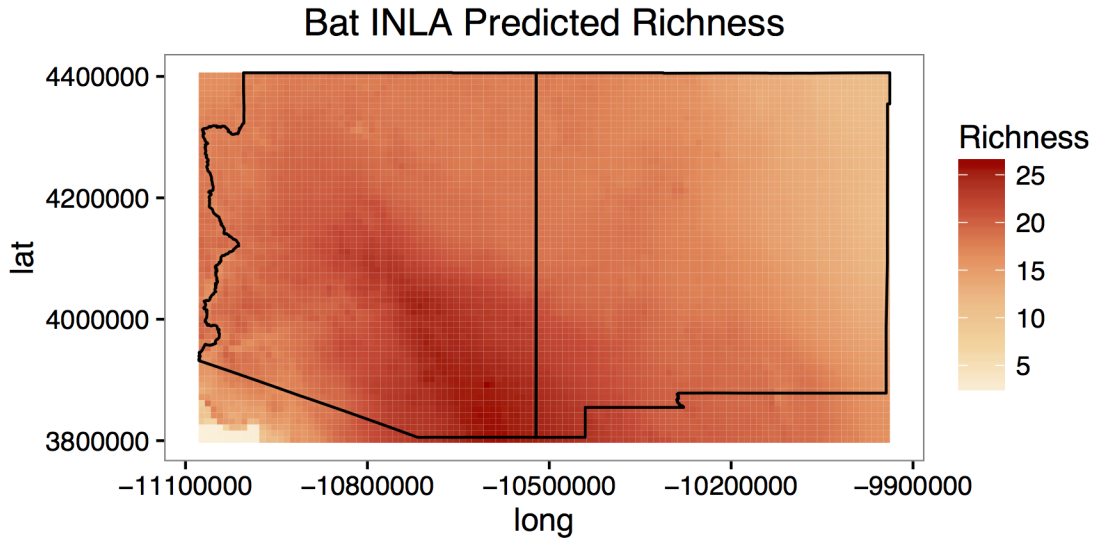Integrated nested Laplace approximation (INLA) prediction of bat species richness on a 10 kilometer grid in Arizona and New Mexico using the INLA package in R.

Bat INLA Predicted Richness

Call:
c("inla(formula = form, family = \"poisson\", data = trdf, control.compute = list(dic = TRUE, ", "
waic = TRUE, cpo = TRUE), control.predictor = list(compute = TRUE))")

Time used:
Pre-processing	Running inla	Post-processing	Total
1.0053	19.6244	0.6048	21.2346

Fixed effects:

		mean	sd	0.025quant	0.5quant	0.975quant	mode	kld
(Intercept)		0.7993	0.1447	0.512	0.8004	1.0805	0.8026	0
tempmean	Annual temp	0.0282	0.003	0.0223	0.0282	0.0341	0.0282	0
precipmean	Annual precipitation	0.0005	0.0001	0.0004	0.0005	0.0007	0.0005	0
NPPlogmean	Log NPP	0.0336	0.014	0.0061	0.0337	0.0611	0.0337	0
ETOPO1mean	Elevation	0.3175	0.035	0.2488	0.3175	0.3863	0.3175	0
ETOPO1stde	Elevation STDE	1.332	0.2696	0.7992	1.3331	1.858	1.3354	0
tempseasme	Annual temp STDEV	0	0	0	0	0.0001	0	0

		mean	sd	0.025quant	0.5quant	0.975quant	mode	kld
precipseas	Annual precipitation STDEV	0.0025	0.0007	0.0011	0.0025	0.0038	0.0025	0
ETOPO1mean:ETOPO1stde -		0.5015	0.1198	-0.7359	-0.5017	-0.2657	-0.5023	0

Random effects:
Name   Model
 idx   Besags ICAR model

Model hyperparameters:
            mean   sd 0.025quant 0.5quant 0.975quant   mode
Precision for idx 284.13 24.25   239.72   283.02   334.85 280.77

Expected number of effective parameters(std dev): 238.53(12.85)
Number of equivalent replicates : 29.15

Deviance Information Criterion (DIC) ...: 33903.05
Effective number of parameters ....: 238.58

Watanabe-Akaike information criterion (WAIC) ...: 33687.13
Effective number of parameters ....: 21.81

Marginal log-Likelihood: -21031.72
CPO and PIT are computed

Posterior marginals for linear predictor and fitted values computed

References
Bat richness
from US National Atlas Bat Ranges geospatial data set (available at
https://catalog.data.gov/dataset/north-american-bat-ranges-direct-download)

QGIS – trimming of US National Atlas Bat Ranges to Arizona and New Mexico
Quantum GIS Development Team (YEAR). Quantum GIS Geographic Information System. Open
Source Geospatial Foundation Project. http://qgis.osgeo.org"

INLA model
Havard Rue, Sara Martino, and Nicholas Chopin (2009). Approximate Bayesian Inference for Latent
Gaussian Models Using Integrated Nested Laplace Approximations (with discussion). Journal of the
Royal Statistical Society B, 71, 319-392.

Thiago G. Martins, Daniel Simpson, Finn Lindgren and Havard Rue (2013). Bayesian computing with
INLA: New features Computational Statistics and Data Analysis, 67(2013) 68-83

Finn Lindgren, Havard Rue, and Johan Lindstrom (2011). An Explicit Link Between Gaussian Fields
and Gaussian Markov Random Fields: The Stochastic Partial Differential Equation Approach (with
discussion). Journal of the Royal Statistical Society B, 73(4), 423-498.

Finn Lindgren, Havard Rue (2015). Bayesian Spatial Modelling with R-INLA. Journal of Statistical Software, 63(19), 1-25. URL http://www.jstatsoft.org/v63/i19/.