Remote Sensing in Wildlife Management: Modelling Habitat Suitability

Patrick Sumrell

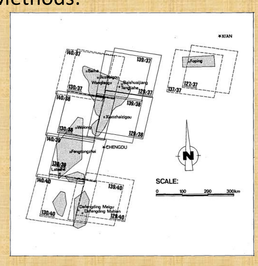
Giant Panda

De Wulf et al 2008

image-source

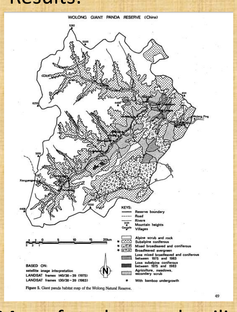
Question: Where and why are pandas experiencing habitat loss in China?

Methods:



Overlaid LANDSAT MSS images and classified habitat within study area

Results:



Map of study area detailing habitat loss and barriers to movement

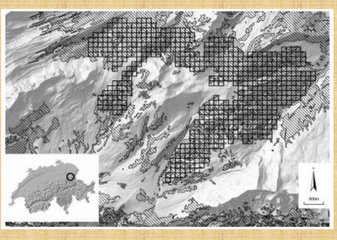
Western Capercaillie

Graf et al 2009

image-source

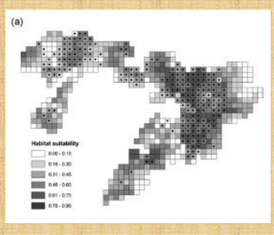
Question: Can LiDAR data provide high-quality habitat suitability modelling for capercaillie in the Alps?

Methods:



Divided study area into 1.6 ha^2 cells and analyzed via vegetation stand structure data from LiDAR and presence/absence data from the field

Results:



Map of study area modelling capercaillie presence on top of habitat suitability data

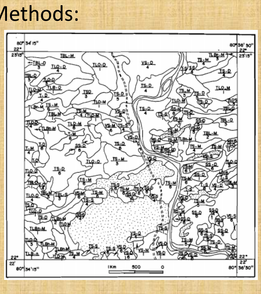
Sambar

Porwal et al 1996

image-source

Question: What is current suitability of habitat within Kahna N.P. for sambar?

Methods:



Classified cover type within study area into four main categories through visual analysis of LANDSAT TM FCC images

Results:

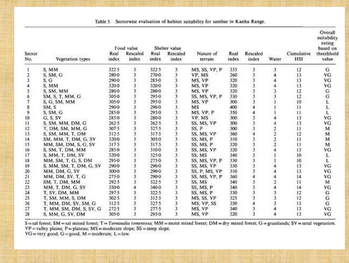


Table 5. Sectorwise evaluation of habitat suitability for sambar in Kanha Range.

Sector No.	Vegetation types	Food value Real index	Food value Rescaled index	Shelter value Real index	Shelter value Rescaled index	Nature of terrain	Real index	Rescaled index	Water	Cumulative HSI	Overall suitability rating based on threshhold value
1	S, MM	3213	3	3213	3	MS, SS, VP, P	335	3	3	12	G
2	S, MM, G	3010	3	3010	3	MS, VP, P	330	3	3	12	G
3	S, G	2963	3	2963	3	MS, VP	330	3	4	13	VG
4	S, MM	3260	3	3260	3	MS, VP	330	3	4	13	VG
5	S, MM, MM	2889	3	2889	3	MS, VP	330	3	3	12	G
6	SM, S, T, MM, G	3050	3	3950	3	SS, MS, VP, P	330	3	3	12	G
7	S, T, SM, MM	3050	3	3950	3	MS, VP	330	3	3	12	G
8	SM, S	2950	3	2950	3	MS	400	4	1	11	L
9	S, SM, G	2850	3	2950	3	MS, VP, P	330	4	1	11	L
10	S, G	3650	3	3650	3	VP, MS	300	3	4	13	VG
11	S, SM, MM, DM, G	3050	3	3050	3	SS, MS, VP	300	3	4	13	VG
12	T, DM, SM, MM, G	3053	3	3153	3	SS, MS	300	3	2	11	M
13	S, SM, MM, T, DM	3153	3	3153	3	SS, MS, VP	360	4	2	12	M
14	SM, MM, T, DM, G, SV	3200	3	3050	3	SS, MS, P	330	3	2	11	M
15	S, SM, MM, T, DM, G	3150	3	3150	3	SS, MS, VP	330	3	4	13	VG
16	S, SM, T, DM, MM	3010	3	3160	3	SS, MS, VP	330	3	4	13	VG
17	S, MM, T, DM, SV	3200	3	3250	3	SS, MS	340	3	1	10	L
18	MM, SM, T, G, S, DM	2950	3	2750	3	SS, MS, VP, P	330	3	1	10	L
19	S, MM, SM, T, DM, G, SV	2900	3	2900	3	SS, MS, VP	330	3	4	13	VG
20	S, SM, MM, G	2900	3	2900	3	SS, MS, VP, P	330	3	4	13	VG
21	MM, DM, SV, T, G	2750	3	2900	3	SS, MS, VP, P	360	4	4	14	VG
22	SM, T, DM, MM	2923	3	3223	3	SS, MS	340	3	2	11	M
23	S, SM, T, DM, SV	2973	3	3223	3	SS, MS, P	330	3	4	13	VG
24	T, D, DM, MM	2973	3	3223	3	SS, MS, P	330	3	4	13	VG
25	T, SM, MM, S, DM	3023	3	3223	3	MS, SS, VP	325	3	3	12	G
26	T, MM, DM, SV, SM, G	3173	3	3273	3	SS, MS, VP, SS	330	3	3	12	G
27	T, MM, SM, DM, S, SV, G	3223	3	3373	3	MS, VP	340	3	4	13	VG
28	S, MM, G, SV, DM	3050	3	3950	3	MS, VP	330	3	4	13	VG

S=sal forest; SM=sal mixed forest; T=*Terminalia tomentosa*; MM=moist mixed forest; DM=dry mixed forest; G=grasslands; SV=saval vegetation. VP=valley plains; P=plateau; MS=moderate slope; SS=steep slope. VG=very good; G=good; M=moderate; L=low.

Combined cover type data from LANDSAT with other variables to form habitat suitability rankings for each sector within K.N.P.

Sage Grouse: winter habitat

Homer et al 1993

image-source

Question: Is remote sensing a useful tool for modelling winter habitat for sage grouse?

Methods:

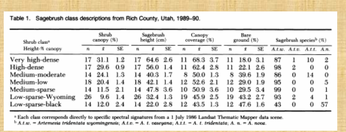


Table 1. Sagebrush class descriptions from Rich County, Utah, 1989–90.

Shrub class* Height % canopy	Shrub canopy (%) n	x̄	SE	Sagebrush height (cm) n	x̄	SE	Canopy coverage (%) n	x̄	SE	Bare ground (%) n	x̄	SE	Sagebrush species† (%) A.t.w.	A.t.v.	A.n.
Very high-dense	17	31.1	1.2	17	64.6	2.6	11	68.3	5.7	11	18.0	5.1	87	1	10	2
High-dense	17	29.6	0.9	17	56.0	1.4	11	62.4	2.8	11	22.1	2.6	98	2	0	0
Medium-moderate	14	24.1	1.3	14	40.3	1.7	8	50.0	1.3	8	39.6	1.9	96	0	14	0
Medium-low	18	20.4	1.4	18	42.1	1.4	12	52.6	2.1	12	29.0	1.9	95	0	0	5
Medium-sparse	14	11.5	2.1	14	47.8	3.6	10	50.9	3.6	10	29.5	3.4	99	0	0	1
Low-sparse-Wyoming	26	9.6	1.4	26	32.4	1.3	19	45.9	2.5	19	43.2	2.7	93	2	4	1
Low-sparse-black	14	12.0	2.4	14	22.0	2.8	12	43.5	1.3	12	47.6	1.6	43	0	0	57

* Each class corresponds directly to specific spectral signatures from a 1 July 1986 Landsat Thematic Mapper data scene.
† *A.t.w.* = *Artemesia tridentata wyomingensis*, *A.t.v.* = *A. t. vaseyana*, *A.t.t.* = *A. t. tridentata*, *A. n.* = *A. nova*.

Classified landscape into 8 shrub classes using LANDSAT TM images

Results:

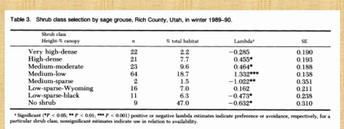


Table 3. Shrub class selection by sage grouse, Rich County, Utah, in winter 1989–90.

Shrub class Height % canopy	n	% total habitat	Lambda*	SE
Very high-dense	22	2.2	−0.285	0.190
High-dense	21	7.7	0.455*	0.193
Medium-moderate	23	9.6	0.464*	0.188
Medium-low	64	18.7	1.332***	0.138
Medium-sparse	2	1.5	−1.602**	0.351
Low-sparse-Wyoming	16	7.0	0.162	0.211
Low-sparse-black	11	6.3	−0.473*	0.238
No shrub	9	47.0	−0.632*	0.310

* Significant (*P* < 0.05, ** *P* < 0.01, *** *P* < 0.001) positive or negative lambda estimates indicate preference or avoidance, respectively, for a particular shrub class. nonsignificant estimates indicate use in relation to availability.

Combined shrub classes with sage grouse wintering location data, ran analyses, and found that sage grouse prefer certain shrubs for winter habitat over others

Conclusion: Remote sensing is incredibly useful in modelling habitat suitability, making it a valuable tool for wildlife management

Citations

De Wulf, R. D., Goossens, R. E., Mackinnon, J. R., and W. S. Cai. 1988. Remote sensing for wildlife management: giant panda habitat mapping from LANDSAT MSS images. Geocarto International 3:41-50. <http://www.tandfonline.com/doi/pdf/10.1080/10106048809354132>. Accessed 19 Apr 2017.

Graf, R. F., Mathys, L., and K. Bollmann. 2009. Habitat assessment for forest dwelling species using LiDAR remote sensing: capercaillie in the Alps. Forest Ecology and Management 257:160-167. <http://www.sciencedirect.com/science/article/pii/S0378112708006592>. Accessed 19 Apr 2017.

Homer, C. G., Edwards, T. C., Jr., Ramsey, R. D., and K. P. Price. 1993. Use of remote sensing methods in modelling sage grouse winter habitat. Journal of Wildlife Management 57:78-84. <http://www.jstor.org/stable/3809003?seq=1#page_scan_tab_contents>. Accessed 19 Apr 2017.

Porwal, M. C., Roy, P. S., and V. Chellamuthu. 1996. Wildlife habitat analysis for 'sambar' (*Cervus unicolor*) in Kanha National Park using remote sensing. International Journal of Remote Sensing 17:2683-2697. <http://www.tandfonline.com/doi/abs/10.1080/01431169608949100>. Accessed 19 April 2017.