Supplementary Material

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Appendix S1. Information on sampling design

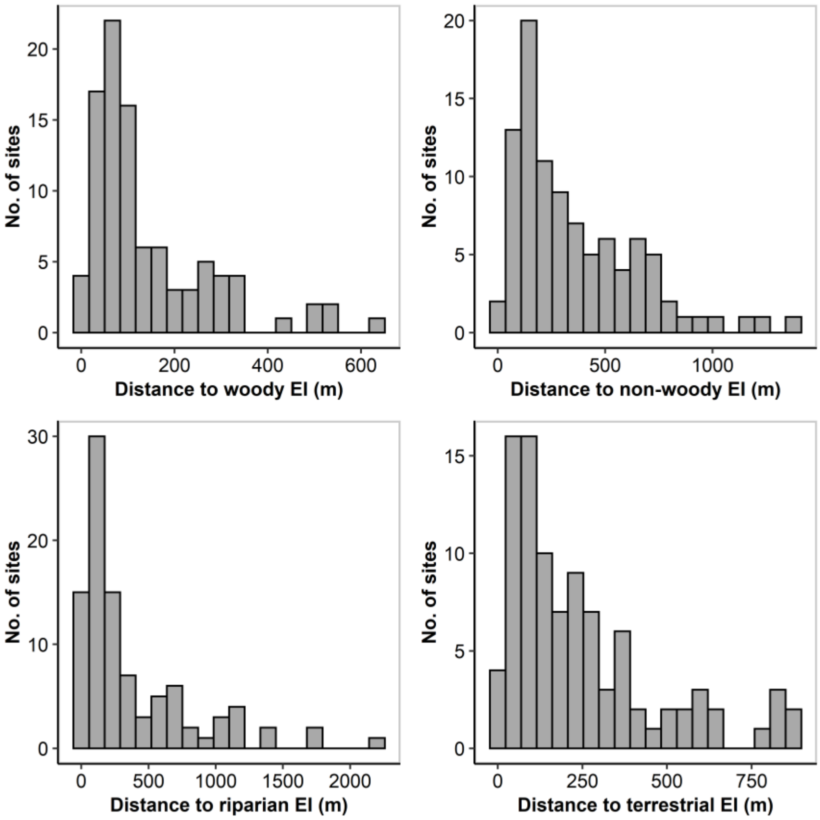

Figure S1-1. Distance gradient of sampling sites to the different types of ecological infrastructure (EI).

Appendix S2. Details on the calculation of the Biodiversity Potential Index

Table S2-1. Details on the scoring rank criteria and class values for each metric of the index used to characterise EI patches concerning their biodiversity potential.

	Score categories		
	1	**3**	**5**
1. Vegetation structure			
1.1. Native tree species	0 species	1 - 3 species	> 3 species
1.2. Invasive species	≥ 30%	> 0% to < 30%	0%
1.3. Vertical strata	1	2 - 3	4
2. Vegetation habitats			
2.1. Microhabitats at trees (>3m)	0	1 - 2	≥ 3
2.2. Microhabitats at trees (<3m)	0	1 - 2	≥ 3
2.3. Standing dead trees	0	1 - 2	≥ 3
2.4. Dead trunks	0	1 - 2	≥ 3
2.5. Large living trees	0	1 - 4	≥ 5
2.6. Leaf litter	0	< 50%	≥ 50%
3. Associated habitats			
3.1. Shade	< 25 %	≥ 75	≥ 25 to < 75
3.2. Aquatic habitats	0	1	≥ 2
3.3. Rocky habitats (natural)	0	1	≥ 2
3.4. Rocky habitats (artificial)	≥ 2	1	0
4. Vegetation management			
4.1. Tree clearing	High	Medium	Low
4.2. Understorey clearing	High	Medium	Low
4.3. Tree pruning	High	Medium	Low

Appendix S3. Weather conditions and moon illumination during bat surveys

Data on climatic conditions during the sampling period were obtained via the Portuguese National Information System on Hydric Resources (https://snirh.apambiente.pt). Using the monitoring stations in the study areas or their vicinity, we confirmed that surveys were conducted during (i) warm nights: minimum of the mean hourly temperature per night was 11.3 ºC and 13.6 ºC for Tagus and Sorraia study areas, respectively, and (ii) dry nights, except for one sampling night when a total of 1.4 mm of rain were recorded in the Sorraia study area (Figure S3-1). Data on wind velocity indicated that all sampling occurred in mild wind nights (<15 km/h; Figure S3-1). Data on moon illumination were retrieved for each sampling night at midnight from https://www.mooncalc.org/. Moon illumination varied from 22.7 to 98.8% (Figure S3-1). Preliminary analysis showed that moon illumination was not associated with bat activity (GLMM; SRE: Est = 0.03, SE = 0.15, lower 95% CI = -0.27, upper 95% CI = 0.32; MRE: Est = 0.13, SE = 0.12, lower 95% CI = -0.11, upper 95% CI = 0.36; LRE: Est = 0.22, SE = 0.17, lower 95% CI = -0.11, upper 95% CI = 0.54).

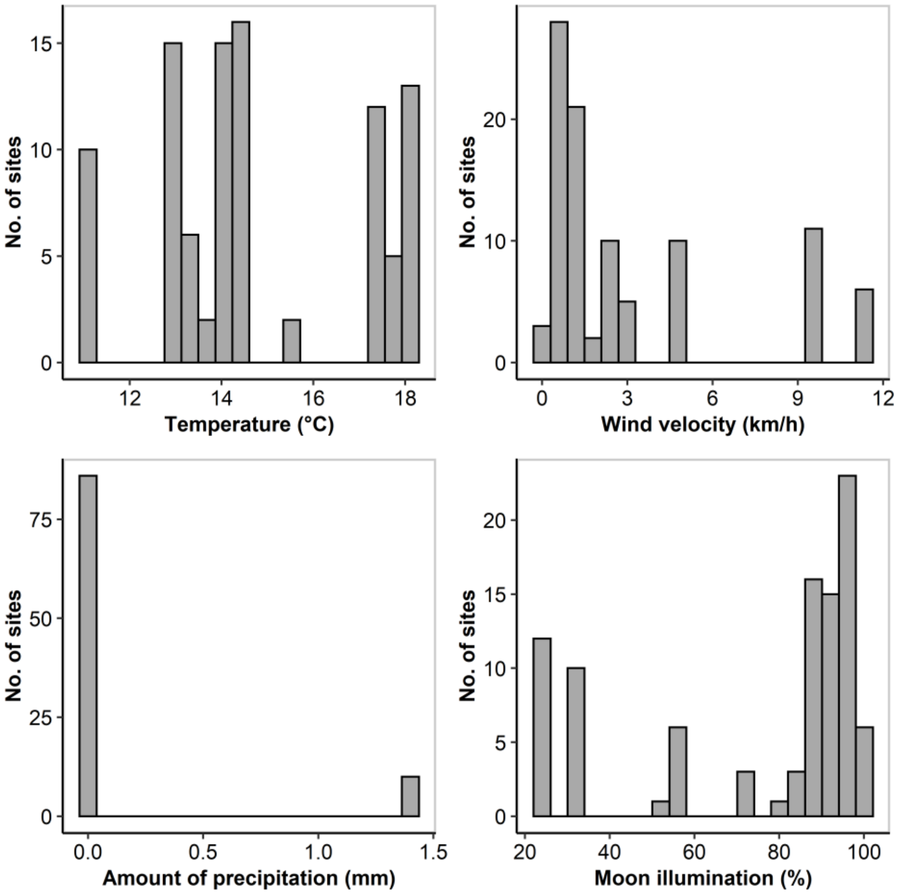

Figure S3-1. Histograms of (i) minimum of mean hourly temperature at night, (ii) maximum of mean hourly wind velocity at night, (iii) amount of precipitation at night, and (iv) percentage of moon illumination.

Appendix S4. Details on bat echolocation call identification

We used the software Kaleidoscope Pro (v.5.1.8, Wildlife Acoustics, Massachusetts, USA) to assist in the identification of bats at the guild level. In the first step of the procedure, we aimed to retain the files with bat passes, defined as a continuous run of pulses with a time gap smaller than 1s (Fenton *et al.*, 1973). Thus, we defined the Kaleidoscope signal detection parameters to encompass every species acoustic specificity: 8 kHz and 120 kHz as the minimum and maximum frequency range, 1 to 100 ms of pulse duration and a minimum of two pulses separated by a maximum of one second. In the second step, we aimed to run Kaleidoscope targeting the LRE and MRE guilds and an output identification with a low percentage of misclassifications. Both signal detection parameters and the classifier option were refined towards the acoustic characteristics of each guild: frequency range 8 to 31 kHz (LRE) and 35 to 65 kHz (MRE); pulse duration of 3 to 25 ms (LRE) and 3 to 10 ms (MRE); minimum number of pulses 3 with a 0.5-second (LRE) and 0.25-second (MRE) maximum separation and a conservative option in the classifier parameter. For the SRE guild, considering that most species are generally less abundant and/or with small amplitude calls we opted to use nearly the same definitions as in the first step, augmenting the minimum number of pulses and defining the classifier parameter as conservative. This last specification to run Kaleidoscope also enabled identifying MRE and LRE records that were erroneously discarded in step two targeted analysis.

Before conducting manual verification, we calibrated guild identification between the two observers (Table S4-1). Then, for each sampling month and area, we manually analysed around 250 to 300 randomly selected records of the Kaleidoscope classification outputs for the MRE to check for classification errors. If the error was above 5% all records were manually checked. The same procedure was adopted for the LRE guild classification outputs including three species, *Nyctalus leisleri* and the two *Eptesiscus* species. All the LRE output classifications identifying other species or considered as "no_ID" were manually checked. The same procedure was adopted for the records discarded in step two and where Kaleidoscope identified MRE and LRE species. The classification output for the SRE guild allowed to manually inspect each of the files identified as having bat passes of species for this guild. The manual identification criteria were based on call characteristics detailed by Obrist *et al.* (2004), Russo and Jones (2002), Rainho *et al.* (2011) and Barataud (2015).

References

Barataud, M., 2015. Acoustic ecology of european bats: species identification, study of their habitats and foraging behaviour. Paris: Muséum national d'Histoire naturelle & Mèze: Biotope (Inventaires & biodiversité), 352.

Obrist, M.K., Boesch, R., Flückiger, P.F., 2004. Variability in echolocation call design of 26 Swiss bat species: consequences, limits and options for automated field identification with a synergetic pattern recognition approach. Mammalia 68, 307-322.

Rainho, A., Amorim, F., Marques, J.T., Alves, P., Rebelo, H., 2011. Chave de identificação de vocalizações dos morcegos de Portugal continental.

Russo, D., Jones, G., 2002. Identification of Twenty-two Bat Species (Mammalia: Chiroptera) from Italy by Analysis of Time-Expanded Recordings of Echolocation Calls. J. Zool. 258, 91-103.

Table S4-1. Classification results from each observer in the calibration procedure. Calibration was made using guild and the identification outputs (ID) of Kaleidoscope. Each observer verified (i) if the bat passes present in a recording and assigned to a given ID in the Kaleidoscope were correctly associated to the respective guild ("OK" column) or not ("Wrong Guild" column), (ii) if there were several guilds present ("Sev Guilds" column), and (iii) if it was noise or a non-identifiable bat pass ("Noise" and "BAT" columns, respectively). The error rate for each guild and Kaleidoscope ID was calculated and values between observers compared. Differences between observers are residuals.

		LRE analysis																							
		Tadarida teniotis						*Nyctalus leisleri - Eptesicus serotinus/isabellinus*						*Nyctalus noctula/lasiopterus*						NoID					
		OK	Sev guilds	Wrong Guild	Noise	BAT	Error Rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate
GD	Random selection 1	2	0	1	5	0	75.00	93	22	0	0	1	0.00	8	2	0	38	0	79.17	49	15	2	9	0	14.67
	Random selection 2	0	0	0	3	0	100.00	379	19	0	0	0	0.00	112	9	0	36	0	22.93	237	14	0	0	0	0.00
JF	Random selection 1	2	0	1	5	0	75.00	95	21	0	0	0	0.00	8	2	0	38	0	79.17	49	15	2	9	0	14.67
	Random selection 2	0	0	0	3	0	100.00	372	26	0	0	0	0.00	113	8	0	36	0	22.93	239	12	0	0	0	0.00

		MRE analysis											
		Pipistrellus spp. – *Miniopterus schreibersii*						NoID					
		OK	Sev guilds	Wrong Guild	Noise	BAT	Error Rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate
GD	Random selection 1	599	23	0	3		0.48	251	11	6	3	0	3.32
	Random selection 2	475	39	2	110		17.89	151	13	11	7		9.89

JF	Random selection 1	602	19	1	3	0	0.64	250	12	6	3	0	3.32
	Random selection 2	477	37	2	110	0	17.89	152	12	11	7	0	9.89

		Overall analysis																						
		Pipistrellus spp. – *Miniopterus schreibersii*						*Nyctalus leisleri - Eptesicus serotinus/isabellinus*						*Nyctalus noctula/lasiopterus*						*Tadarida teniotis*				
		OK	Sev guilds	Wrong Guild	Noise	BAT	Error Rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate	OK	Sev guilds	Wrong Guild	Noise	BAT	Error rate	OK	Sev guilds	Wrong Guild	Noise	BAT
GD	Random selection 1	199	3	0	7	0	3.35	22	3	0	0	0	0.00	9	0	10	67	0	89.53	0	1	0	11	0
	Random selection 2	828	16	0	149	0	15.01	573	16	0	6	1	1.01	304	13	46	410	5	58.61	4	0	1	19	0
JF	Random selection 1	198	4	0	7	0	3.35	22	3	0	0	0	0.00	9	0	10	67	0	89.53	0	1	0	11	0
	Random selection 2	830	14	0	149	0	15.01	572	17	0	6	1	1.01	304	13	49	410	2	59.00	4	1	1	19	0

Appendix S5. Correlation matrix

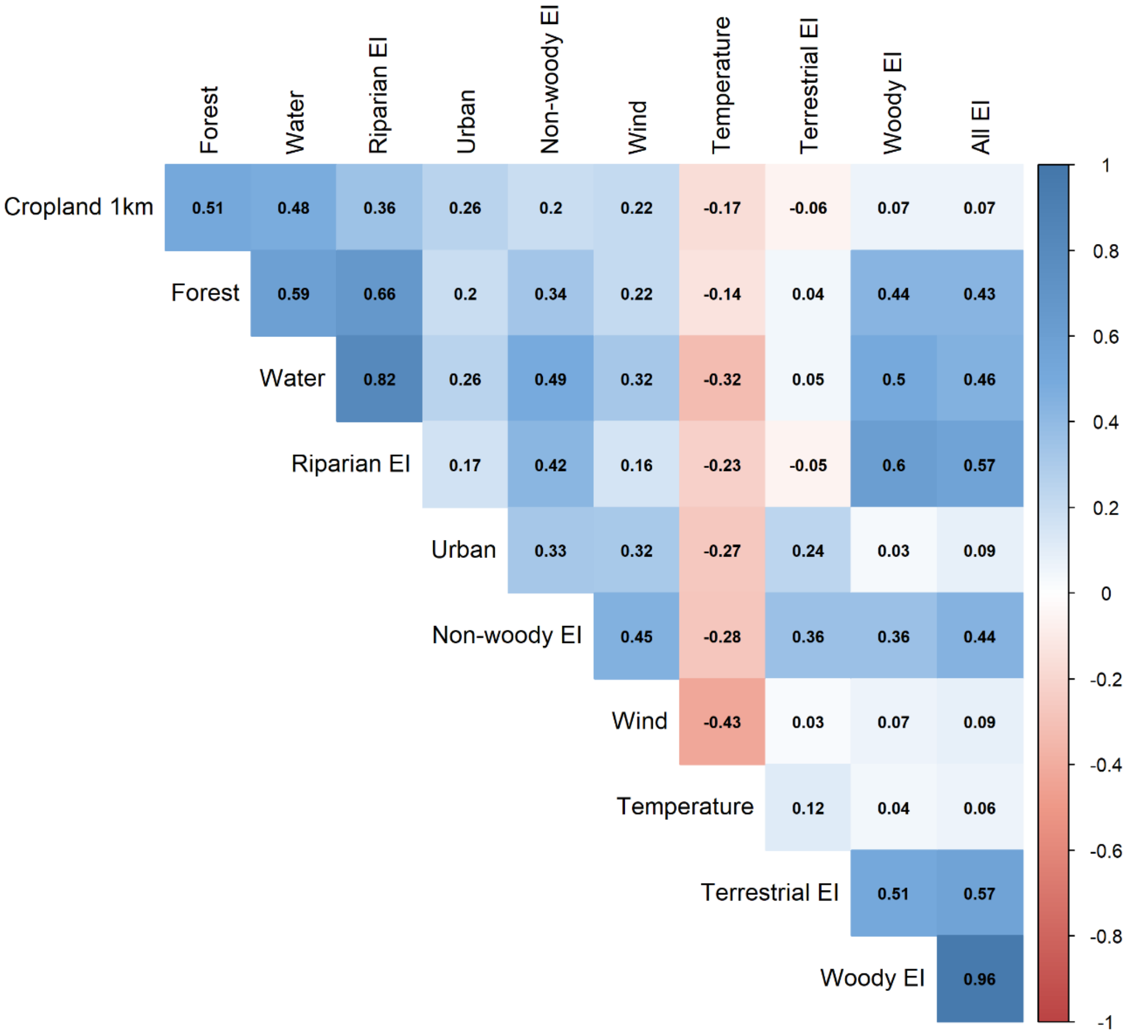

Figure S5-1. Correlation matrix between the explanatory variables. Values represent the Spearman's correlation coefficient. EI: ecological infrastructure.

Appendix S6. Reference list of R packages used

"glmmTMB″ package: Brooks *et al*., (2017)

"DHARMa" package: Hartig (2017)

"performance" package: Lüdecke *et al*., (2021)

"spdep" package: Bivand (2020)

"MuMIn" package: Bartoń (2020)

References

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Brooks, M.E., Kristensen, K., van Benthem, K.J., Magnusson, A., Berg, C.W., Nielsen, A., Skaug, H.J., Machler, M. & Bolker, B.M. (2017) glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. *The R journal*, **9,** 378-400.

Hartig, F. (2017) DHARMa: residual diagnostics for hierarchical (multi-level/mixed) regression models. R package version 0.3.2.0. Available at https://cran.r-project.org/web/packages/DHARMa/index.html.

Lüdecke, D., Ben-Shachar, M.S., Patil, I., Waggoner, P. & Makowski D. (2021). performance: An R package for assessment, comparison and testing of statistical models. *Journal of Open Source Software*, 6, 3139. Available at https://cran.r-project.org/web/packages/performance/index.html.

Appendix S7. Description of the most parsimonious GLMMs

Table 7-1. Description of the most parsimonious GLMMs (Δ*AICc* <2) relating the effects of ecological infrastructures (EI) on the activity of three bat functional guilds: (a) short-range echolocators, (b) mid-range echolocators, and (c) long-range echolocators. Models are ranked in ascending order of *AICc* values and number of parameters (*K*), delta *AICc*, and AICc weight (*ωi*) are given for each model.

a) Short-range echolocators

Model	**K**	***AICc***	**Δ*AIC***	***ωi***
Null model	3	338.21	0.00	0.13
Terrestrial *vs* riparian EI	4	338.26	0.05	0.12
Wind	4	338.77	0.57	0.10
Dist. urban + Wind	5	339.30	1.09	0.07
Temperature	4	339.35	1.15	0.07
Terrestrial *vs* riparian EI + Wind	5	339.37	1.16	0.07
Terrestrial *vs* riparian EI + Dist. urban + Wind	6	339.46	1.25	0.07
Terrestrial vs riparian EI + Dist. Urban	5	339.55	1.35	0.06
Dist. terrestrial EI	4	339.81	1.61	0.06
Dist. urban	4	339.90	1.69	0.05
Dist. non-woody EI	4	340.14	1.93	0.05
Dist. woody EI	4	340.14	1.93	0.05
Terrestrial *vs* riparian EI + Temperature	5	340.14	1.94	0.05
Terrestrial vs riparian EI + Dist. riparian EI	5	340.17	1.96	0.05

b) Mid-range echolocators

Model	**K**	***AICc***	***ΔAIC***	***ωi***
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature	8	1315.51	0.00	0.18
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + % Cropland (1 km)	9	1316.06	0.55	0.13
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + Dist. urban	9	1316.28	0.77	0.12
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + % Cropland (1 km) + Dist. urban	10	1316.65	1.14	0.10
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + Dist. urban + Dist. woody EI	10	1316.80	1.29	0.09
Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + Dist. woody EI	9	1317.04	1.53	0.08
Terrestrial vs riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + % Cropland (1 km) + Wind	10	1317.08	1.57	0.08
Terrestrial vs riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + Wind	9	1317.14	1.63	0.08
Terrestrial vs riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + % Cropland (1 km) + Dist. urban + Dist. woody EI	11	1317.24	1.72	0.07
Terrestrial vs riparian EI + Dist. non-woody EI + Dist. terrestrial EI + Dist. Riparian EI + Temperature + % Cropland (1 km) + Dist. urban + Wind	11	1317.45	1.94	0.07
Null model	3	1353.29	37.78	/

c) Long-range echolocators

Model	**K**	***AICc***	***ΔAIC***	***ωi***
Spatial autocovariate + Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. woody EI + Temperature + Wind + Dist. terrestrial EI	10	1068.26	0.00	0.52
Spatial autocovariate + Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. woody EI + Temperature + Wind	9	1069.78	1.52	0.25
Spatial autocovariate + Terrestrial *vs* riparian EI + Dist. non-woody EI + Dist. woody EI + Temperature + Wind + Dist. terrestrial EI + % Cropland (1 km)	11	1069.95	1.68	0.23
Null model	3	1116.8	26.76	/