MODELING RESOURCE SELECTION

CREATING A PREDICTIVE MAP

U.S. Fish & Wildlife Service
National Conservation Training Center
Shepherdstown, West Virginia

Learn How To…

Use ArcGIS to extract resource variables for data analysis in R

Use a mixed-effects logistic regression in R to create resource selection functions (RSF)

Create a predictive map from the estimated resource selection functions

Resource Selection Function (RSF)

A statistical model (i.e., an equation) that estimates the relative probability of use

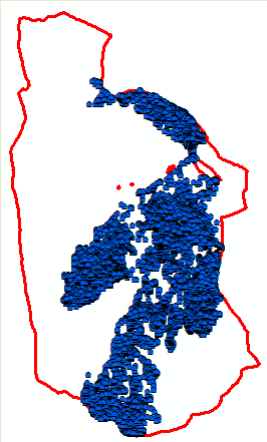
$$RSF = EXP(\beta_1 X_1 + \beta_2 X_2 .... B_p X_p)$$

Used to predict species distribution, abundance and resource preference

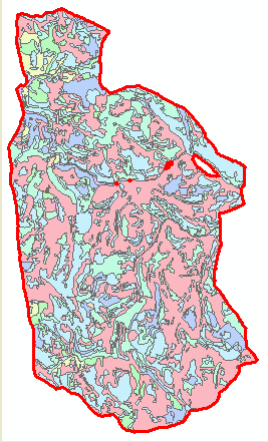
Study Site

Mule Deer Vector Datasets

- 7 Deer (Aug-Oct, 2008)
- 38,235 GPS Collar locations



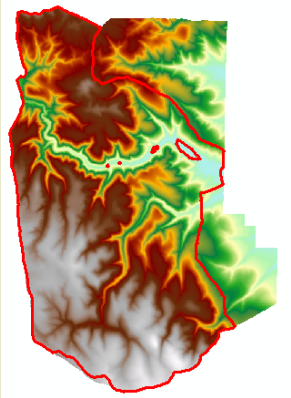
- 8 Habitat Types



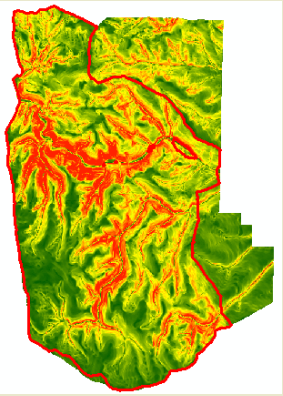
Mule Deer Raster Datasets

Distance to Roads

Elevation

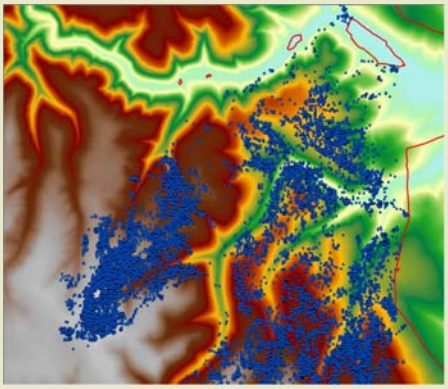


Slope

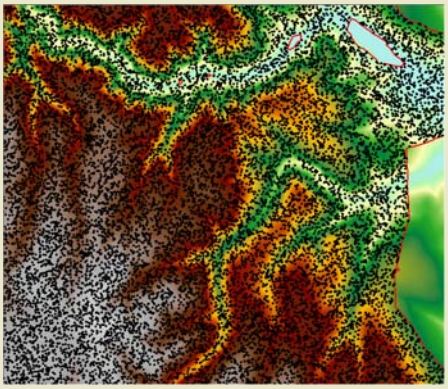


Step 1 – Extract Values to Points

What was Used



What was Available



Step 2 – Compile Dataset for R

Table

Eric_Data.csv

OBJECTID	roads	elevation	slope	Hab_type	Used	RADIO
25316	30	1240.5	39.4002	MD	0	457
20224	1019	1296.7	39.8723	PIPOL	0	458
26444	2206	1335.5	39.9185	MESIL	0	457
3936	573	1173.3	39.9323	MESIL	0	1789
28448	1846	1303.8	40.7118	PIPOL	0	302
32210	1129	1304.5	40.9043	PIPOL	0	302
37671	474	1163.6	41.2807	MESIL	0	296
3522	1550	1233.6	41.7374	MESIL	0	1789
71055	1824	1306.6	41.9417	MESIL	1	458
18383	1124	1291.8	42.3483	PIPOL	0	458
46063	598	1166	42.8264	MESIL	1	1634
46064	598	1166	42.8264	MESIL	1	1634
1131	516	1174.4	43.298	MESIL	0	1789
17955	1321	1331.5	43.7815	PIPOL	0	458
9858	1894	1268.2	44.1544	MD	0	1634
8036	1442	1267	44.4206	MESIS	0	1634
46061	598	1171.6	45.1302	MESIL	1	1634
46062	598	1171.6	45.1302	MESIL	1	1634
71215	1321	1330	47.1792	PIPOL	1	458
10778	1400	1270.9	47.4628	MESIS	0	1634

0 (0 out of 76345 Selected)

Eric_Data.csv

Step 3 – Run and Evaluate the Model

```
Random effects:
 Groups Name        Variance Std.Dev.
 RADIO  (Intercept) 0.05911  0.2431
Number of obs: 76356, groups: RADIO, 7

Fixed effects:
               Estimate Std. Error z value Pr(>|z|)
(Intercept)   -2.029e+00  1.952e-01  -10.39  < 2e-16 ***
Hab_typeMESIL  7.185e-01  1.999e-02   35.95  < 2e-16 ***
Hab_typeMESIS  6.469e-01  3.326e-02   19.45  < 2e-16 ***
Hab_typeMM    -1.383e+00  1.754e-01   -7.89 3.10e-15 ***
Hab_typePICOL -6.220e-02  4.877e-02   -1.28    0.202
Hab_typePICOS -5.547e+00  7.087e-01   -7.83 4.98e-15 ***
Hab_typePIPOL  9.041e-01  2.413e-02   37.48  < 2e-16 ***
Hab_typePIPOS -2.375e+00  4.614e-01   -5.15 2.65e-07 ***
elevation      1.521e-03  1.209e-04   12.58  < 2e-16 ***
slope          1.350e-02  1.341e-03   10.07  < 2e-16 ***
roads         -1.421e-03  1.959e-05  -72.53  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

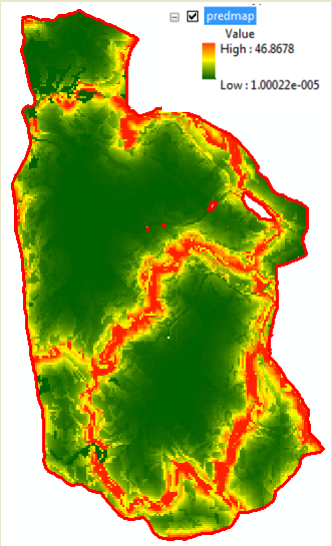
Step 5 – Create Predictive Values

- Create a Point Grid & Extract Values to Points
- Use the RSF to Calculate Predicted Values in Excel

=+EXP(B2*-0.00421+C2*0.001521+D2*0.035+F2*0.7185+G2*0.6469+H2*-1.383+I2*-0.0622+J2*-5.547+K2*0.9041+L2*-2.375)

B	C	D	E	F	G	H	I	J	K	L	M	
roads	elevation	slope	Hab_type	MESIL	MESIS	MM	PICOL	PICOS	PIPOL	PIPOS	Predicted	
30	1471.60000000000	1.21532000000	PICOL	0	0	0	1	0	0	0	8	377
42	1471.20000000000	0.79117100000	MESIL	1	0	0	0	0	0	0	17	377
60	1471.10000000000	0.54540500000	MESIL	1	0	0	0	0	0	0	15	377
60	1471.20000000000	0.50629100000	MESIL	1	0	0	0	0	0	0	15	377

Step 5 – Create Predictive Map



Convert Points to Raster using Predicted Values for the Cell Values

Recommended Reading

Bryan, F.J. Manly, et al. 2010. Resource selection by animals: statistical design and analysis for field studies. Second edition.

Also, see the PDF's in the Publications folder