Supplementary Files

Exploratory spatial analysis of each animal carcass

1. Spatial statistics

The first step we have developed was to perform an exploratory analysis of the spatial point patterns (Baddeley et al., 2016; Wiegand and Moloney, 2013) for each case study, using the 'spatstat' library (Baddeley et al., 2016; Baddeley and Turner, 2005) in R (R Core Team, 2022) and the workflow and code previously proposed by Moclán et al. (2023b, 2023a).

Spatial analyses play a central role in taphonomic research, as they make it possible to evaluate, among other issues, the extent to which taphogenic processes are random or not (Domínguez-Rodrigo et al., 2018). This is particularly important when determining whether fossil assemblages formed synchronously or penecontemporaneously, as well as when assessing the intensity of modification by taphonomic agents such as water.

The use of these analytical approaches in archaeological contexts has been widely proposed (Arteaga Brieba, 2024; Cobo-Sánchez et al., 2024; Diez-Martín et al., 2021; Domínguez-Rodrigo et al., 2017; Luzón et al., 2021; Marín et al., 2019; Merino-Pelaz et al., 2024; Mielgo et al., 2024; Moclán et al., 2023b, 2023a; Panera et al., 2019; Saladié et al., 2021; Villaescusa et al., 2026). In this line of research, a key objective is to quantify the degree of randomness in spatial point patterns.

The analysis started with an evaluation of spatial intensity (i.e. the number of points per unit area) by generating a kernel intensity map with likelihood cross-validation smoothing ('bw.ppl' function in 'spatstat') and identifying areas showing statistically significant values at the 99% confidence level (i.e., hot spot analysis). It should be emphasized that these maps cannot, by themselves, be used to define the degree of randomness of a spatial point pattern. Intensity maps indicate where points are concentrated, while hot spot maps highlight locations where those concentrations are statistically significant. Nevertheless, the occurrence of high-intensity zones in either type of map does not necessarily indicate true spatial clustering. For comparison, this work includes a single plate (Supplementary Figure [hereinafter SF] 1) featuring all animal carcass intensity maps. Furthermore, each map has been integrated into the respective plates for each carcass (SF 2 – 14).

The spatial windows analysed were created in ArcGIS 10.5, considering the polygon size of each analysed bone. These windows were generated using 1x1 m grids.

Subsequently, we determined the typology of the point pattern in order to achieve a more robust taphonomic characterization of the site. To this end, and after confirming sample inhomogeneity through a χ^2 (p-values = <0.05) test using four different grid sizes (5×5, 8×8, 10×10, and 12×12), we applied several methods to test the null hypothesis of spatial randomness. The analyses included the DCLF (Diggle–Cressie–Loosmore–Ford) and MAD (Maximum Absolute Deviation) tests, based on the inhomogeneous K, L, F, G, and J functions, together with the scaled K and L functions. Likewise, the pair correlation function, the inhomogeneous K, L, F, G, and J functions, together with the locally scaled K and L functions, were used to provide a graphical description of the behaviour of the spatial point patterns. All these tests are designed to characterise the structure of the point pattern, using spatial randomness as the null hypothesis (H_0) and considering clustering (tendency toward aggregation) or regularity (tendency toward segregation) as alternative hypotheses (H_a).

It should be noted that we initially attempted to use a studentized permutation test to assess sample inhomogeneity; however, it could not be applied due to the small sample size in all cases (i.e., too few points within each created sub-window). This constraint led us to utilize the inhomogeneous and scaled versions of all functions instead.

Finally, potential clustering of materials was explored using the Nearest Neighbour Clutter Removal ('nnclean') function (*k* values = 5 & 10). This approach is particularly valuable because it evaluates the spatial pattern based on neighbourhood relationships (i.e. proximity between points) rather than relying on intensity-based measures. It is important to consider that this test is based on the initial bias of assuming a single cluster exists within the spatial point pattern. Therefore, if the spatial point pattern is not actually clustered, the 'nnclean' results should be interpreted as a tool for identifying points with the most statistically significant neighbors.

To further explore the spatial point pattern, we fitted four Poisson point process models with increasing polynomial complexity (linear, quadratic, cubic, and fourth-degree). Model performance was assessed using the Akaike Information Criterion (AIC), after which their relative validity was compared by ANOVA test. The model with the lowest AIC value was selected as the best-fitting one, and three outputs were subsequently generated: (1) a map of the predicted intensity of the point process; (2) an intensity map of a simulated point pattern produced using the fitted model; and (3) a difference map obtained by subtracting the intensity of the simulated pattern from the observed ("real") intensity.

For a comprehensive explanation of all these methods, see Baddeley *et alli* (Baddeley et al., 2016).

2. Results

The first aspect to be considered in point patterns is that, in general, spatial windows tend to be largely empty of points, with animal remains concentrated in a single high-intensity focus, which can be identified both through intensity and hot spot maps. In this regard, the maps generated from the modelling procedures are particularly informative, as they show that the modelled intensity generally produces only one large high-intensity focus. However, in several cases (Elephant_3, Elephant_5, Haynes_2, White-Diedrich, Áridos-2), in addition to the main high-intensity focus, other small high-intensity foci can be identified in the hot spot maps. The only case that deviates somewhat from this pattern is Elephant_2, which displays intensity and hot spot maps with several small high-intensity foci, although the modelled intensity still shows a single large high-intensity focus.

In numerical terms, intensity is generally quite low in all the analysed cases (mean = 1.75), which is consistent with the presence of large empty spaces. In the new modern carcasses presented in this study, intensity values range from 0.11 (Elephant_2 and Elephant_3) to 3.31 (Giraffe), and these values are consistent with those obtained for other modern carcasses previously analysed (Haynes_1 = 0.18; Haynes_2 = 2.33; White_Diedrich = 1.59). Thus, considering all these modern carcasses analysed, the mean intensity is 0.92, and when the giraffe is included, the mean intensity decreases to 0.65.

In the case of the archaeological samples, the mean intensity is substantially higher (4.51), with values of 1.55 at Marathousa 1, 4.25 at Áridos-2, and up to 7.74 at EAK. These results are consistent with the fact that the spatial windows analysed in archaeological contexts are clearly smaller than those analysed for modern carcasses.

The use of the DCLF and MAD tests has generally yielded very similar results in all the analysed cases. The overall pattern of results shows that both tests, when applied using the inhomogeneous K and L functions and the locally scaled K and L functions, reject the null hypothesis of spatial randomness. However, there are three cases that show slightly different results. In the case of Giraffe, the null hypothesis is rejected only when using the locally scaled functions with the DCLF test and the inhomogeneous K and L functions with the MAD test, whereas in Áridos-2 the DCLF test rejects the null hypothesis when using the locally scaled K function, and the MAD test rejects it when using both locally scaled functions. Finally, in Marathousa 1 the null hypothesis is rejected with the inhomogeneous K and L functions using both the DCLF and the MAD tests.

The application of the functions has produced somewhat more variable results, although it is consistently observed that the inhomogeneous F, G, and J functions never reject the null hypothesis. The pair correlation function proposes clustering at very short distances as an alternative hypothesis in Elephant_1, Elephant_2, and EAK. The inhomogeneous K function almost always rejects the null hypothesis, except for Áridos-2. However, in Elephant_1, Elephant_3, Elephant_4, Elephant_5, Elephant_6, Giraffe, Haynes_1, White-Diedrich, and Marathousa, a regular-type distribution is proposed. In the cases of Elephant_2, Haynes_2, and EAK, a regular distribution is also suggested at medium to large distances, while clustering is additionally proposed at short distances.

The results obtained with the inhomogeneous L function are very similar to those of the K function, differing in that a combined pattern of clustering and regularity is proposed for Elephant_3 and Haynes_1.

The locally scaled functions generally suggest the presence of clustering in most cases, with the null hypothesis not being rejected in Giraffe, Áridos-2, and Marathousa (as well as in Elephant_6 when using the K function). White-Diedrich stands out in the case of the locally scaled L function, where a regular

pattern is proposed.

Therefore, in general terms, it can be stated that functions based on intensity estimation indicate the absence of spatial randomness, with patterns ranging from regular distributions to regular patterns at larger distances combined with clustering at short distances. In contrast, functions based on nearest-neighbour calculations (F, G and J) do not reject the null hypothesis of spatial randomness.

The analysis using the 'nnclean' function is particularly informative (see ST 1), as it reveals a high degree of variability among samples in terms of the points classified as part of the main cluster and those considered as noise.

	Intensity	*k* = 5					*k* = 10				
		p (cluster)	λ (cluster)	λ (noise)	% Dev (cluster)	% Dev (noise)	p (cluster)	λ (cluster)	λ (noise)	% Dev (cluster)	% Dev (noise)
Elephant_1	0.35	0.56	10.14	0.17	2839.71	-51.88	0.55	10.35	0.20	2900.87	-43.48
Elephant_2	0.11	0.69	2.05	0.10	1729.46	-11.61	0.83	0.59	0.04	425.89	-67.86
Elephant_3	0.11	0.69	1.84	0.05	1588.07	-55.96	0.83	0.88	0.01	706.42	-88.99
Elephant_4	0.09	0.67	0.95	0.07	1009.30	-24.42	0.68	0.75	0.06	766.28	-36.05
Elephant_5	0.24	0.78	1.35	0.09	463.60	-61.51	0.80	0.95	0.05	297.91	-78.66
Elephant_6	0.84	0.88	5.14	0.30	511.18	-63.97	0.87	4.45	0.43	428.66	-48.51
Giraffe	3.31	0.85	7.97	2.23	140.53	-32.62	0.85	6.82	2.26	105.76	-31.74
Haynes_1	0.18	0.50	0.90	0.10	386.41	-47.83	0.42	1.12	0.12	508.70	-35.87
Haynes_2	2.33	0.54	23.30	3.96	898.97	69.73	0.48	25.93	4.39	1011.88	88.25
White-Diedrich	1.59	0.80	10.08	0.43	533.69	-72.91	0.74	10.40	0.74	553.68	-53.55
Áridos-2	4.25	0.91	28.45	4.57	569.36	7.53	0.73	30.14	8.76	609.13	106.05
Marathousa 1	1.55	0.71	4.49	0.77	189.74	-50.36	0.66	4.69	0.95	202.65	-38.73
EAK	7.74	0.91	86.73	1.46	1020.11	-81.13	0.89	83.38	2.53	976.87	-67.27

Supplementary Table (ST) 1. Comparison of the real intensity and 'nnclean' values. % Dev = Percent deviation. % Dev = $\%Dev = (\frac{\lambda nnclean - \lambda real}{\lambda real}) \times 100$

When evaluating the analysis with *k* = 5, in some cases only slightly more than 50% of the sample is classified as belonging to the main cluster (Elephant_1, Haynes_1, Haynes_2), whereas in Áridos-2 and EAK values as high as 91% are obtained. The remaining cases display intermediate values between these two extremes. Cluster intensities are also highly variable, ranging from very low values below 1 (Elephant_4, Haynes_1), to slightly higher values such as those observed in Elephant_2 (2.05), Elephant_3 (1.84), and Elephant_5 (1.35), and to very high values reaching 10.14 in Elephant_1, 23.30 in Haynes_2, 28.45 in Áridos-2, and 86.73 in EAK. By contrast, intensity values outside the clusters are more homogeneous, varying between 0.05 and 4.57.

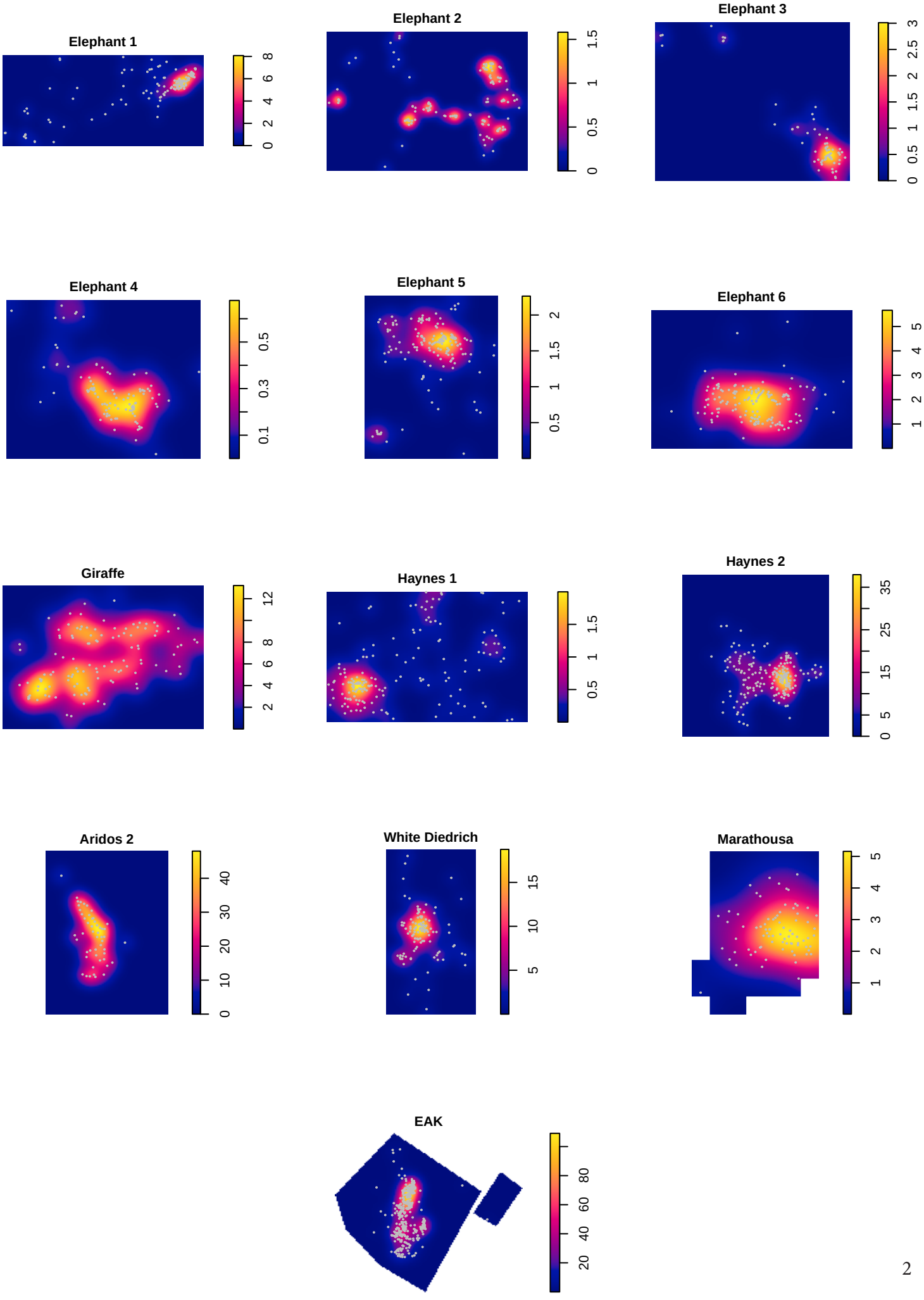
When comparing the observed overall intensity with the intensity within clusters, the increase is very pronounced in several cases, particularly in Elephant_1 (29-fold higher), Elephant_2 (17-fold higher), Elephant_3 (16-fold higher), Elephant_4 (10-fold higher), and EAK (10-fold higher). The remaining cases show lower relative increases, ranging from almost twofold to nearly ninefold.

The results obtained using k = 10 do not differ substantially from those described above for k = 5.

3. Summary

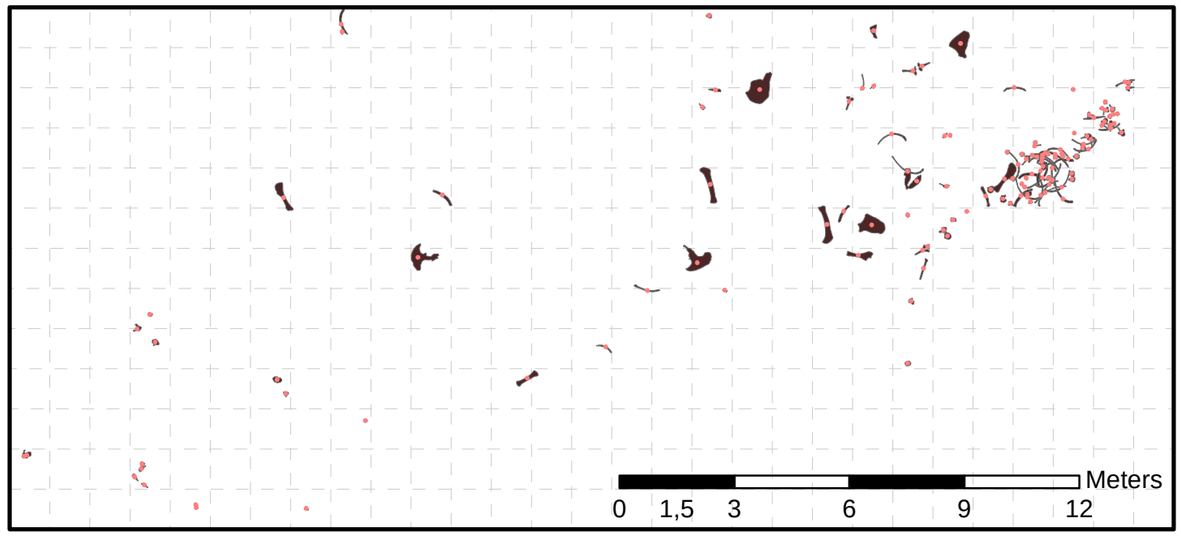
The spatial results obtained indicate that, in general terms, there is a common pattern across all the cases studied. Overall, intensity is strongly dependent on the analysed spatial window, and in all cases the distributions are clearly inhomogeneous. Most accumulations tend to be concentrated in very specific locations within the space, and as distance from the main accumulations increases, intensity decreases very sharply. From a spatial perspective, the null hypothesis of spatial randomness can therefore be broadly rejected. However, the non-random patterns observed vary between potential clustered distributions, regular distributions, or combinations of both. The use of Nearest Neighbour Clutter Removal function further provides a clearer view of how intensity differs inside and outside high-energy foci, reaching, in one case, values up to 29 times higher within the main accumulation than in areas where points are interpreted as noise.

SF 1: Intensity comparison (Likelihood cross-validation smoothing)



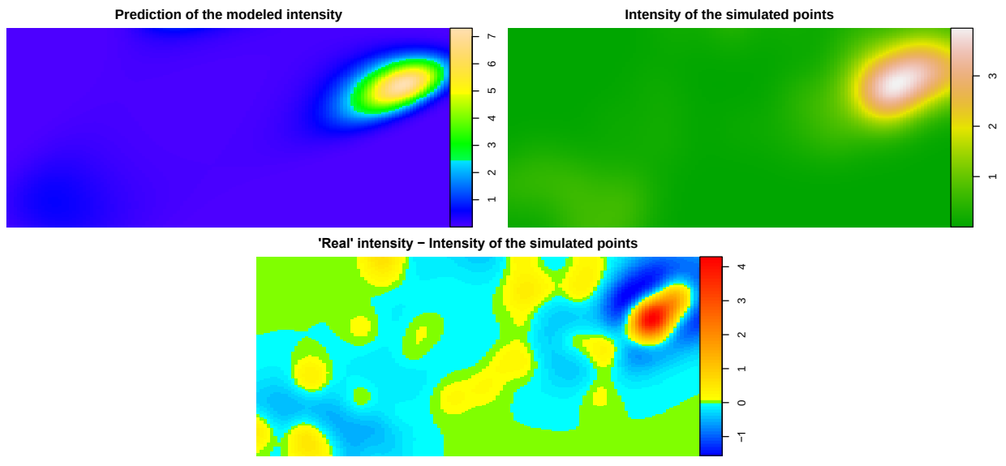
SF 2: Elephant 1

a) Spatial point pattern including polygonal features

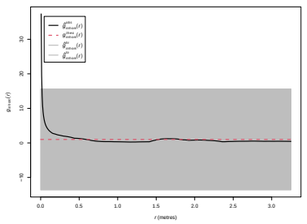


b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)

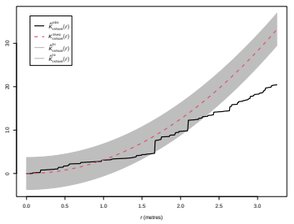
m) Spatial modeling



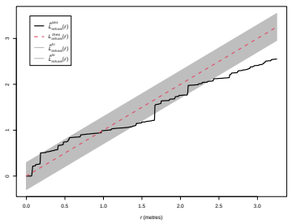
e) Pair Corr. Function



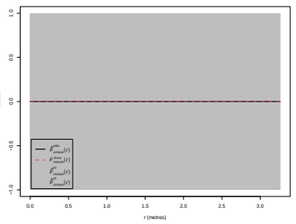
f) Inh. *K* function



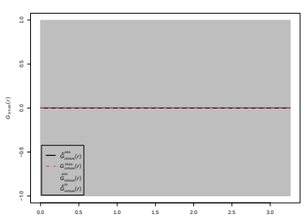
g) Inh. *L* function



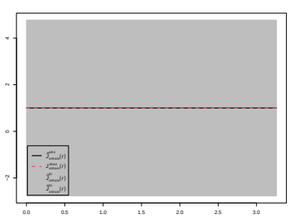
h) Inh. *F* function



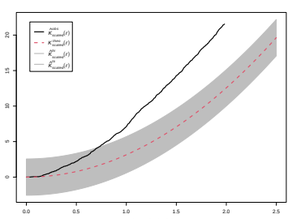
i) Inh. *G* function



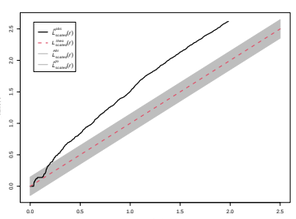
j) Inh. *J* function



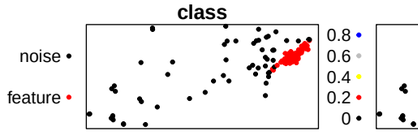
k) *K*-scaled function



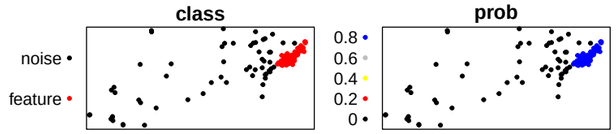
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

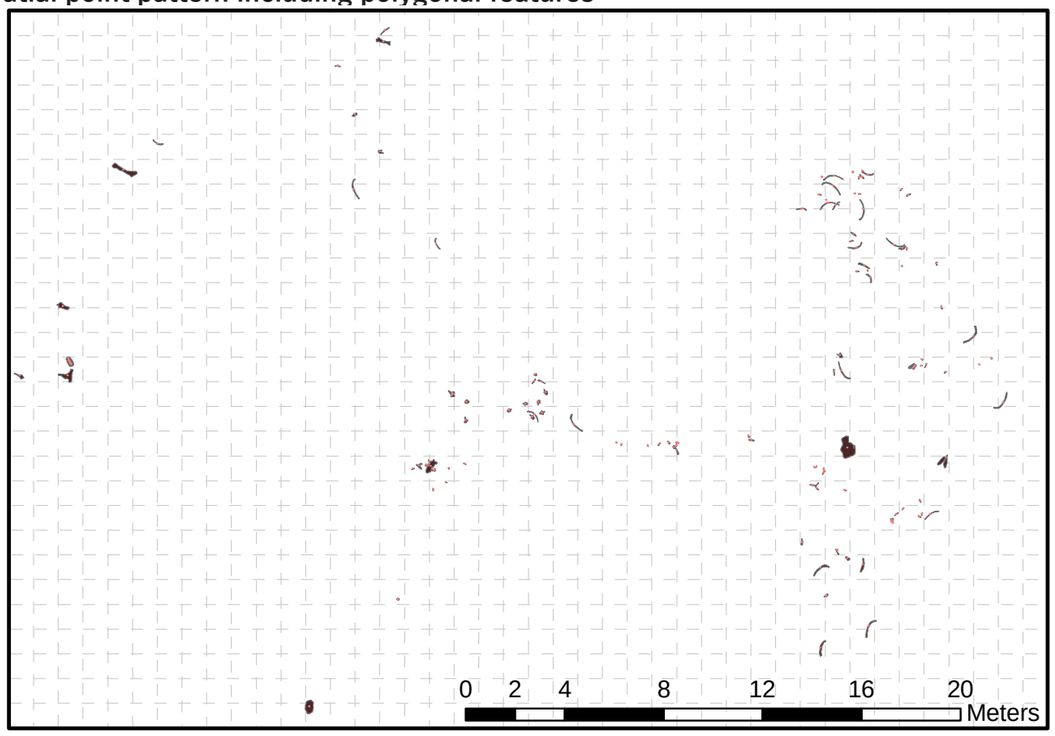


p) Spatial statistics

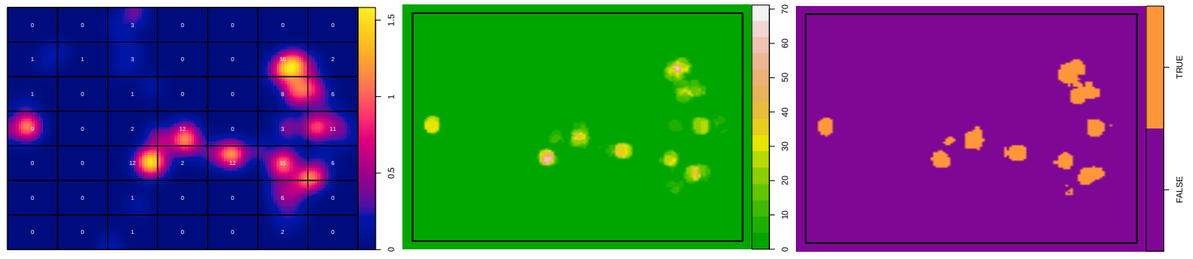
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
130	0.345	377	2.92E-160	1.94E-156	2.61E-173	3.32E-266
DCLF test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.558	10.142		0.166			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.547	10.353		0.195			
Model 1 (spp~ x + y)	Model 2 (spp~polynom(x,y,2)		Model 3 (spp~polynom(x,y,3)		Model 4 (spp~polynom(x,y,4)	
AIC: 413.94	AIC: 295.54		AIC: 236.47		AIC: 173.24	

SF 3: Elephant 2

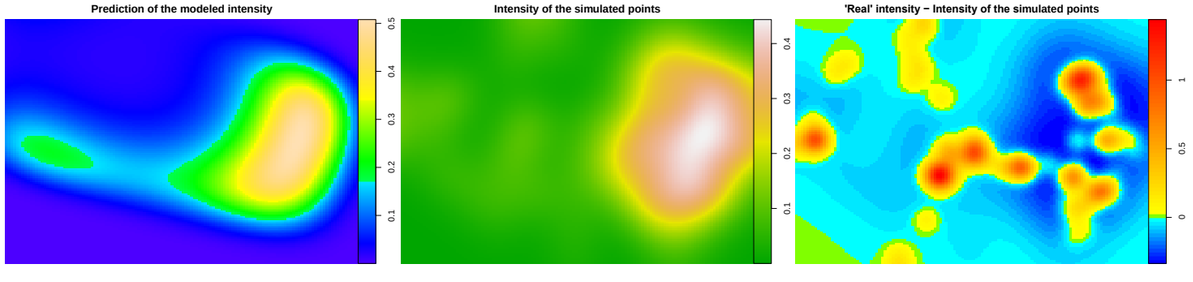
a) Spatial point pattern including polygonal features



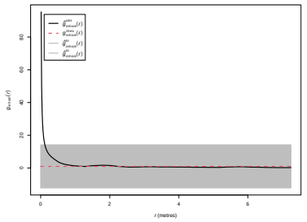
b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)



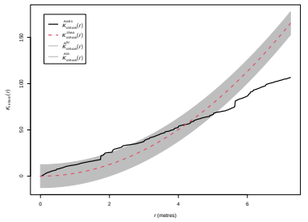
m) Spatial modeling



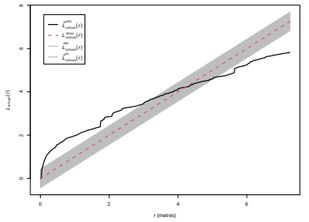
e) Pair Corr. Function



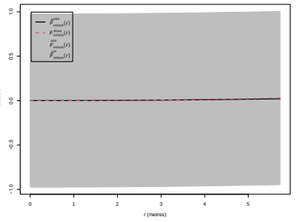
f) Inh. *K* function



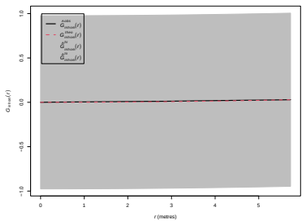
g) Inh. *L* function



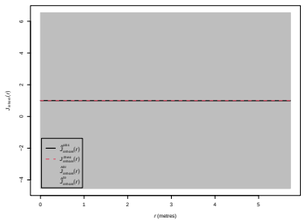
h) Inh. *F* function



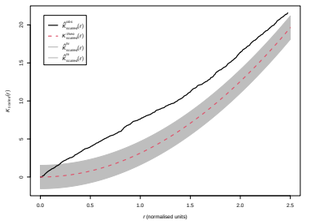
i) Inh. *G* function



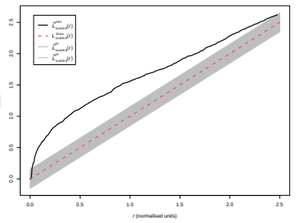
j) Inh. *J* function



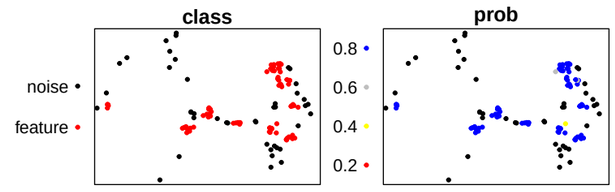
k) *K*-scaled function



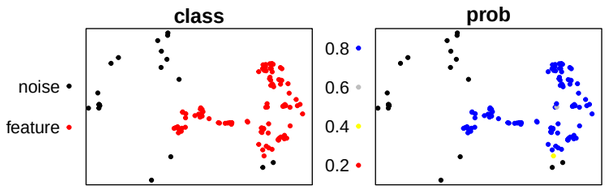
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

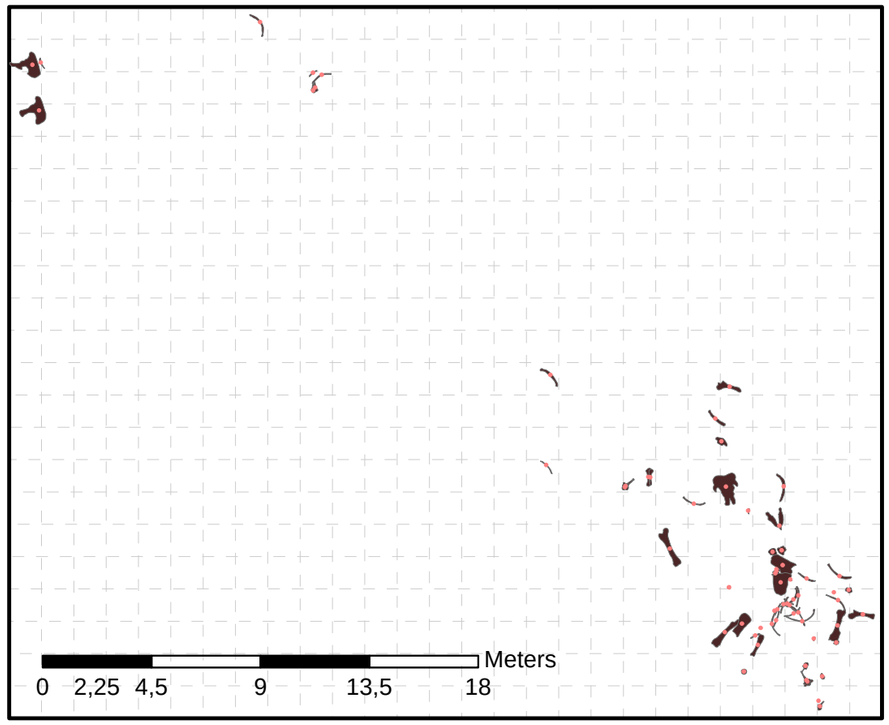


p) Spatial statistics

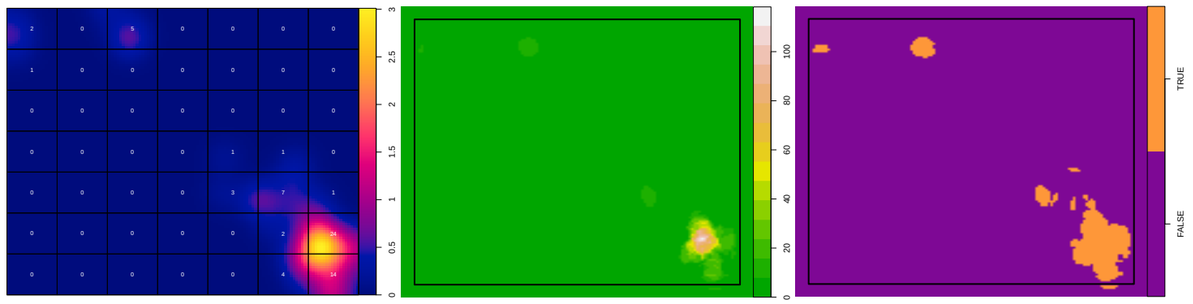
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
136	0.112	1218	1.06E-32	1.64E-75	3.48E-74	2.24E-92
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.688	2.049		0.099			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.829	0.589		0.036			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
843.04	772.933		757.648		745.515	

SF 4: Elephant 3

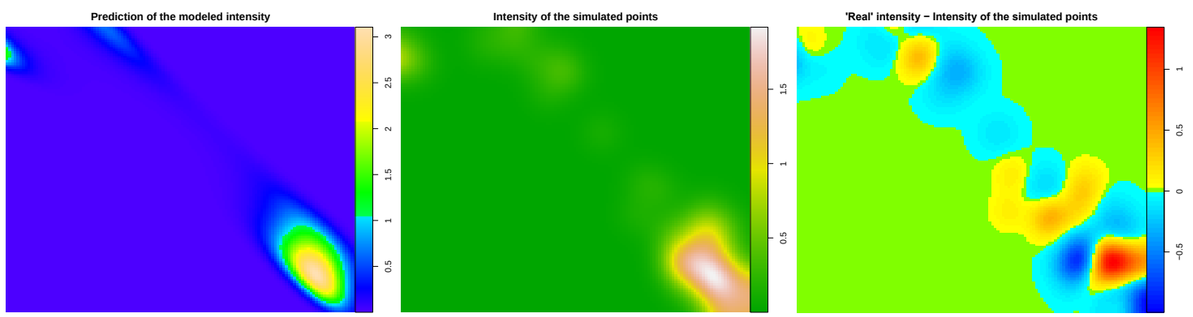
a) Spatial point pattern including polygonal features



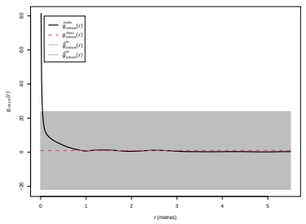
b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)



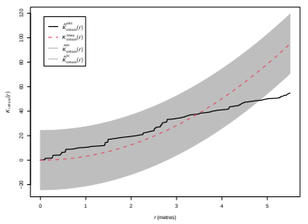
m) Spatial modeling



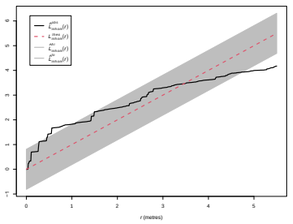
e) Pair Corr. Function



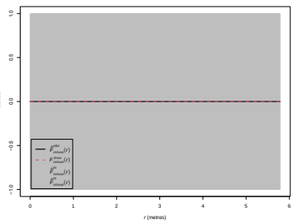
f) Inh. *K* function



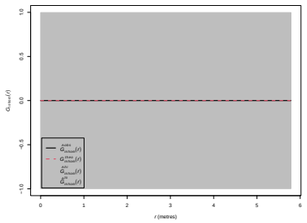
g) Inh. *L* function



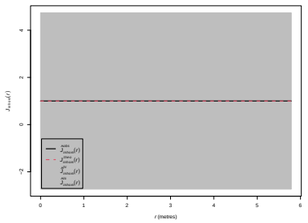
h) Inh. *F* function



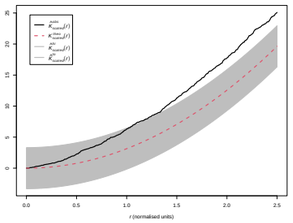
i) Inh. *G* function



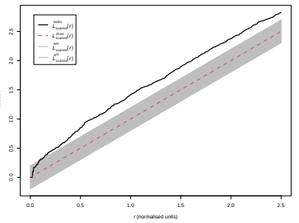
j) Inh. *J* function



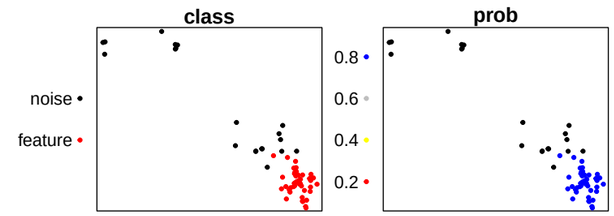
k) *K*-scaled function



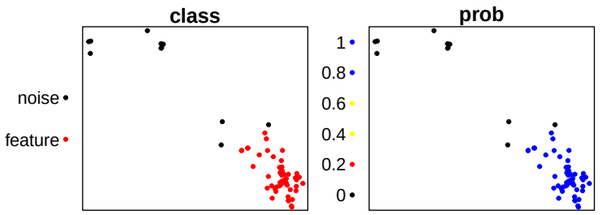
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

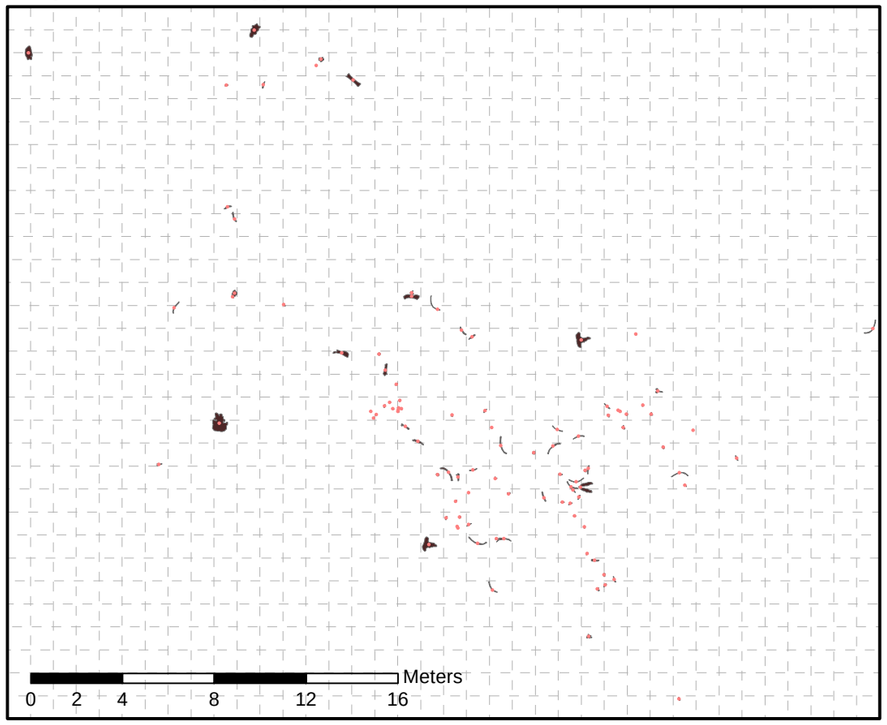


p) Spatial statistics

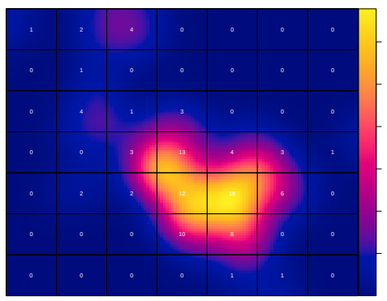
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
65	0.109	594	4.43E-93	1.27E-114	1.04E-117	7.11E-108
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.691	1.84		0.048			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.829	0.879		0.012			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
313.617	213.732		183.167		169.218	

SF 5: Elephant 4

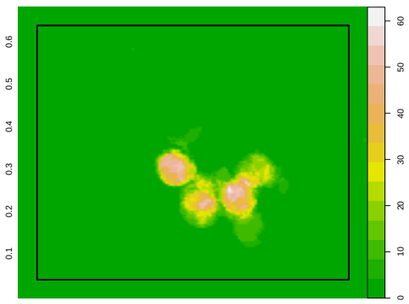
a) Spatial point pattern including polygonal features



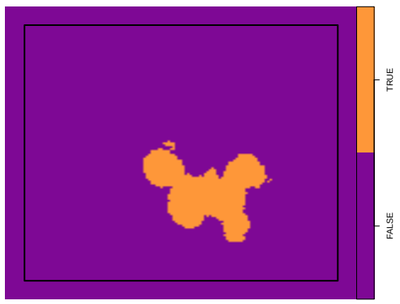
b) Kernel Smoothed Intensity



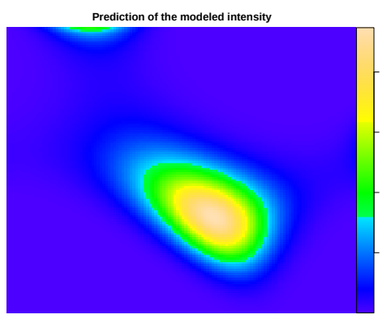
c) Likelihood Ratio Test Stat.

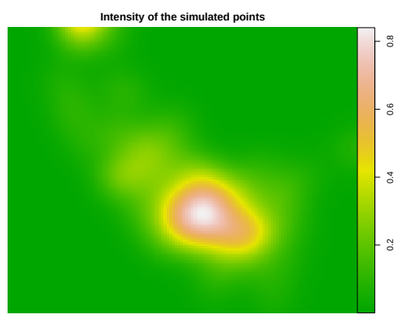


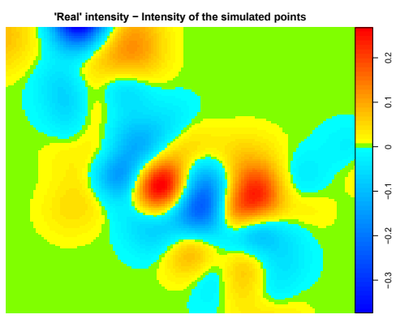
d) L. R. T. S. (p-value < 0.01)



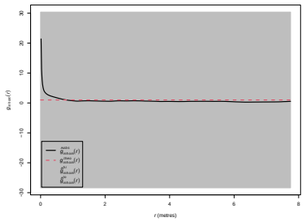
m) Spatial modeling



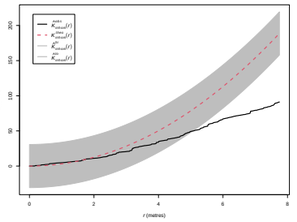




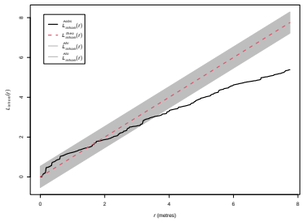
e) Pair Corr. Function



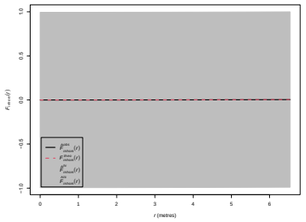
f) Inh. *K* function



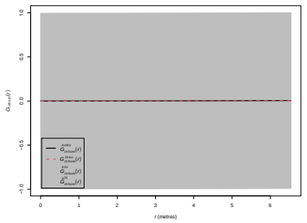
g) Inh. *L* function



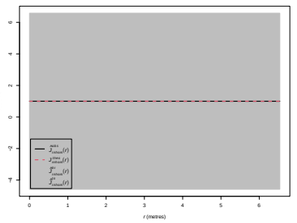
h) Inh. *F* function



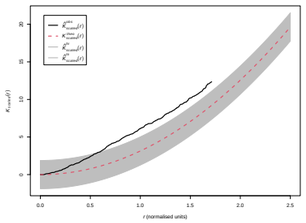
i) Inh. *G* function



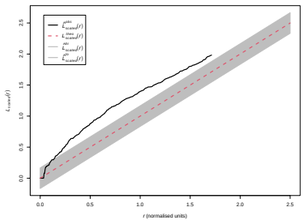
j) Inh. *J* function



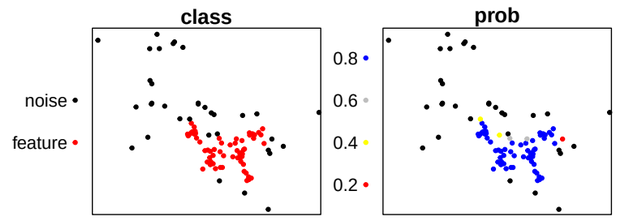
k) *K*-scaled function



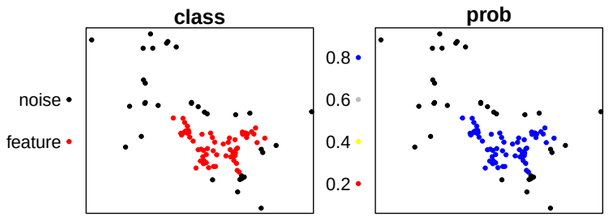
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

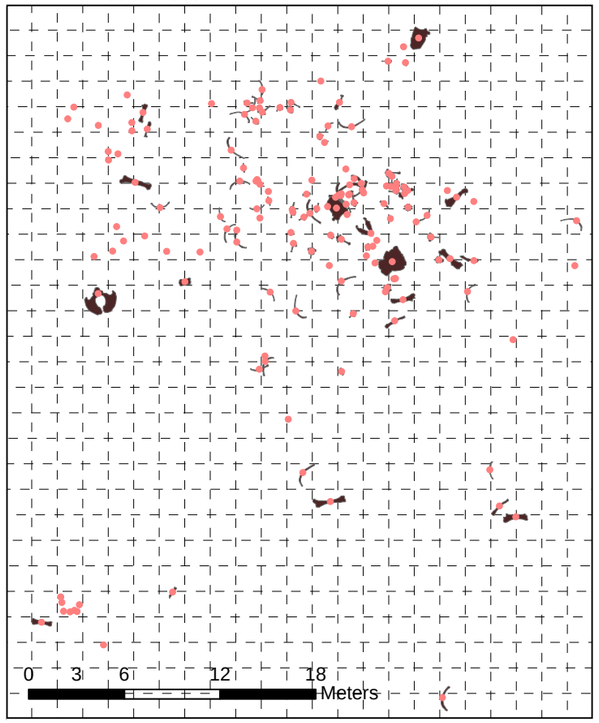


p) Spatial statistics

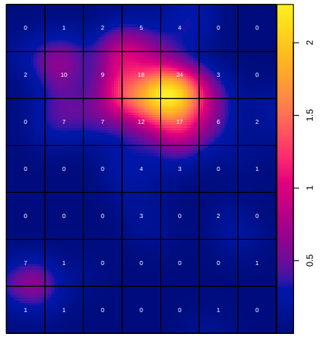
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
101	0.086	1178	3.80E-50	2.02E-65	1.30E-72	8.20E-88
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.671	0.954		0.065			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.676	0.745		0.055			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
694.686	525.505		494.478		488.366	

SF 6: Elephant 5

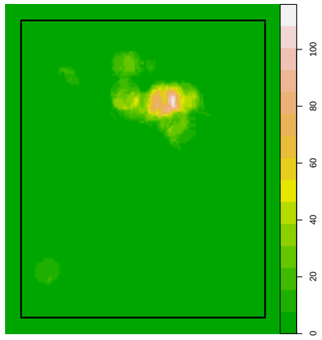
a) Spatial point pattern including polygonal features



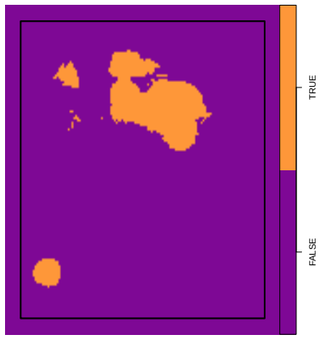
b) Kernel Smoothed Intensity



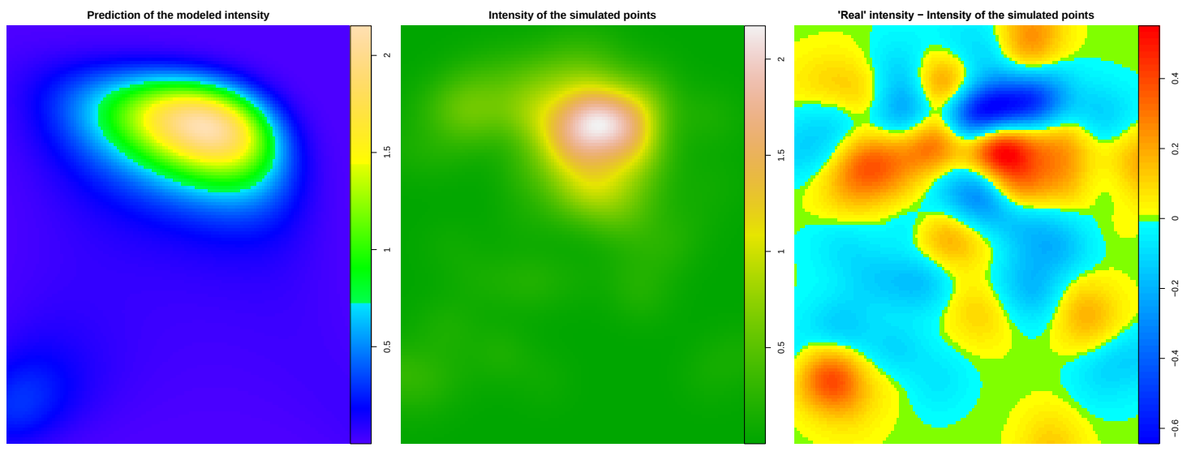
c) Likelihood Ratio Test Stat.



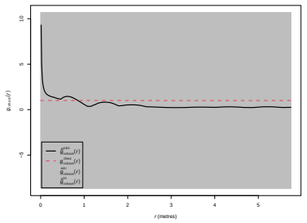
d) L. R. T. S. (p-value < 0.01)



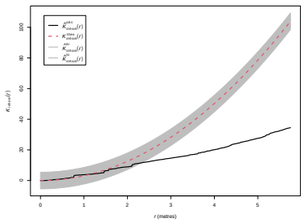
m) Spatial modeling



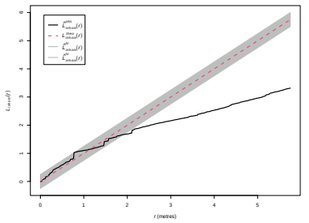
e) Pair Corr. Function



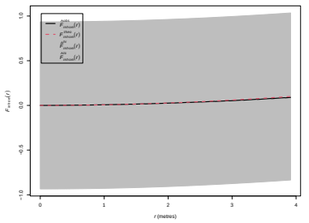
f) Inh. *K* function



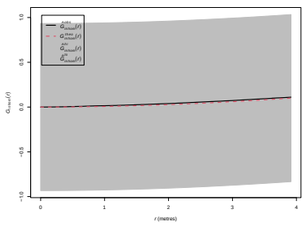
g) Inh. *L* function



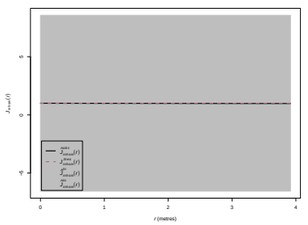
h) Inh. *F* function



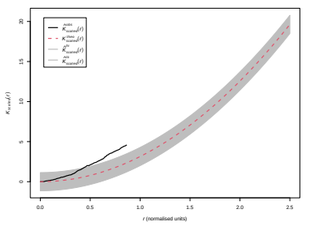
i) Inh. *G* function



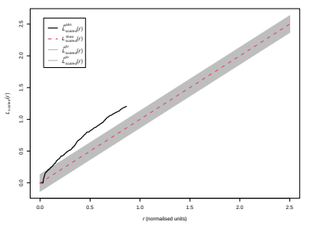
j) Inh. *J* function



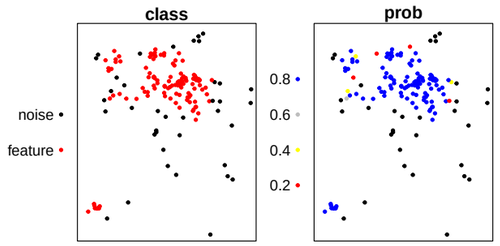
k) *K*-scaled function



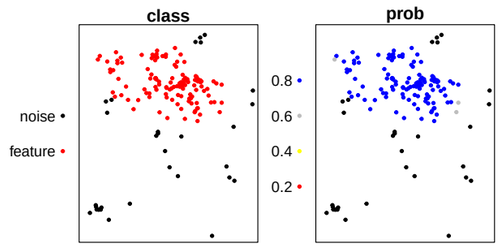
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

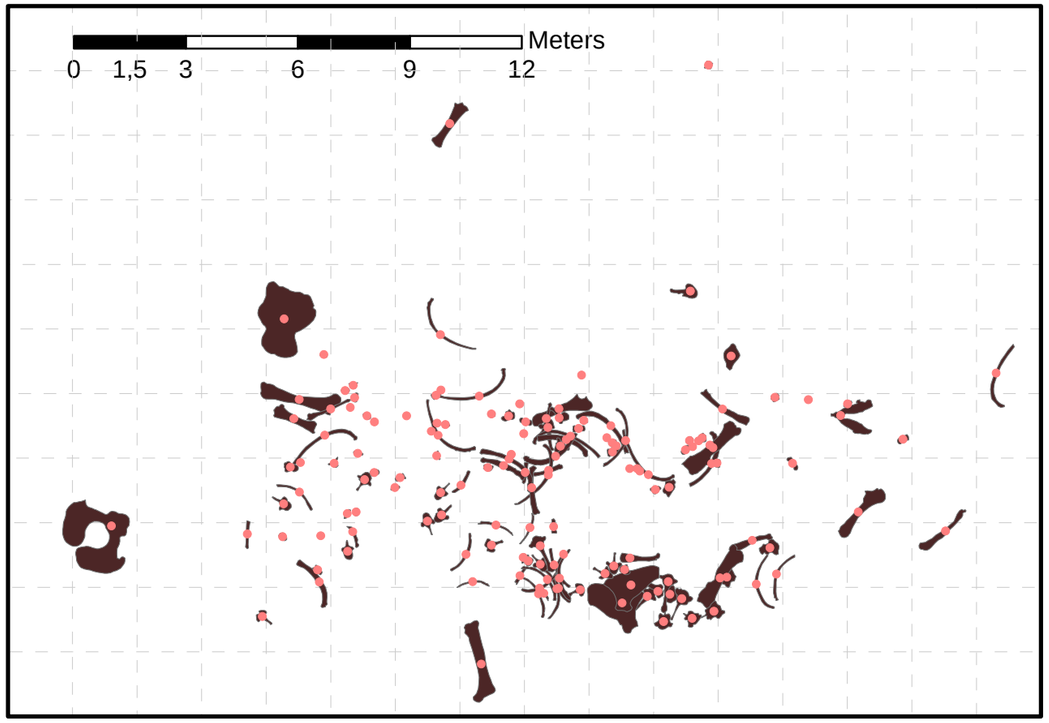


p) Spatial statistics

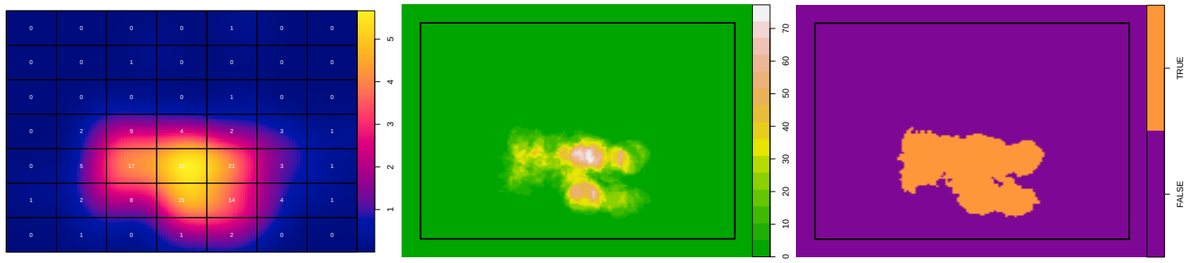
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
154	0.239	644	2.50E-69	1.85E-93	4.49E-89	6.55E-92
DCLF test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.779	1.347		0.092			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.798	0.951		0.051			
Model 1 (spp~ x + y)	Model 2 (spp~polynom(x,y,2)		Model 3 (spp~polynom(x,y,3)		Model 4 (spp~polynom(x,y,4)	
700.085	597.233		513.886		493.854	

SF 7: Elephant 6

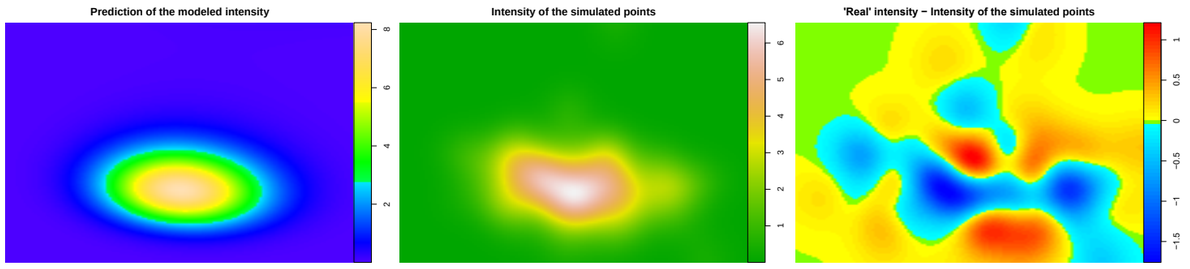
a) Spatial point pattern including polygonal features



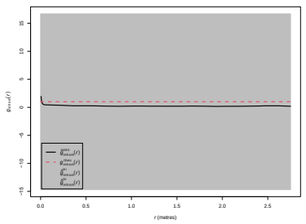
b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)



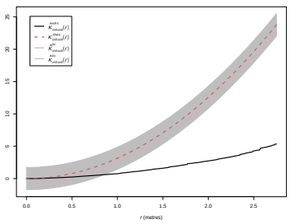
m) Spatial modeling



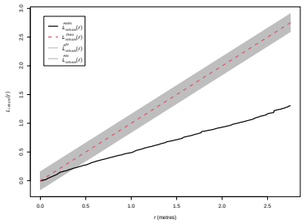
e) Pair Corr. Function



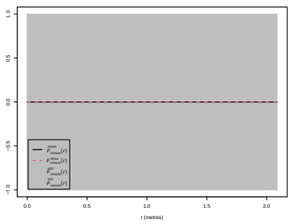
f) Inh. *K* function



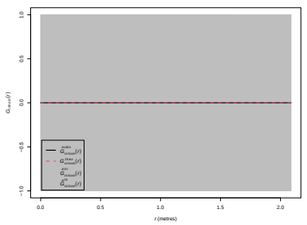
g) Inh. *L* function



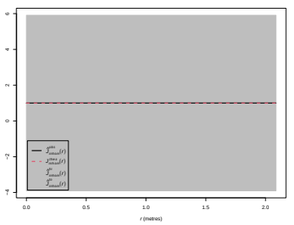
h) Inh. *F* function



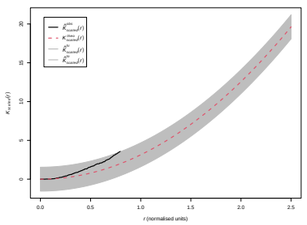
i) Inh. *G* function



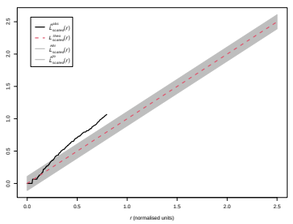
j) Inh. *J* function



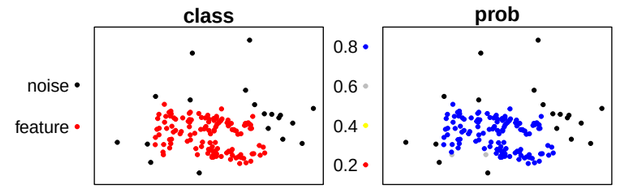
k) *K*-scaled function



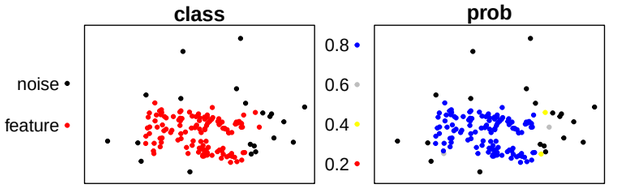
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

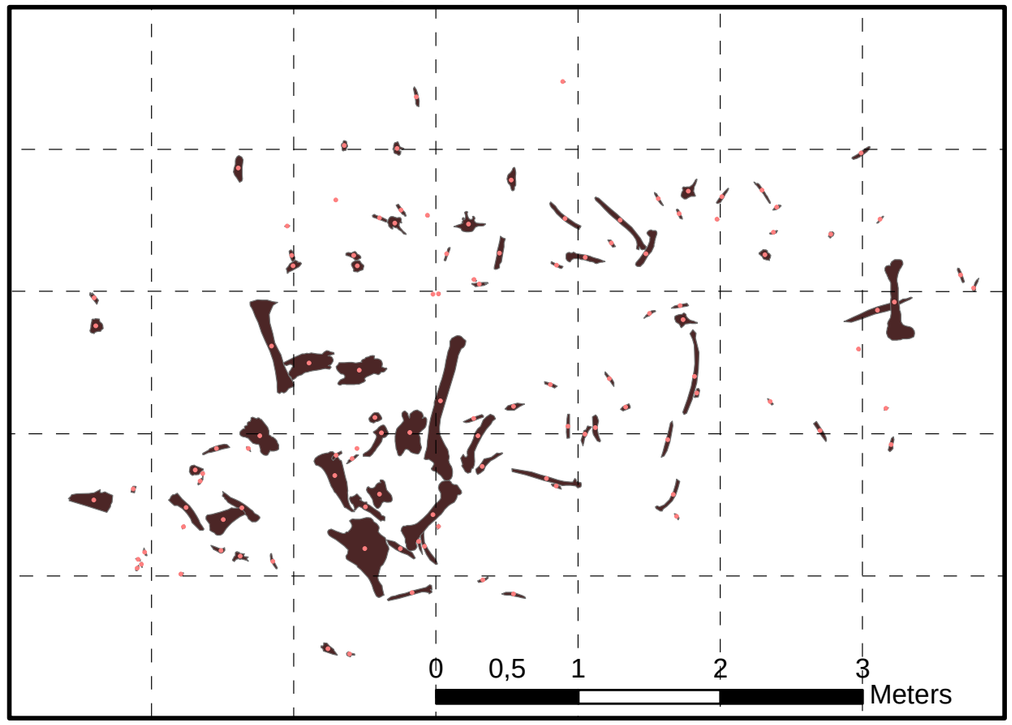


p) Spatial statistics

n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
148	0.841	176	9.14E-63	1.32E-85	9.86E-82	5.31E-94
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.875	5.14		0.303			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.865	4.446		0.433			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
301.011	21.157		8.735		10.266	

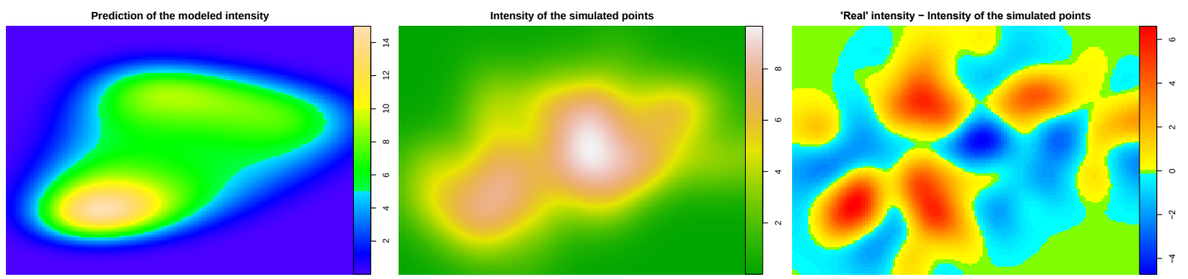
SF 8: Giraffe

a) Spatial point pattern including polygonal features

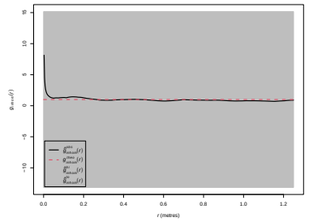


b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)

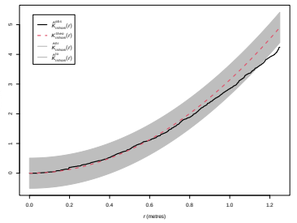
m) Spatial modeling



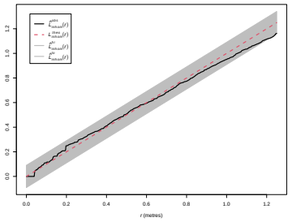
e) Pair Corr. Function



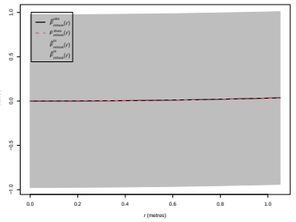
f) Inh. *K* function



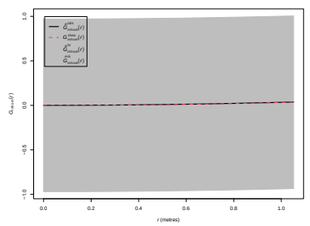
g) Inh. *L* function



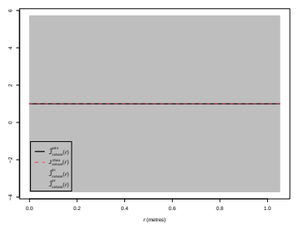
h) Inh. *F* function



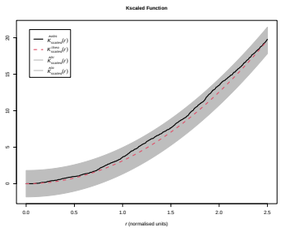
i) Inh. *G* function



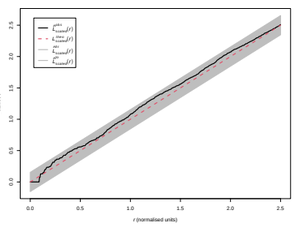
j) Inh. *J* function



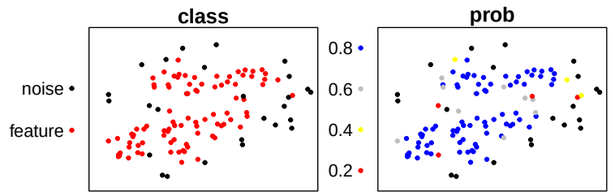
k) *K*-scaled function



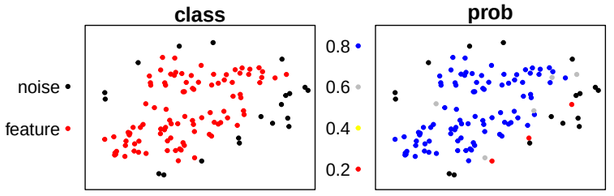
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

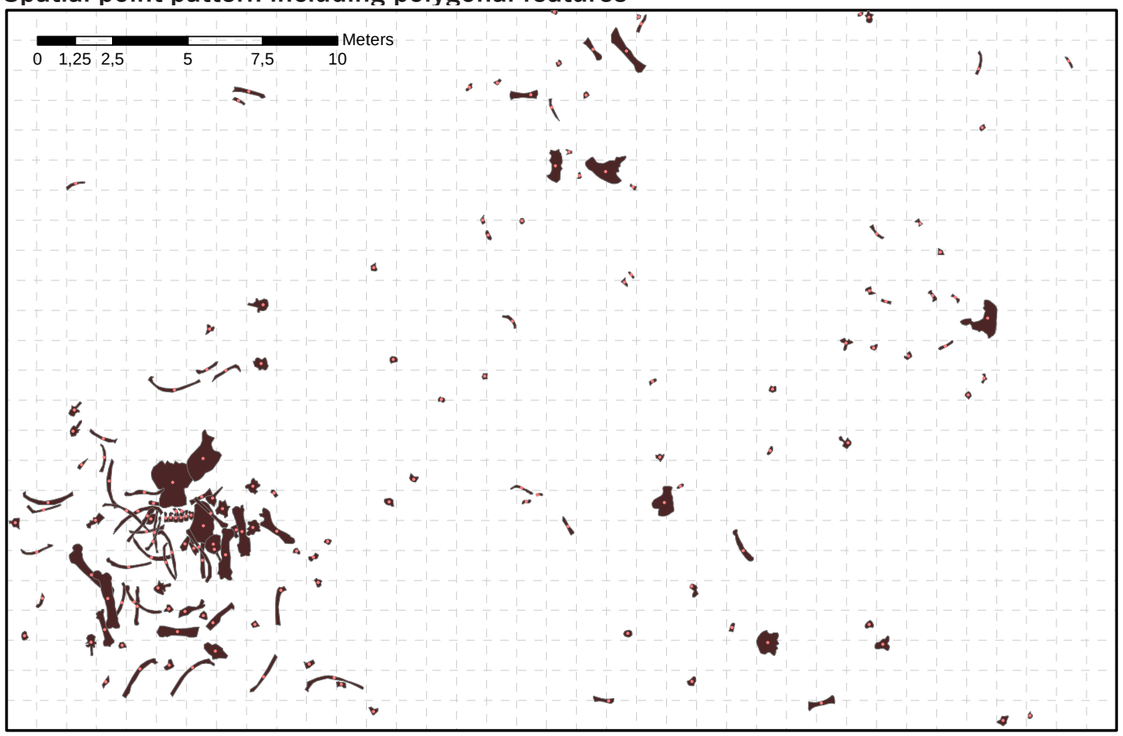


p) Spatial statistics

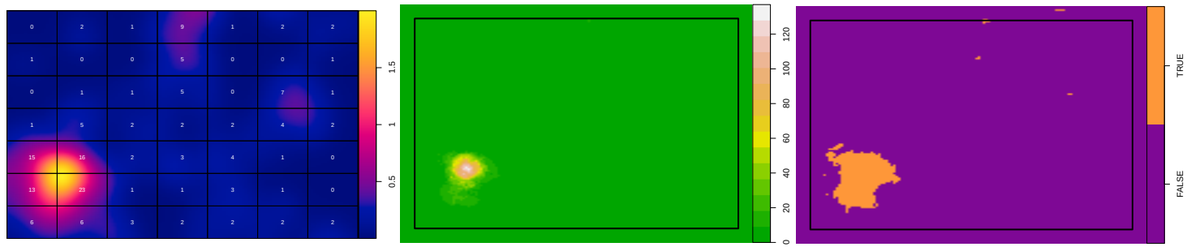
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
116	3.314	35	7.30E-14	6.55E-12	4.55E-10	1.97E-09
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.05	0.2	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.080	0.200
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.793	7.971		2.233			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.852	6.819		2.262			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
-41.713	-140.417		-139.682		-155.991	

SF 9: Haynes' (2005) elephant 1

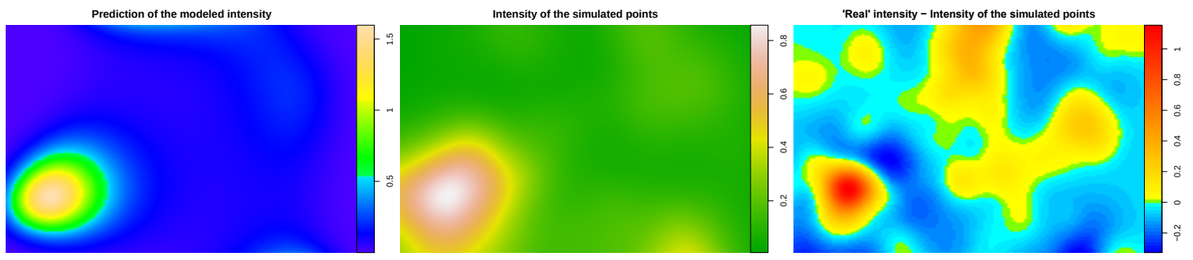
a) Spatial point pattern including polygonal features



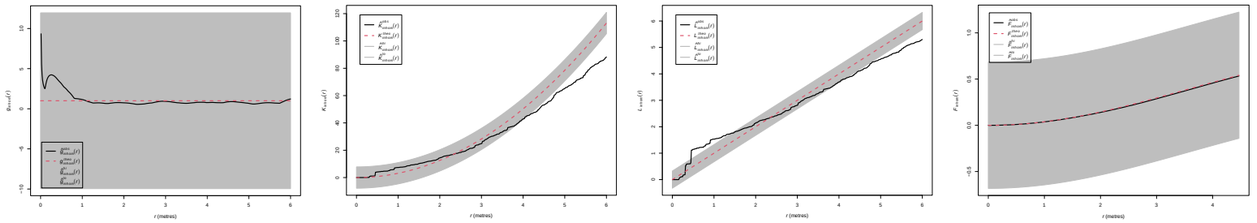
b) Kernel Smoothed Intensity c) Likelihood Ratio Test Stat. d) L. R. T. S. (p-value < 0.01)



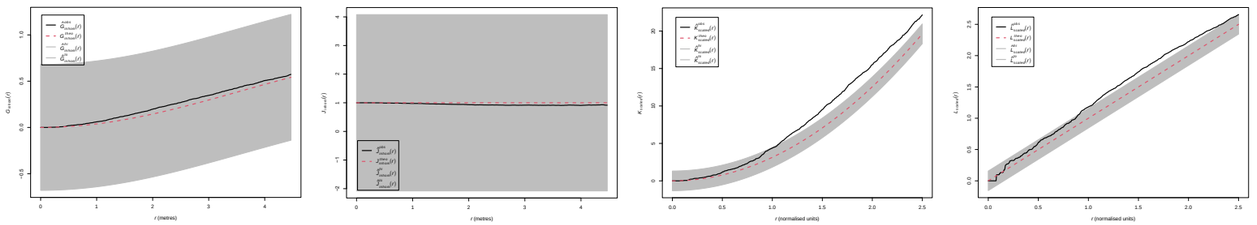
m) Spatial modeling



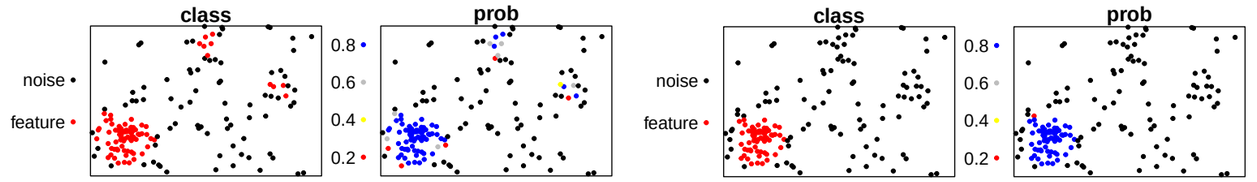
e) Pair Corr. Function f) Inh. *K* function g) Inh. *L* function h) Inh. *F* function



i) Inh. *G* function j) Inh. *J* function k) *K*-scaled function l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$) o) Nearest Neighbour Cleaning ($k = 10$)

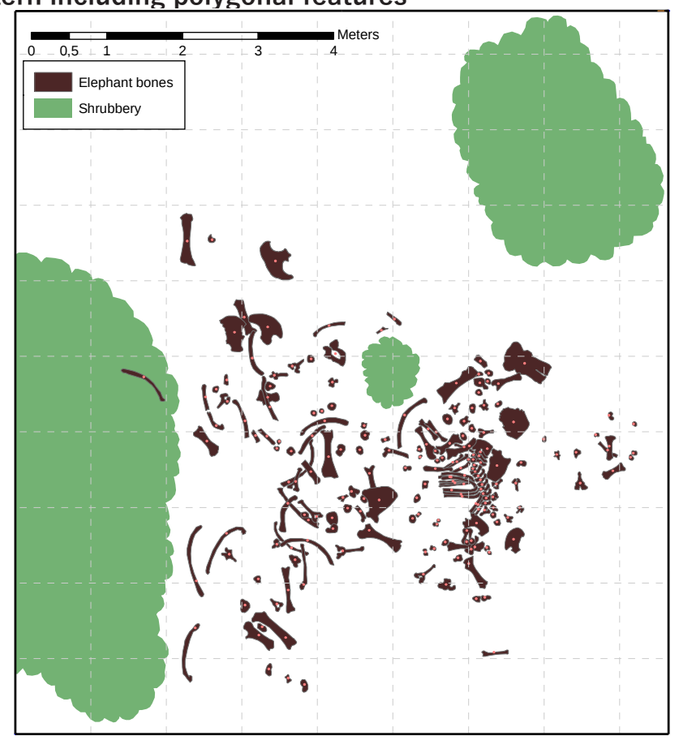


p) Spatial statistics

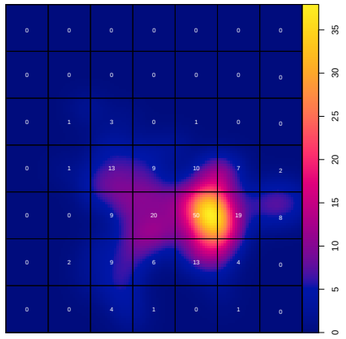
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
163	0.184	888	5.05E-49	1.02E-65	2.00E-60	1.07E-66
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	0.95	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.5	0.895		0.096			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.423	1.12		0.118			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
824.048	794.671		762.376		719.879	

SF 10: Haynes' (2005) elephant 2

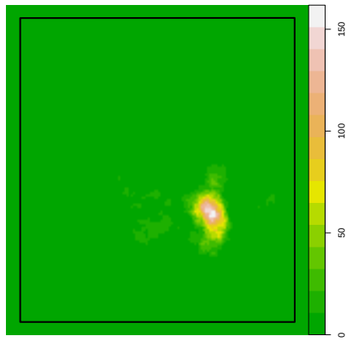
a) Spatial point pattern including polygonal features



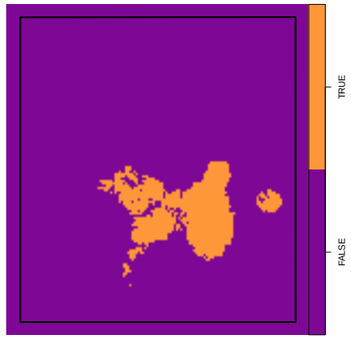
b) Kernel Smoothed Intensity



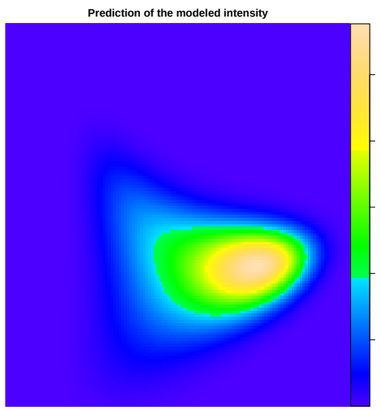
c) Likelihood Ratio Test Stat.

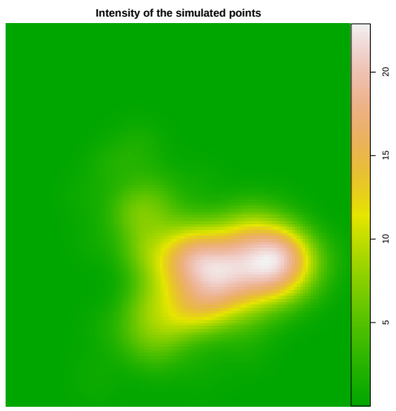


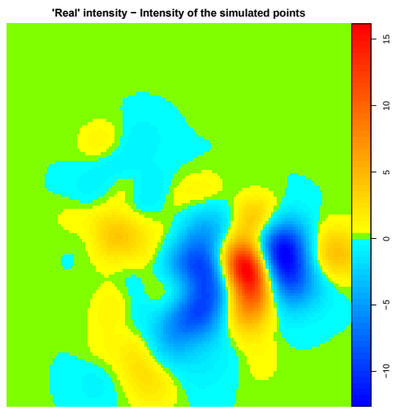
d) L. R. T. S. (p-value < 0.01)



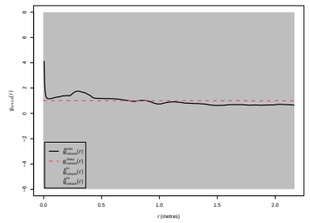
m) Spatial modeling



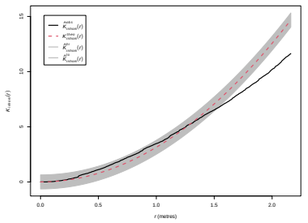




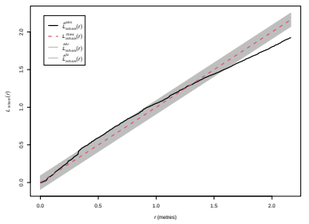
e) Pair Corr. Function



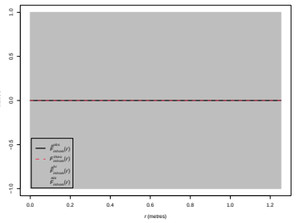
f) Inh. *K* function



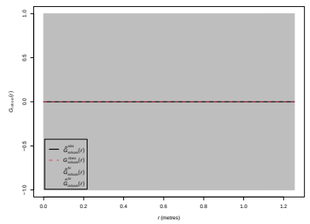
g) Inh. *L* function



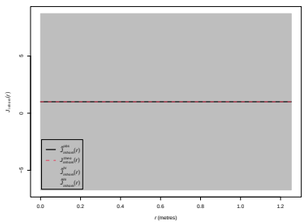
h) Inh. *F* function



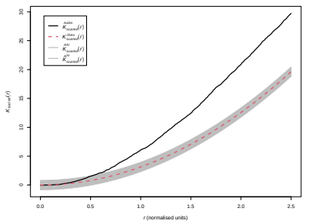
i) Inh. *G* function



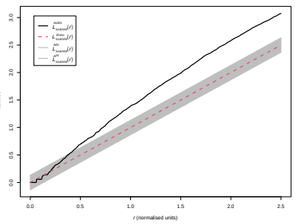
j) Inh. *J* function



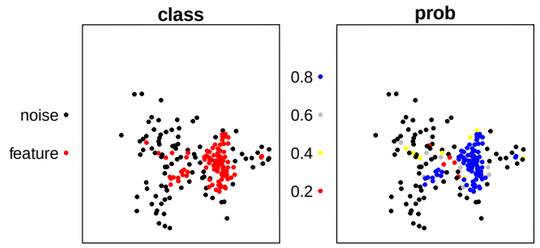
k) *K*-scaled function



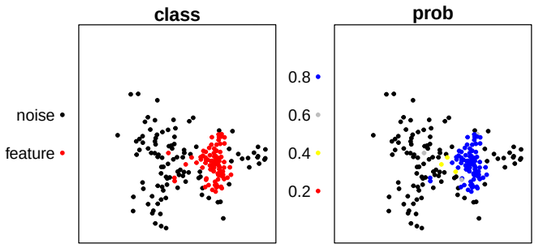
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

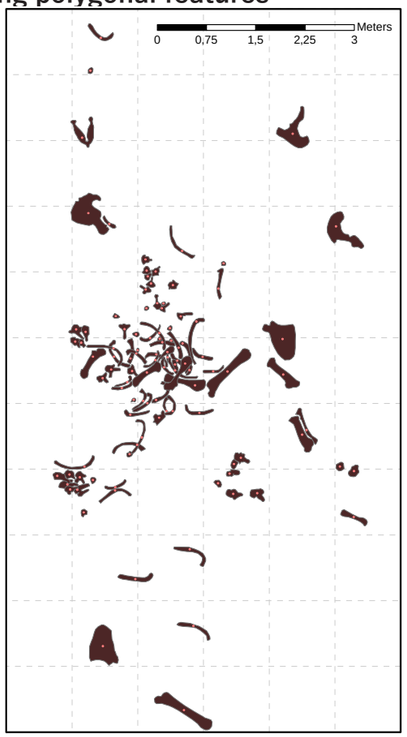


p) Spatial statistics

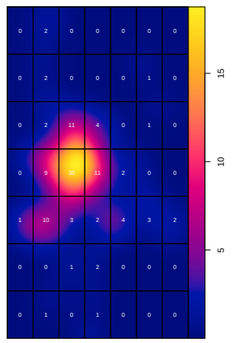
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
193	2.332	82.75	1.69E-148	1.19E-204	6.44E-160	3E-198
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.542	23.296		3.958			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.479	25.929		4.39			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
0.499	-404.328		-436.9		-450.629	

SF 11: White and Diedrich's (2012) elephant

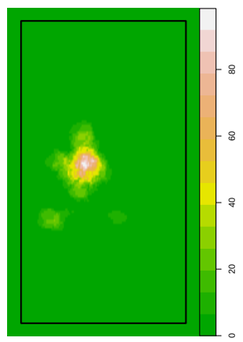
a) Spatial point pattern including polygonal features



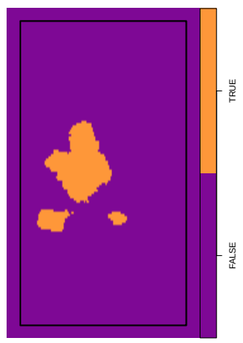
b) Kernel Smoothed Intensity



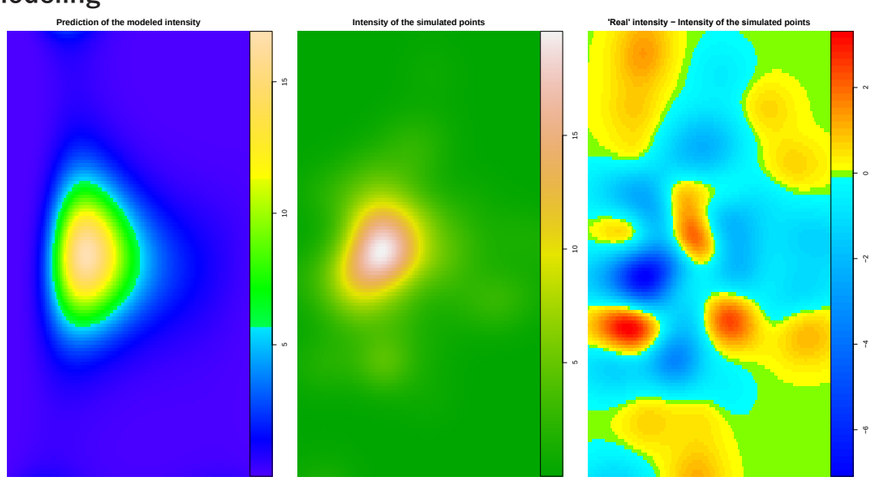
c) Likelihood Ratio Test Stat.



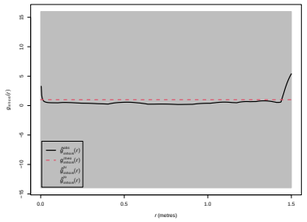
d) L. R. T. S. (p-value < 0.01)



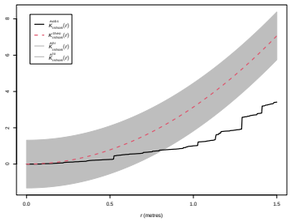
m) Spatial modeling



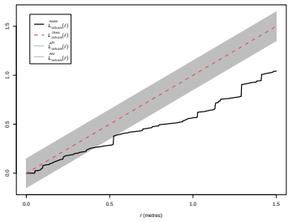
e) Pair Corr. Function



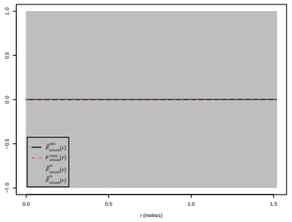
f) Inh. *K* function



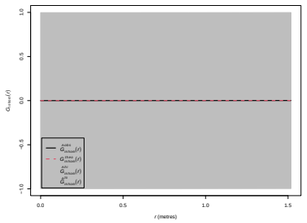
g) Inh. *L* function



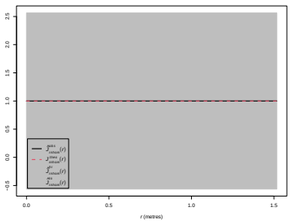
h) Inh. *F* function



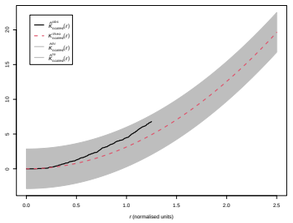
i) Inh. *G* function



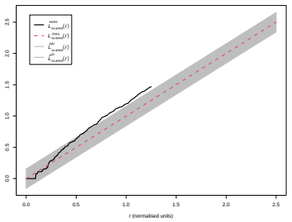
j) Inh. *J* function



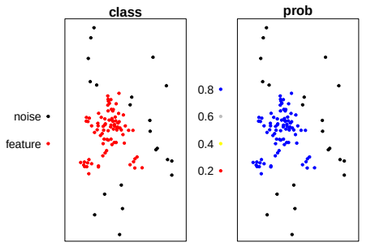
k) *K*-scaled function



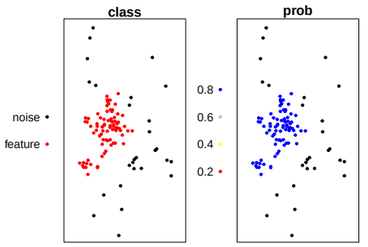
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

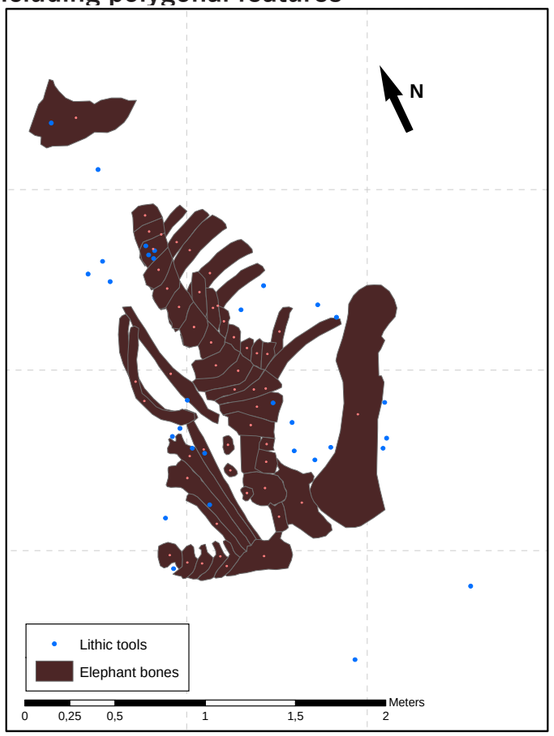


p) Spatial statistics

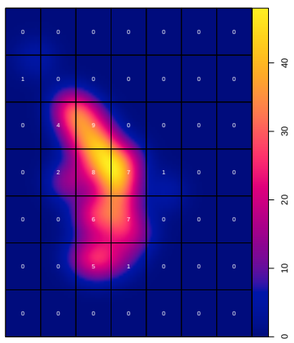
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
105	1.591	66	1.27E-53	8.49E-80	1.51E-79	2.28E-76
DCLF test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.05
MAD test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.8	10.082		0.431			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.743	10.4		0.739			
Model 1 (spp~ x + y)	Model 2 (spp~polynom(x,y,2)		Model 3 (spp~polynom(x,y,3)		Model 4 (spp~polynom(x,y,4)	
104.385	-68.746		-79.332		-87.753	

SF 12: Áridos 2 site (Santonja and Querol, 1980)

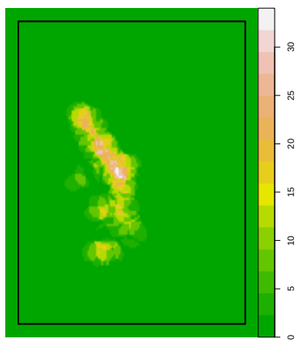
a) Spatial point pattern including polygonal features



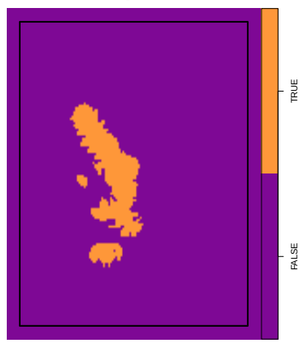
b) Kernel Smoothed Intensity



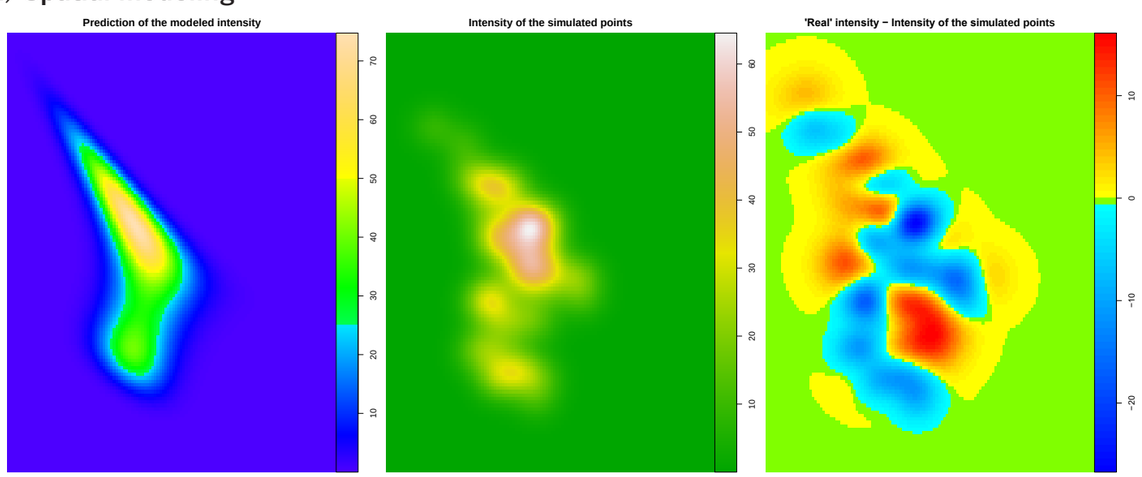
c) Likelihood Ratio Test Stat.



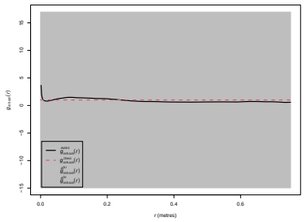
d) L. R. T. S. (p-value < 0.01)



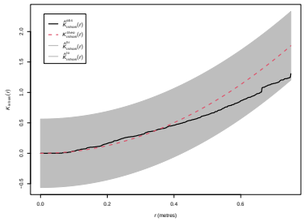
m) Spatial modeling



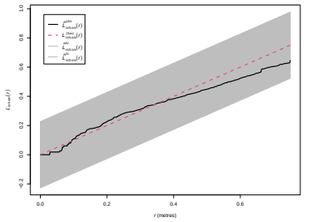
e) Pair Corr. Function



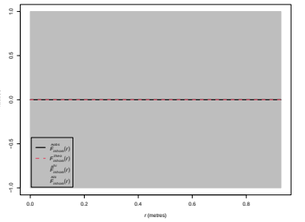
f) Inh. *K* function



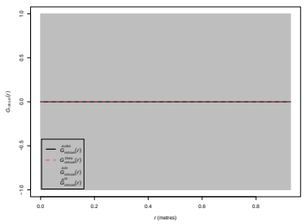
g) Inh. *L* function



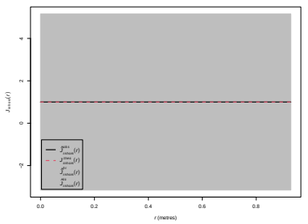
h) Inh. *F* function



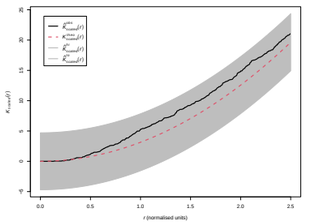
i) Inh. *G* function



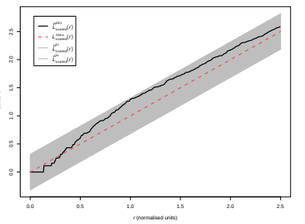
j) Inh. *J* function



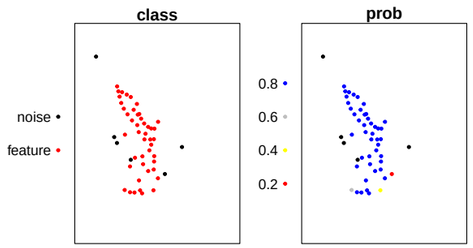
k) *K*-scaled function



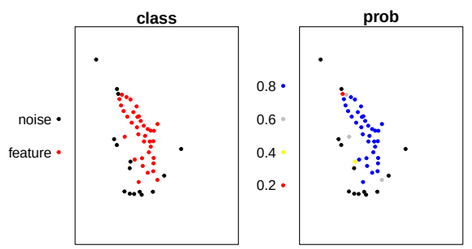
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

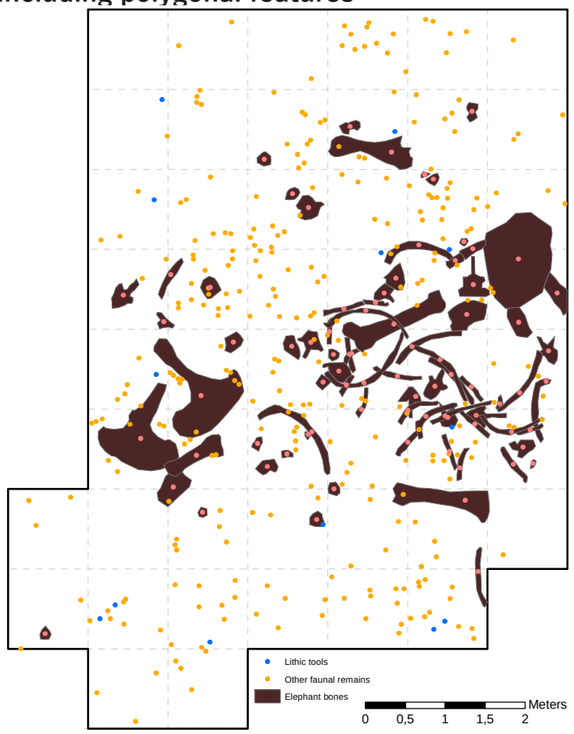


p) Spatial statistics

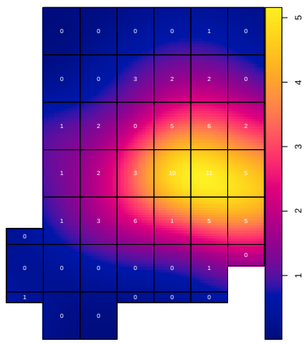
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
51	4.25	12	2.04E-27	4.08E-32	3E-35	7.35E-40
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.2	0.35	1	1	1	0.025	0.175
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.125	0.2	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.908	28.448		4.57			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.73	30.138		8.757			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
-47.894	-195.992		-198.552		-206.61	

SF 13: Marathousa 1 site (Panagopoulou et al. 2018)

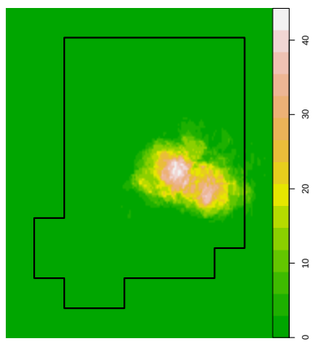
a) Spatial point pattern including polygonal features



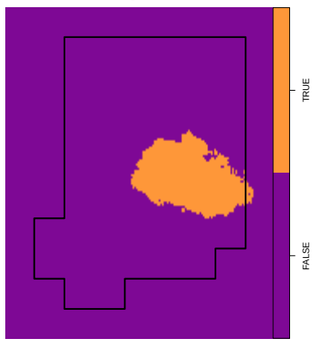
b) Kernel Smoothed Intensity



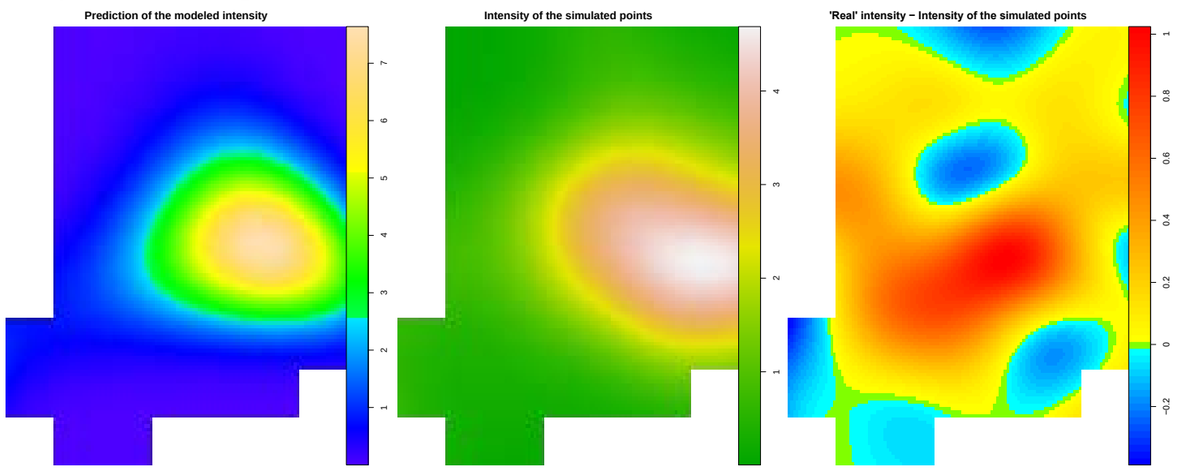
c) Likelihood Ratio Test Stat.



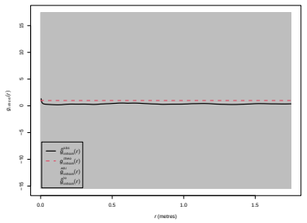
d) L. R. T. S. (p-value < 0.01)



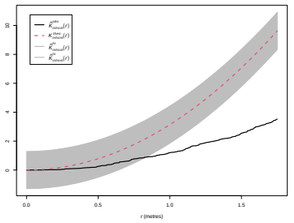
m) Spatial modeling



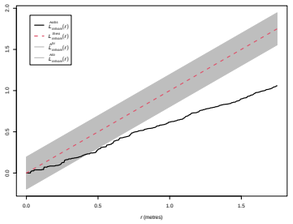
e) Pair Corr. Function



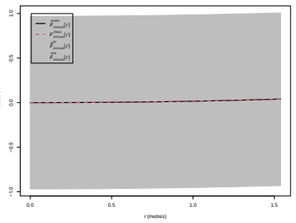
f) Inh. *K* function



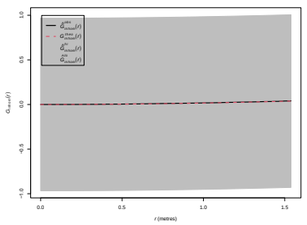
g) Inh. *L* function



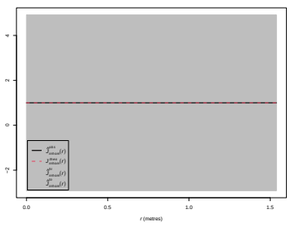
h) Inh. *F* function



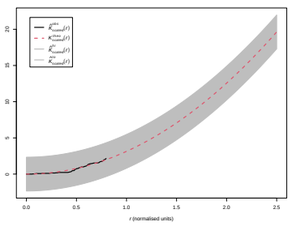
i) Inh. *G* function



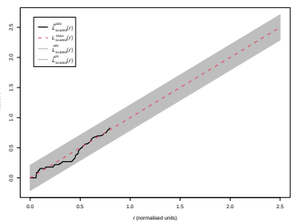
j) Inh. *J* function



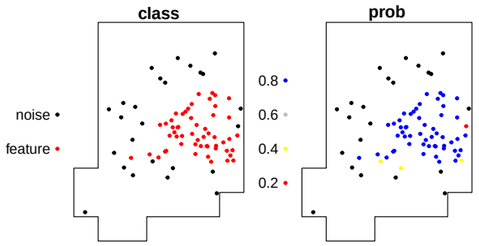
k) *K*-scaled function



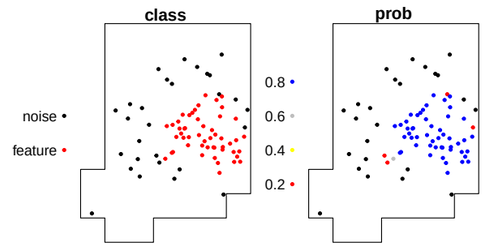
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)

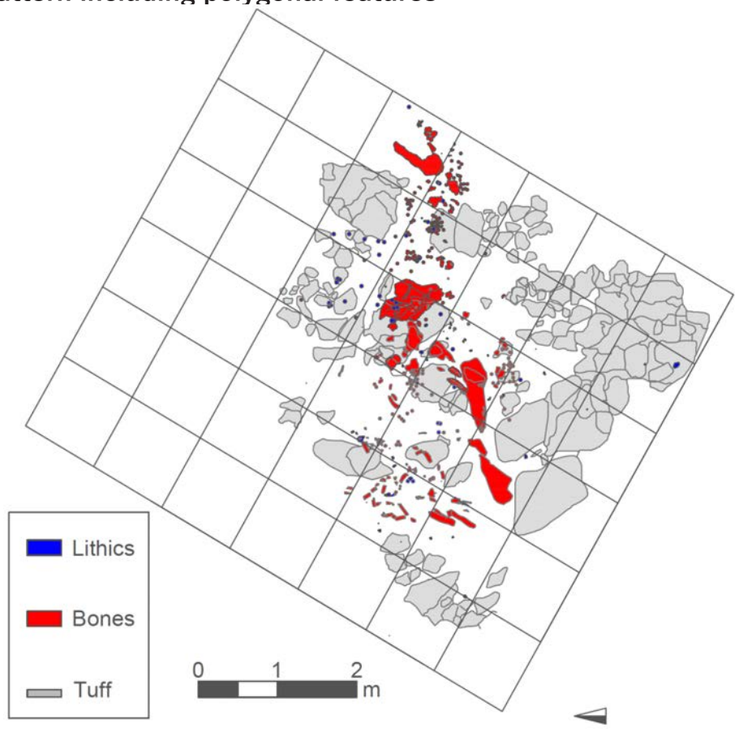


p) Spatial statistics

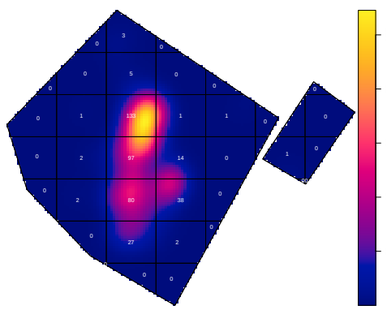
n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
79	1.549	51	1.54E-12	3.04E-08	2.25E-08	2.89E-05
DCLF test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	1	0.975
MAD test						
K	L	F	G	J	Kscaled	Lscaled
0.025	0.025	1	1	1	0.075	0.05
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.709	4.488		0.769			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	lambda [cluster]		Lambda [noise]			
0.663	4.688		0.949			
Model 1 (spp~ x + y)	Model 2 (spp~polynom(x,y,2)		Model 3 (spp~polynom(x,y,3)		Model 4 (spp~polynom(x,y,4)	
72.616	4.658		4.019		9.715	

SF 14: EAK site

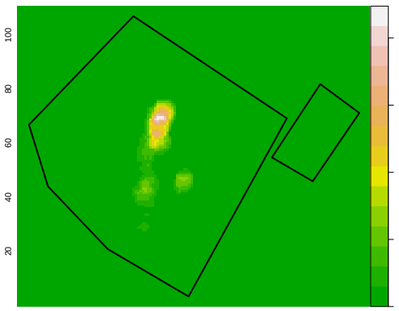
a) Spatial point pattern including polygonal features



b) Kernel Smoothed Intensity

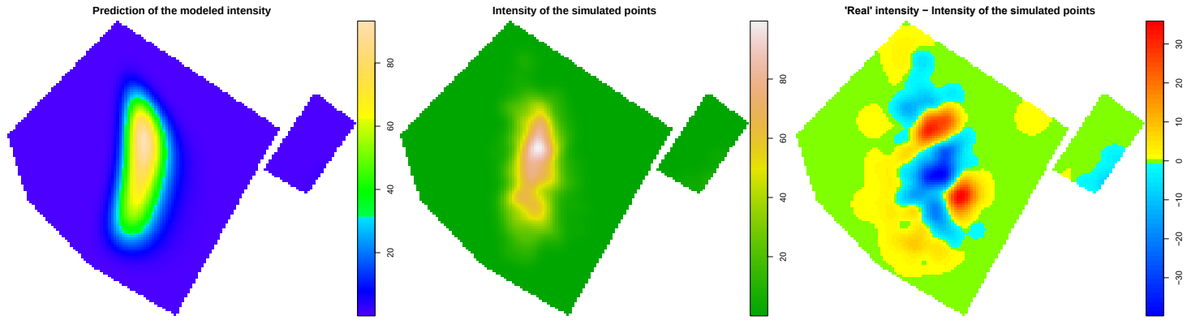


c) Likelihood Ratio Test Stat.

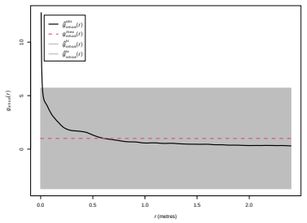


d) L. R. T. S. (p-value < 0.01)

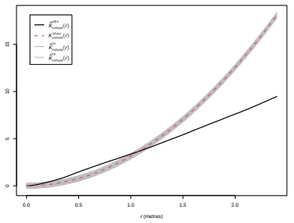
m) Spatial modeling



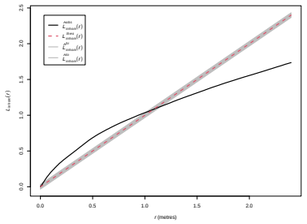
e) Pair Corr. Function



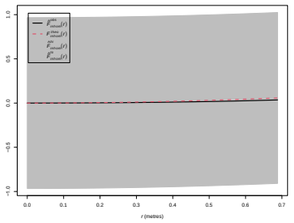
f) Inh. *K* function



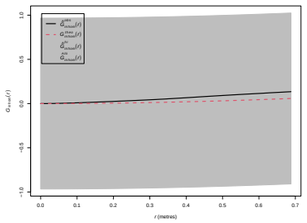
g) Inh. *L* function



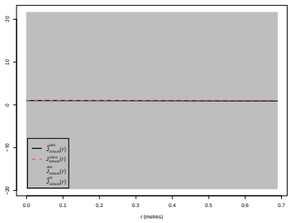
h) Inh. *F* function



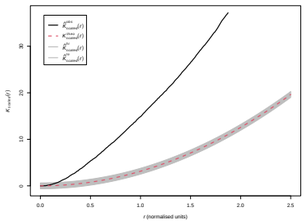
i) Inh. *G* function



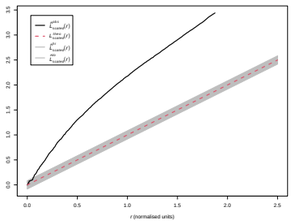
j) Inh. *J* function



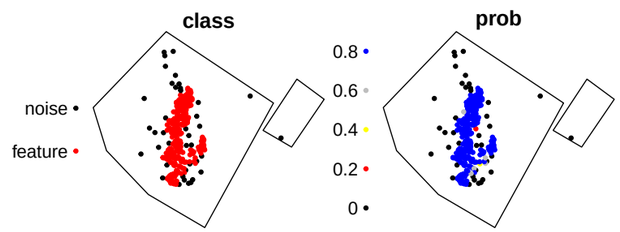
k) *K*-scaled function



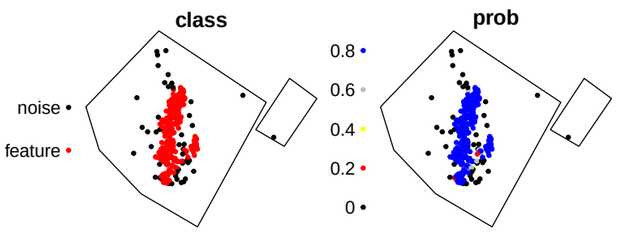
l) *L*-scaled function



n) Nearest Neighbour Cleaning ($k = 5$)



o) Nearest Neighbour Cleaning ($k = 10$)



p) Spatial statistics

n points	Intensity	Window area (m2)	χ2 (p-value)			
			5x5	8x8	10x10	12x12
407	7.743	52.57	2.48E-97	4.01E-243	0	0
DCLF test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
MAD test						
K	**L**	**F**	**G**	**J**	**Kscaled**	**Lscaled**
0.025	0.025	1	1	1	0.025	0.025
Nearest Neighbour Cleaning (k = 5)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.907	86.73		1.461			
Nearest Neighbour Cleaning (k = 10)						
p [cluster]	**lambda [cluster]**		**Lambda [noise]**			
0.894	83.382		2.534			
Model 1 (spp~ x + y)	**Model 2 (spp~polynom(x,y,2)**		**Model 3 (spp~polynom(x,y,3)**		**Model 4 (spp~polynom(x,y,4)**	
-861.53	-1990.689		-2076.402		-2100.389	

	Aridos_2	EAK	Elephant_1	Elephant_2	Elephant_3	Elephant_4	Elephant_5	Elephant_6	Giraffe	Haynes_1	Haynes_2	Marathousa	White-Diedrich
Linhom_ml	31.39043386	75.52220151	4.993983263	0.955046139	1.551930564	0.377142962	1.003630274	3.384217535	9.160284184	0.700405712	15.76642249	3.276474108	7.424491826
Linhom_mn	8.540385763	58.97631381	4.89294019	2.0434899	2.862376455	1.159068682	2.23675176	3.614867008	4.341843426	1.633815883	13.29846987	2.49748862	4.045054176
Linhom_mlg	4.253806523	7.745605347	0.347802971	0.11210397	0.112642846	0.08596412	0.242802851	0.858137858	3.329006799	0.185622449	2.340229366	1.612198052	1.627861311
Linhom_clust	7.379375081	9.750329139	14.35865613	8.51928917	13.77744459	4.387213673	4.133519312	3.943675838	2.751656797	3.773281281	6.737127016	2.032302485	4.560887206
Finhom_nn	28.3724432	37.46960719	55.63387797	32.85648347	54.47957633	16.89740376	16.12230923	15.45957572	10.61739445	14.65761762	25.96896236	8.125276938	17.92708662
pcf_index	3.42176522	2.838883979	6.869455438	2.318109441	6.606483824	3.034447852	2.496439348	2.920608021	0.746079378	1.905376516	3.225921484	1.136494223	3.549307578
pcf_index2	3.433039745	2.421435163	6.295833814	1.721730285	6.041596381	2.710306045	2.313914649	2.784249912	0.706498903	1.832428671	3.109613419	1.154714225	3.477889773
hopskel	0.038810381	0.047715442	0.084535428	0.057615715	0.01399854	0.102267048	0.146662125	0.0963353	0.139600715	0.316840245	0.017845067	0.296357401	0.18675292
quadrat_stat	263.1764717	3633.392062	1595.646159	804.2352976	733.5230751	600.9802002	801.6363639	813.297301	230.3103454	706.8834337	1397.587546	159.8792053	638.8095222
NND_index	0.602157563	0.441988152	0.502341976	0.403355056	0.453081936	0.427904775	0.448621242	0.456005405	0.514830968	0.538245023	0.539020463	0.547221721	0.474043482
M_area	2.775555496	61.73398665	107.5670793	301.5146767	91.94742587	395.4395641	267.5324943	63.03531921	19.76657147	565.9645687	26.60051122	32.53039486	27.03308928
M_perimeter	13.17443869	42.99150699	172.8572677	269.6714602	86.09820359	227.6377163	199.5398693	83.66809728	42.2259693	307.4229508	48.45360201	41.01616162	74.01446655
M_euler	256538	34828	323608	613320	588020	327271	340874	312260	161897	134606	544367	117770	179587
scatter_area	1.696066888	27.7127671	219.6586422	760.7079356	176.5227566	600.3386665	429.179566	79.8998225	17.3977665	730.593803	25.51026295	29.18033956	33.61711689
max_distance	2.643022339	7.103955073	29.05611745	39.7702451	31.41938583	39.92118304	27.28572735	13.90511517	6.36583231	39.7240694	6.790138118	8.442604493	10.30638248
mean_pairwise	0.799432694	1.711356115	8.099097449	14.37738597	8.014015265	9.831690431	8.168931818	3.432178377	2.271871036	13.88593993	2.134233654	2.377815464	2.209011613

Supplementary Table 2. Raw data from each of the variables used within the hyperframe, using all carcasses (modern and archaeological).

Carcass	PC1	PC2	PC3	PC4	TM	Survival	Time*
Aridos_2	2.761772372	0.117963004	1.385222602	0.551058365	-	-	-
EAK	4.866357808	-1.448380351	-4.175004863	0.078928491	-	-	-
Elephant_1	-0.591705161	-3.703808292	0.794899631	1.691262652	26.5	19.6	>1 year
Elephant_2	-3.515842229	-1.03190664	-1.191685754	-1.702155249	84.3	21.4	6 months
Elephant_3	-0.817097534	-4.000379801	1.632486822	-0.079502168	36.9	14.1	4 months
Elephant_4	-2.855626267	0.271828401	-0.831509205	-0.514613459	40	15	10 months
Elephant_5	-1.788535042	0.787229014	-0.384163252	-0.507875704	61.6	18.4	9 months
Elephant_6	0.385193309	0.672879198	0.80817478	-0.87609893	6.6	36.8	3.5 months
Giraffe	1.567819968	2.662769894	0.615632573	-0.637496649	5.3	40	>2 years
Haynes_1	-3.681620437	2.092247918	-1.663957862	1.985811657	-	-	-
Haynes_2	1.735024331	-0.586779748	0.947702385	-0.919175298	-	-	-
Marathousa	0.997918826	3.319196484	1.080276768	0.640663612	-	-	-
White-Diedrich	0.936340055	0.847140919	0.981925375	0.289192679	-	-	-

*Approximate time estimates provided by rangers and safari game drivers.

Supplementary Table 3. PCA scores on the first four components (comprising >90% of the sample variance) for each carcass, including also the taphonomic variables. TM, frequency of carnivore-modified bones. Survival, frequency of preserved carcass parts.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13
Linhom_ml	0.306109102	-0.07825513	-0.352161832	0.042385308	-0.191001881	0.128173977	-0.180789656	0.18938217	-0.45183648	-0.232812704	-0.418608056	-0.18450702	0.248664692
Linhom_mn	0.269284914	-0.103630267	-0.421880597	0.00026551	0.010310504	-0.018451156	0.174700192	0.327452018	0.053171564	-0.092003896	-0.006926022	0.000662165	-0.309511238
Linhom_mlg	0.346814204	0.021851365	-0.25626037	0.000799542	-0.228692002	-0.015575655	-0.325780388	0.007771397	-0.035936099	0.453140461	0.590591839	0.23288059	0.076957101
Linhom_clust	0.026382764	-0.440237578	-0.002422668	0.150982669	-0.111934886	-0.386157237	-0.144371519	-0.077407403	0.076681201	-0.031020837	0.044014392	-0.174459582	0.560574346
Finhom_nn	0.024347487	-0.440446612	0.004571084	0.15169738	-0.099657817	-0.393604066	-0.146776932	-0.02287065	0.088421085	0.031440198	-0.015062869	-0.296030219	-0.621290704
pcf_index	-0.015488318	-0.40963695	0.180900914	0.254563167	0.187084992	0.276567509	-0.004190756	0.067093828	-0.147617379	-0.004855502	0.094089718	0.275226468	0.081613245
pcf_index2	-0.000708013	-0.389815848	0.219530384	0.294753459	0.179740631	0.376675206	0.031013606	0.098679372	-0.225053972	0.158788359	0.009738982	0.062255448	-0.100706058
hopskel	-0.117719685	0.333794649	-0.034911723	0.48940521	0.30596392	-0.446728854	0.225653876	0.355192118	-0.325321217	0.066366773	0.183590908	-0.056660732	0.078852776
quadrat_stat	0.174133212	-0.215383739	-0.430492468	0.04520487	0.162292546	0.014233566	0.631992065	-0.274765509	0.208435715	-0.052401877	0.0487935	0.189083584	0.096945915
NND_index	0.142582114	0.156382404	0.261671229	0.506288947	-0.695043867	0.057881007	0.26033407	-0.069117192	0.144290378	-0.171323555	-0.008930853	0.094832556	-0.018353426
M_area	-0.325302354	0.053760252	-0.285998906	0.168828895	-0.175345839	0.403195882	0.026743043	0.331794375	0.244543124	0.377211111	-0.046438249	-0.336079306	0.012448377
M_perimeter	-0.356921052	-0.021476858	-0.231172787	0.102287996	-0.064875558	0.079882353	0.102880812	-0.560057511	-0.288855626	0.120387912	0.14405601	-0.38567283	0.033426312
M_euler	-0.167400907	-0.253588334	0.211445484	-0.506881752	-0.33714664	-0.112578431	0.455483028	0.359056987	-0.250377018	0.114715834	0.179621994	-0.070352278	0.096952124
scatter_area	-0.352751252	-0.006314737	-0.249094294	-0.023040171	-0.216823962	0.040017241	-0.122149471	-0.060102226	-0.384326253	-0.400838866	0.241929803	0.333020525	-0.241243539
max_distance	-0.36124405	-0.131195889	-0.147326631	0.059865233	0.042150404	0.030511331	-0.17814531	0.270866954	0.424966169	-0.443088326	0.249605609	0.022963413	0.184173529
mean_pairwise	-0.36234725	-0.089011636	-0.180751158	0.053043687	-0.144542181	-0.270738262	-0.061383365	0.002294106	0.035456585	0.375987542	-0.502629928	0.536655801	0.025586179

Supplementary Table 4. PCA variable loadings on the complete hyperframe variable set.

Carcass	Linhom_ml	Linhom_mn	Linhom_mlg	Linhom_clust	Finhom_nn	pcf_index	pcf_index2	hopskel	quadrat_stat	NND_index	M_area	M_perimeter	M_euler	scatter_area	max_distance	mean_pairwise	TM	Survival	Time
Elephant_1	4.993983263	4.89294019	0.347802971	14.35865613	55.63387797	6.869455438	6.295833814	0.084535428	1595.646159	0.502341976	107.5670793	172.8572677	323608	219.6586422	29.05611745	8.099097449	26.5	19.6	long
Elephant_2	0.955046139	2.0434899	0.11210397	8.51928917	32.85648347	2.318109441	1.721730285	0.057615715	804.2352976	0.403355056	301.5146767	269.6714602	613320	760.7079356	39.7702451	14.37738597	84.3	21.4	short
Elephant_3	1.551930564	2.862376455	0.112642846	13.77744459	54.47957633	6.606483824	6.041596381	0.01399854	733.5230751	0.453081936	91.94742587	86.09820359	588020	176.5227566	31.41938583	8.014015265	36.9	14.1	short
Elephant_4	0.377142962	1.159068682	0.08596412	4.387213673	16.89740376	3.034447852	2.710306045	0.102267048	600.9802002	0.427904775	395.4395641	227.6377163	327271	600.3386665	39.92118304	9.831690431	40	15	medium
Elephant_5	1.003630274	2.23675176	0.242802851	4.133519312	16.12230923	2.496439348	2.313914649	0.146662125	801.6363639	0.448621242	267.5324943	199.5398693	340874	429.179566	27.28572735	8.168931818	61.6	18.4	medium
Elephant_6	3.384217535	3.614867008	0.858137858	3.943675838	15.45957572	2.920608021	2.784249912	0.0963353	813.297301	0.456005405	63.03531921	83.66809728	312260	79.8998225	13.90511517	3.432178377	6.6	36.8	short
Giraffe	9.160284184	4.341843426	3.329006799	2.751656797	10.61739445	0.746079378	0.706498903	0.139600715	230.3103454	0.514830968	19.76657147	42.2259693	161897	17.3977665	6.36583231	2.271871036	5.3	40	long

Supplementary Table 5. Raw data for each of the hyperframe variables according to carcass. For time categorization, see Table S3.

Carcass	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Elephant_1	-0.122908896515716	3.636632634935990	1.760266698152790	0.464911442705206	-0.0157053948222152	-0.1741812967394140	2.089281533013570E-16
Elephant_2	-3.604688075861540	-1.505167461711720	-0.616449234547392	1.575476515810080	-0.3509003626085040	-0.1245067443409390	1.010923867158120E-16
Elephant_3	-1.493853725278670	2.901062822633980	-1.751162998105000	-0.545094626015553	0.4560310735939800	0.2590510722119920	4.214970204449810E-16
Elephant_4	-2.105674924157150	-2.090139561510080	0.473150630731035	-1.069383902574480	0.6270934474435320	-0.6131708196753160	5.242373573186430E-19
Elephant_5	-0.748891960691722	-1.766550167438790	0.926729710042918	-0.444863006900938	-0.1070948875622630	0.9159326963665760	5.660493367362330E-16
Elephant_6	2.472859636792320	-0.070081708798167	-0.482153219966518	-0.712654904430206	-1.2999967770809800	-0.2510606196754240	7.575398629575620E-16
Giraffe	5.603157945712470	-1.105756558111200	-0.310381586307823	0.731608481405894	0.6905729010364470	-0.0120642881474724	-7.639307083356350E-17

Supplementary Table 6. PCA scores for each modern carcass that we studied, including also the taphonomic variables.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Linhom_ml	0.2854621194748	0.0809876622738	0.0847500760338	0.3799664275205	0.2576908904198	-0.1965844896822	-0.2554302180678
Linhom_mn	0.2196272660326	0.2665643382505	0.1764236547728	0.3206476480756	-0.1814502582249	0.0069505779867	0.4038281245277
Linhom_mlg	0.2909200653076	-0.0761325675306	-0.0891029571029	0.2998324869627	0.3559893282601	-0.0800879937876	0.0749196794561
Linhom_clust	-0.1423448107020	0.3731974126395	-0.0244595528889	0.1998016661947	0.1513645248254	0.0117478099602	0.2496342759229
Finhom_nn	-0.1413971983815	0.3744619066028	-0.0363036225795	0.1884203836969	0.1534933079835	0.0273008058141	-0.2472460213667
pcf_index	-0.1203489007279	0.3862432283661	0.0660082657023	-0.2146527580405	0.0669550763616	-0.0282485778423	-0.2593656089607
pcf_index2	-0.1023900319720	0.3897830659007	0.0770253024667	-0.2658828945134	0.0601738297059	0.0013724893883	-0.2435880142587
hopskel	0.1717472866190	-0.2482834025793	0.5007550823317	-0.0754916977628	0.0331848141878	0.4294639713440	-0.0671635609491
quadrat_stat	-0.1167639485072	0.2802880333417	0.4897075070425	0.0903637682120	-0.4889497933931	-0.0514937799331	0.0310078860424
NND_index	0.2576725349566	0.1925324833257	0.2590994816423	0.0785860255588	0.3536294785159	0.1373758357595	0.1413751438969
M_area	-0.2441833083310	-0.2418608625999	0.2131103867494	-0.1274395295859	0.2071823263035	-0.2324559567287	0.2983165413179
M_perimeter	-0.2665361652179	-0.1473772833547	0.3350888776301	0.2130700783141	-0.0661396233536	-0.1668437635629	0.1745573648900
M_euler	-0.2560148566850	0.0894276473554	-0.4409910854349	0.2186335779169	-0.1649679208691	0.2254807225925	0.3278588705824
scatter_area	-0.2691261340249	-0.2062541150913	0.1113471885475	0.2186521143254	0.0603888334740	-0.2132608228952	-0.3245957308129
max_distance	-0.3140595942958	-0.0065762224055	0.0709296666771	-0.0153947099653	0.2284338634080	-0.2814071455002	0.0966292923538
mean_pairwise	-0.3027637233529	-0.0507833655882	0.0381453997913	0.3285139399947	0.0752883361953	-0.1000109086120	-0.1323169006473
TM	-0.2709035381060	-0.1312211732756	0.0054934155568	0.3516743845226	0.0047928429684	0.6199893724866	-0.2456008431729
survival	0.2802933409121	-0.0900266708298	-0.1129457428334	0.2481851789621	-0.4670193276756	-0.3089863499191	-0.2665910799210

Supplementary Table 7. Variable loadings on each of the PCA components for the analysis of carcasses in analytical Stage 2 (modern carcasses in this study) (See text for additional explanation).

carcass	Linhom_ml	Linhom_mn	Linhom_mlg	Linhom_clust	Finhom_nn	pcf_index	pcf_index2	hopskel	quadrat_stat	NND_index	M_area	M_perimeter	M_euler	scatter_area	max_distance	mean_pairwise
Aridos_2	30.760673053	17.838342751	0.510000000	60.315045192	231.693582463	12.264462431	10.735690432	0.002424638	1454.549019608	0.597211997	21.988850311	22.377622378	63237	1.696066888	2.643022339	0.799432694
EAK	75.647141096	59.976422715	4.070470953	18.584370695	71.398067550	5.983819937	5.227338969	0.013921083	7688.331695332	0.441073168	60.600762873	36.398601399	31860	27.712767100	7.103955073	1.711356115
Elephant_1	8.798988051	7.267131533	0.987744472	8.908162283	34.141758054	3.329715106	3.097696146	0.043550194	744.434343434	0.532839513	32.833862305	67.539062500	394999	35.098082540	8.901614738	2.685409183
Elephant_2	1.716383442	1.600250177	0.320740301	5.351318302	20.604054261	2.524014048	2.314615825	0.045342611	98.500000000	0.444060273	25.384758071	40.682196339	268406	17.248063666	7.157599546	2.596594881
Elephant_3	2.510698235	2.307066131	0.504547046	4.976142970	19.289139769	2.528123490	2.381998529	0.088087426	251.840000000	0.487887647	37.421977065	50.292598967	210148	27.011413317	8.862164343	2.700364886
Elephant_4	0.983444971	1.021056003	0.539269591	1.823661093	7.127915482	0.511878159	0.499755004	0.361330839	116.188679245	0.512034751	66.188131412	51.902654867	68928	65.663934393	11.259512738	4.654985519
Elephant_5	2.372439403	2.319108257	1.026037405	2.312234810	9.023231542	0.697092829	0.625822388	0.210172280	270.287128713	0.512312784	69.610372798	64.322469983	103129	66.022448500	11.371832262	4.068055831
Elephant_6	5.822977403	5.444533935	1.422751018	4.092759260	15.752341100	1.532614829	1.456750070	0.072650366	464.422535211	0.521802043	44.214924317	64.870801034	332963	43.131422000	9.645527720	3.147830543
Giraffe	7.123507323	7.230919347	1.137347293	6.263264850	24.003654710	3.041275664	2.947052285	0.007497937	690.543859649	0.466244659	22.260407448	29.593147752	676575	16.831327000	5.922939220	2.221558646
Haynes_1	1.561988863	1.574634131	0.787277285	1.984039034	7.692573907	0.784557130	0.762900201	0.541508618	142.153846154	0.592479121	81.051780267	39.592760181	37044	66.251457872	11.532460162	3.750189677
Haynes_2	15.696172627	15.019048309	1.931091737	8.128134116	31.240991199	3.623315148	3.463343454	0.013547035	1487.725388601	0.538481174	27.898602817	48.276573787	675065	25.510262954	6.790138118	2.134233654
Marathousa	3.708775200	3.698052221	0.791689265	4.684634952	18.033987570	2.505353561	2.510075454	0.065505366	358.810126582	0.558758176	36.031455644	42.769953052	260018	29.180339563	8.442604493	2.377815464
White-Diedrich	9.846663634	8.039351478	1.041565252	9.453717484	36.370067769	4.012111687	3.803477478	0.052610926	751.769230769	0.537614652	30.538924984	62.747804266	439785	31.307699474	9.252806154	2.149971410

Supplementary Table 8. Raw data for each of the hyperframe variables according to carcass, excluding window effects (see text).

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13
Aridos_2	6.589756022	1.932351471	-3.261656941	-0.07037036	-0.287087382	0.228971617	-0.070980854	0.016950604	0.012001381	0.006250544	-0.001486877	-0.00010496	-1.78871E-16
EAK	4.067945085	-5.490873136	0.724379216	0.233190936	-0.115763743	-0.14193018	0.027831451	-0.014809128	-0.011288285	0.001402628	0.002900052	0.003062617	4.40042E-16
Elephant_1	-0.352803003	0.652714653	0.648391358	-1.314745584	-0.407126962	0.034585712	0.190109614	-0.150884815	0.035814358	-0.102517913	0.017726898	0.038447685	-3.0252E-16
Elephant_2	0.000543363	1.243901379	1.217459925	1.583476808	-0.896525063	-0.187666425	0.109573174	-0.026680345	0.139094025	-0.022682266	0.050803011	-0.025317575	-7.31422E-17
Elephant_3	-0.681771628	0.746294508	0.469151899	0.540646007	-0.746648383	-0.427895828	0.125336434	0.085325106	0.022292148	-0.005286247	-0.094098071	0.006869612	-4.83329E-16
Elephant_4	-3.527544148	-0.740766759	-1.304569997	0.57953814	-0.372081642	0.574713936	0.068801362	-0.324424529	-0.090312748	0.044497617	-0.014069822	-0.006128834	-4.70327E-17
Elephant_5	-3.181467009	-0.930855462	-0.671221355	-0.439746219	-0.741829654	0.37890788	-0.317912091	0.267542154	-0.095517937	-0.064446962	0.008398543	-0.015858223	-7.05957E-17
Elephant_6	-1.441572218	-0.000712841	0.683359435	-0.926813946	-0.281981247	0.084490917	-0.292768454	0.044074286	0.198083289	0.114097545	0.008761709	0.018185301	-3.10187E-16
Giraffe	1.055203802	1.277974018	2.051732538	1.31390186	0.877300547	0.527847063	-0.007696717	0.125249683	-0.113062081	0.014909189	0.006267717	0.030934339	-1.82167E-16
Haynes_1	-3.417427527	-0.908789318	-2.763741835	0.483410614	1.324058127	-0.292604066	0.228690382	0.108607415	0.104671331	-0.014600655	0.011908705	0.007858924	-4.58317E-16
Haynes_2	1.083740818	0.476197929	1.533491573	-0.767365736	1.272407944	0.307600553	-0.086732511	-0.08811619	0.098337513	-0.041099915	-0.031584095	-0.039111468	8.41585E-17
Marathousa	-0.318555049	0.950635209	0.028896496	0.054070447	0.440463408	-0.877104392	-0.444460798	-0.143694949	-0.147593834	-0.000127953	0.013938964	0.000960449	-3.19295E-16
White-Diedrich	0.123951494	0.79192835	0.644327687	-1.269192968	-0.065185948	-0.209916786	0.470209008	0.100860708	-0.152519162	0.069604386	0.020533266	-0.019797866	-2.73896E-16

Supplementary Table 9. PCA scores for archaeological and modern carcasses, including also the taphonomic variables. Window effects were removed (see text).

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13
Linhom_ml	0.306109102	-0.07825513	-0.352161832	0.042385308	-0.191001881	0.128173977	-0.180789656	0.18938217	-0.45183648	-0.232812704	-0.418608056	-0.18450702	0.248664692
Linhom_mn	0.269284914	-0.103630267	-0.421880597	0.00026551	0.010310504	-0.018451156	0.174700192	0.327452018	0.053171564	-0.092003896	-0.006926022	0.000662165	-0.309511238
Linhom_mlg	0.346814204	0.021851365	-0.25626037	0.000799542	-0.228692002	-0.015575655	-0.325780388	0.007771397	-0.035936099	0.453140461	0.590591839	0.23288059	0.076957101
Linhom_clust	0.026382764	-0.440237578	-0.002422668	0.150982669	-0.111934886	-0.386157237	-0.144371519	-0.077407403	0.076681201	-0.031020837	0.044014392	-0.174459582	0.560574346
Finhom_nn	0.024347487	-0.440446612	0.004571084	0.15169738	-0.099657817	-0.393604066	-0.146776932	-0.02287065	0.088421085	0.031440198	-0.015062869	-0.296030219	-0.621290704
pcf_index	-0.015488318	-0.40963695	0.180900914	0.254563167	0.187084992	0.276567509	-0.004190756	0.067093828	-0.147617379	-0.004855502	0.094089718	0.275226468	0.081613245
pcf_index2	-0.000708013	-0.389815848	0.219530384	0.294753459	0.179740631	0.376675206	0.031013606	0.098679372	-0.225053972	0.158788359	0.009738982	0.062255448	-0.100706058
hopskel	-0.117719685	0.333794649	-0.034911723	0.48940521	0.30596392	-0.446728854	0.225653876	0.355192118	-0.325321217	0.066366773	0.183590908	-0.056660732	0.078852776
quadrat_stat	0.174133212	-0.215383739	-0.430492468	0.04520487	0.162292546	0.014233566	0.631992065	-0.274765509	0.208435715	-0.052401877	0.0487935	0.189083584	0.096945915
NND_index	0.142582114	0.156382404	0.261671229	0.506288947	-0.695043867	0.057881007	0.26033407	-0.069117192	0.144290378	-0.171323555	-0.008930853	0.094832556	-0.018353426
M_area	-0.325302354	0.053760252	-0.285998906	0.168828895	-0.175345839	0.403195882	0.026743043	0.331794375	0.244543124	0.377211111	-0.046438249	-0.336079306	0.012448377
M_perimeter	-0.356921052	-0.021476858	-0.231172787	0.102287996	-0.064875558	0.079882353	0.102880812	-0.560057511	-0.288855626	0.120387912	0.14405601	-0.38567283	0.033426312
M_euler	-0.167400907	-0.253588334	0.211445484	-0.506881752	-0.33714664	-0.112578431	0.455483028	0.359056987	-0.250377018	0.114715834	0.179621994	-0.070352278	0.096952124
scatter_area	-0.352751252	-0.006314737	-0.249094294	-0.023040171	-0.216823962	0.040017241	-0.122149471	-0.060102226	-0.384326253	-0.400838866	0.241929803	0.333020525	-0.241243539
max_distance	-0.36124405	-0.131195889	-0.147326631	0.059865233	0.042150404	0.030511331	-0.17814531	0.270866954	0.424966169	-0.443088326	0.249605609	0.022963413	0.184173529
mean_pairwise	-0.36234725	-0.089011636	-0.180751158	0.053043687	-0.144542181	-0.270738262	-0.061383365	0.002294106	0.035456585	0.375987542	-0.502629928	0.536655801	0.025586179

Supplementary Table 10. Variable loadings on each of the PCA components for the analysis of carcasses in analytical Stage 3 (reducing the window effects) (See text for additional explanation).