 807–820. doi:10.1016/j.ecolind.2016.03.032.
- 112 43. Simonson, W.D.; Allen, H.D.; Coomes, D.A. Remotely sensed indicators of forest conservation status: Case study from a Natura 2000 site in southern Portugal. *Ecological Indicators* **2013**, *24*, 636–647.
113 doi:10.1016/j.ecolind.2012.08.024.
- 114

- 115 44. Tian, G.; Ouyang, Y.; Quan, Q.; Wu, J. Simulating spatiotemporal dynamics of urbanization with
116 multi-agent systems-A case study of the Phoenix metropolitan region, USA. *Ecological Modelling* **2011**,
117 222, 1129–1138. doi:10.1016/j.ecolmodel.2010.12.018.
- 118 45. Liu, X.; Li, X.; Shi, X.; Wu, S.; Liu, T. Simulating complex urban development using kernel-based non-linear
119 cellular automata. *Ecological Modelling* **2008**, 211, 169–181. doi:10.1016/j.ecolmodel.2007.08.024.
- 120 46. Echeverria, C.; Coomes, D.A.; Hall, M.; Newton, A.C. Spatially explicit models to analyze forest loss
121 and fragmentation between 1976 and 2020 in southern Chile. *Ecological Modelling* **2008**, 212, 439–449.
122 doi:10.1016/j.ecolmodel.2007.10.045.
- 123 47. Schindler, S.; Von Wehrden, H.; Poirazidis, K.; Wrbka, T.; Kati, V. Multiscale performance of landscape
124 metrics as indicators of species richness of plants, insects and vertebrates. *Ecological Indicators* **2013**,
125 31, 41–48. doi:10.1016/j.ecolind.2012.04.012.
- 126 48. Walz, U. Indicators to monitor the structural diversity of landscapes. *Ecological Modelling* **2015**, 295, 88–106.
127 doi:10.1016/j.ecolmodel.2014.07.011.
- 128 49. Ruxton, G.D.; Saravia, L.A. The need for biological realism in the updating of cellular automata models.
129 *Ecological Modelling* **1998**, 107, 105–112. doi:10.1016/S0304-3800(97)00179-8.
- 130 50. Ramesh, T.; Kalle, R.; Downs, C.T. Sex-specific indicators of landscape use by servals: Consequences of
131 living in fragmented landscapes. *Ecological Indicators* **2015**, 52, 8–15. doi:10.1016/j.ecolind.2014.11.021.
- 132 51. Lustig, A.; Stouffer, D.B.; Roigé, M.; Worner, S.P. Towards more predictable and consistent landscape
133 metrics across spatial scales. *Ecological Indicators* **2015**, 57, 11–21. doi:10.1016/j.ecolind.2015.03.042.
- 134 52. Chan, K.M.; Vu, T.T. A landscape ecological perspective of the impacts of urbanization on urban green
135 spaces in the Klang Valley. *Applied Geography* **2017**, 85, 89–100. doi:10.1016/j.apgeog.2017.06.002.
- 136 53. Ray, N.; Burgman, M.A. Subjective uncertainties in habitat suitability maps. *Ecological Modelling* **2006**,
137 195, 172–186. doi:10.1016/j.ecolmodel.2005.11.039.
- 138 54. Su, S.; Jiang, Z.; Zhang, Q.; Zhang, Y. Transformation of agricultural landscapes under rapid
139 urbanization: A threat to sustainability in Hang-Jia-Hu region, China. *Applied Geography* **2011**, 31, 439–449.
140 doi:10.1016/j.apgeog.2010.10.008.
- 141 55. Jawarneh, R.N.; Julian, J.P. Development of an accurate fine-resolution land cover timeline: Little Rock,
142 Arkansas, USA (1857–2006). *Applied Geography* **2012**, 35, 104–113. doi:10.1016/j.apgeog.2012.06.006.
- 143 56. Zhang, Z.; Su, S.; Xiao, R.; Jiang, D.; Wu, J. Identifying determinants of urban growth from a multi-scale
144 perspective: A case study of the urban agglomeration around Hangzhou Bay, China. *Applied Geography*
145 **2013**, 45, 193–202. doi:10.1016/j.apgeog.2013.09.013.
- 146 57. Soares, B.S.; Cerqueira, G.C.; Pennachin, C.L. DINAMICA - a stochastic cellular automata model designed
147 to simulate the landscape dynamics in an Amazonian colonization frontier. *Ecological Modelling* **2002**,
148 154, 217–235.
- 149 58. Larondelle, N.; Haase, D. Valuing post-mining landscapes using an ecosystem services approach - An
150 example from Germany. *Ecological Indicators* **2012**, 18, 567–574. doi:10.1016/j.ecolind.2012.01.008.
- 151 59. Simpkins, C.E.; Dennis, T.E.; Etherington, T.R.; Perry, G.L. Assessing the performance of common
152 landscape connectivity metrics using a virtual ecologist approach. *Ecological Modelling* **2018**, 367, 13–23.
153 doi:10.1016/j.ecolmodel.2017.11.001.
- 154 60. Zhou, J.; Xiao, N.; Liu, L.; Li, Q. A weighted aggregation and closeness approach to measuring
155 the compactness of landscape with multiple parts'. *Ecological Indicators* **2016**, 64, 158–170.
156 doi:10.1016/j.ecolind.2015.12.022.
- 157 61. Frazier, A.E.; Bagchi-Sen, S. Developing open space networks in shrinking cities. *Applied Geography* **2015**,
158 59, 1–9. doi:10.1016/j.apgeog.2015.02.010.
- 159 62. Reza, M.I.H.; Abdullah, S.A. Regional Index of Ecological Integrity: A need for sustainable management
160 of natural resources. *Ecological Indicators* **2011**, 11, 220–229. doi:10.1016/j.ecolind.2010.08.010.
- 161 63. Fernandes, M.R.; Aguiar, F.C.; Ferreira, M.T. Assessing riparian vegetation structure and the influence of
162 land use using landscape metrics and geostatistical tools. *Landscape and Urban Planning* **2011**, 99, 166–177.
163 doi:10.1016/j.landurbplan.2010.11.001.
- 164 64. Bruton, M.J.; Maron, M.; Levin, N.; McAlpine, C.A. Testing the relevance of binary, mosaic and continuous
165 landscape conceptualisations to reptiles in regenerating dryland landscapes. *Landscape Ecology* **2015**,
166 30, 715–728. doi:10.1007/s10980-015-0157-9.

- 167 65. Wheatley, M. Domains of scale in forest-landscape metrics: Implications for species-habitat modeling. *Acta
168 Oecologica* **2010**, *36*, 259–267. doi:10.1016/j.actao.2009.12.003.
- 169 66. Haddad, N.M.; Brudvig, L.A.; Clobert, J.; Davies, K.F.; Gonzalez, A.; Holt, R.D.; Lovejoy, T.E.; Sexton, J.O.;
170 Austin, M.P.; Collins, C.D.; Cook, W.M.; Damschen, E.I.; Ewers, R.M.; Foster, B.L.; Jenkins, C.N.; King,
171 A.J.; Laurance, W.F.; Levey, D.J.; Margules, C.R.; Melbourne, B.A.; Nicholls, A.O.; Orrock, J.L.; Song, D.X.;
172 Townshend, J.R. Habitat fragmentation and its lasting impact on Earth's ecosystems. *Science Advances*
173 **2015**, *1*, 1–10. doi:10.1126/sciadv.1500052.
- 174 67. Rutledge, D. Landscape indices as measures of the effects of fragmentation : can pattern reflect process ?
175 *DOC Science Internal Series 98* **2003**, pp. 1 – 27, [arXiv:1011.1669v3]. doi:10.1007/s10980-011-9650-y.
- 176 68. Li, H.; Wu, J. Use and misuse of landscape indices. *Landscape Ecology* **2004**, pp. 389–399.
- 177 69. Dunn, A.G.; Majer, J.D. In response to the continuum model for fauna research: A hierarchical, patch-based
178 model of spatial landscape patterns. *Oikos* **2007**, *116*, 1413–1418. doi:10.1111/j.0030-1299.2007.15931.x.
- 179 70. Fortin, M.J.; Boots, B.; Csillag, F.; Remmel, T.K. On the role of spatial stochastic models in understanding.
180 *Oikos* **2003**, *102*, 203–212.
- 181 71. László, Z.; Dénes, A.L.; Király, L.; Tóthmérész, B. Biased parasitoid sex ratios: Wolbachia, functional traits,
182 local and landscape effects. *Basic and Applied Ecology* **2018**, *31*, 61–71. doi:10.1016/j.baae.2018.05.014.
- 183 72. Bueno, A.S.; Peres, C.A. Patch-scale biodiversity retention in fragmented landscapes: Reconciling the
184 habitat amount hypothesis with the island biogeography theory. *Journal of Biogeography* **2019**, *46*, 621–632.
185 doi:10.1111/jbi.13499.
- 186 73. Cordeiro, E.M.; Macrini, C.M.; Sujii, P.S.; Schwarcz, K.D.; Pinheiro, J.B.; Rodrigues, R.R.; Brancalion, P.H.;
187 Zucchi, M.I. Diversity, genetic structure, and population genomics of the tropical tree *Centrolobium
188 tomentosum* in remnant and restored Atlantic forests. *Conservation Genetics* **2019**, *20*, 1073–1085.
189 doi:10.1007/s10592-019-01195-z.
- 190 74. Hernández-Martínez, J.; Morales-Malacara, J.B.; Alvarez-Anorve, M.Y.; Amador-Hernández, S.; Oyama, K.;
191 Avila-Cabadiña, L.D. Drivers potentially influencing host-bat fly interactions in anthropogenic neotropical
192 landscapes at different spatial scales. *Parasitology* **2019**, *146*, 74–88. doi:10.1017/S0031182018000732.
- 193 75. Dennis, M.; Scaletta, K.L.; James, P. Evaluating urban environmental and ecological landscape
194 characteristics as a function of land-sharing-sparing, urbanity and scale. *Plos One* **2019**, *14*, e0215796.
195 doi:10.1371/journal.pone.0215796.
- 196 76. Kurta, A.; Auteri, G.G.; Hofmann, J.E.; Mengelkoch, J.M.; White, J.P.; Whitaker, J.O.; Cooley, T.; Melotti, J.
197 Influence of a large lake on the winter range of a small mammal: Lake Michigan and the silver-haired bat
198 (*Lasionycteris noctivagans*). *Diversity* **2018**, *10*. doi:10.3390/d10020024.
- 199 77. Kosicki, J.Z. Are Landscape Configuration Metrics Worth Including When Predicting Specialist and
200 Generalist Bird Species Density? A Case of the Generalised Additive Model Approach. *Environmental
201 Modeling and Assessment* **2018**, *23*, 193–202. doi:10.1007/s10666-017-9575-1.
- 202 78. Lamamy, C.; Bombieri, G.; Zarzo-Arias, A.; González-Bernardo, E.; Penteriani, V. Can landscape
203 characteristics help explain the different trends of Cantabrian brown bear subpopulations? *Mammal
204 Research* **2019**, pp. 559–567. doi:10.1007/s13364-019-00440-7.
- 205 79. Ramachandran, R.M.; Roy, P.S.; Chakravarthi, V.; Sanjay, J.; Joshi, P.K. Long-term land use and land
206 cover changes (1920–2015) in Eastern Ghats, India: Pattern of dynamics and challenges in plant species
207 conservation. *Ecological Indicators* **2018**, *85*, 21–36. doi:10.1016/j.ecolind.2017.10.012.
- 208 80. Monti, F.; Nelli, L.; Catoni, C.; Dell'Olmo, G. Nest box selection and reproduction of European Rollers in
209 Central Italy: a 7-year study. *Avian Research* **2019**, *10*, 1–12. doi:10.1186/s40657-019-0150-0.
- 210 81. Morales-Díaz, S.P.; Alvarez-Añorve, M.Y.; Zamora-Espinoza, M.E.; Dirzo, R.; Oyama, K.; Avila-Cabadiña,
211 L.D. Rodent community responses to vegetation and landscape changes in early successional stages of
212 tropical dry forest. *Forest Ecology and Management* **2019**, *433*, 633–644. doi:10.1016/j.foreco.2018.11.037.
- 213 82. Lastrucci, L.; Cerri, M.; Coppi, A.; Dell'Olmo, L.; Ferranti, F.; Ferri, V.; Filippioni, F.; Foggi, B.; Galardini,
214 R.; Reale, L.; Venanzoni, R.; Viciani, D.; Gigante, D. Spatial landscape patterns and trends of declining
215 reed-beds in peninsular Italy. *Plant Biosystems* **2019**, *153*, 427–435. doi:10.1080/11263504.2018.1498401.
- 216 83. Statuto, D.; Cillis, G.; Picuno, P. GIS-based Analysis of Temporal Evolution of Rural Landscape: A Case
217 Study in Southern Italy. *Natural Resources Research* **2019**, *28*, 61–75. doi:10.1007/s11053-018-9402-7.

- 218 84. Colson, F.; Bogaert, J.; Filho, A.C.; Nelson, B.; Pinagé, E.R.; Ceulemans, R. The influence of forest definition
219 on landscape fragmentation assessment in Rondônia, Brazil. *Ecological Indicators* **2009**, *9*, 1163–1168.
220 doi:10.1016/j.ecolind.2009.02.001.
- 221 85. Aguilar, R.; Calviño, A.; Ashworth, L.; Aguirre-Acosta, N.; Carbone, L.M.; Albrieu-Llinás, G.; Nolasco, M.;
222 Ghilardi, A.; Cagnolo, L. Unprecedented plant species loss after a decade in fragmented subtropical chaco
223 serrano forests. *PLoS ONE* **2018**, *13*, 1–15. doi:10.1371/journal.pone.0206738.
- 224 86. Albrieu-Llinás, G.; Espinosa, M.O.; Quaglia, A.; Abril, M.; Scavuzzo, C.M. Urban environmental clustering
225 to assess the spatial dynamics of *Aedes aegypti* breeding sites. *Geospatial Health* **2018**, *13*, 135–142.
226 doi:10.4081/gh.2018.654.
- 227 87. Colson, F.; Bogaert, J.; Ceulemans, R. Fragmentation in the Legal Amazon, Brazil: Can
228 landscape metrics indicate agricultural policy differences? *Ecological Indicators* **2011**, *11*, 1467–1471.
229 doi:10.1016/j.ecolind.2010.12.020.
- 230 88. Gaucherel, C.; Burel, F.; Baudry, J. Multiscale and surface pattern analysis of the effect of landscape pattern
231 on carabid beetles distribution. *Ecological Indicators* **2007**, *7*, 598–609. doi:10.1016/j.ecolind.2006.07.002.
- 232 89. Llauss, A.; Nogué, J. Indicators of landscape fragmentation: The case for combining ecological indices and
233 the perceptive approach. *Ecological Indicators* **2012**, *15*, 85–91. doi:10.1016/j.ecolind.2011.08.016.
- 234 90. Tattoni, C.; Ciolfi, M.; Ferretti, F. The fate of priority areas for conservation in protected areas: A fine-scale
235 markov chain approach. *Environmental Management* **2011**, *47*, 263–278. doi:10.1007/s00267-010-9601-4.
- 236 91. Gustafson, E.J.; Parker, G.R. Relationships between landcover proportion and indices of landscape spatial
237 pattern. *Landscape Ecology* **1992**, *7*, 101–110. doi:10.1007/BF02418941.
- 238 92. Zaragozá, B.; Belda, A.; Linares, J.; Martínez-Pérez, J.E.; Navarro, J.T.; Esparza, J. A free and open source
239 programming library for landscape metrics calculations. *Environmental Modelling and Software* **2012**,
240 *31*, 131–140. doi:10.1016/j.envsoft.2011.10.009.
- 241 93. Yu, M.; Huang, Y.; Cheng, X.; Tian, J. An ArcMap plug-in for calculating landscape metrics of vector data.
242 *Ecological Informatics* **2019**, *50*, 207–219. doi:10.1016/j.ecoinf.2019.02.004.

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