Incorporating a Process-based Land Use Variable into a Habitat Suitability Modelling and a Species Habitat into a Land Change Model: a Case of Albania

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Why do we use land change models and species distribution models?

Land change models

The land system is the terrestrial component of the Earth System, and stays at the center of understanding the relationship between humans and environment (GLP 2005)

Land (use) change (including forest cover change) is to:

1. measure, model and understand the coupled socioeconomic terrestrial system
2. understanding factors affecting decision making, implementation of land use and management and the impacts on social and ecological systems (GLP 2005)

Changes in forest cover, which were observed from satellite images, differed spatially and temporarily in Albania (Suess 2010)

Changes in forest cover from 2000 to 2007 were explained by:

- a model composed of policy and institutional determinants (Laze 2013) shows as M1 (model 1) in Results section

Habitat suitability models (HSMs)

Species distribution models (SDMs) (including HSMs) are widely used to:

1. identify where habitat for a species is likely to occur
2. determine the core areas important for the conservation of species (Zielinski et al. 2006)

A HSM composed of natural factors explained the existence of lynx (*Lynx lynx martinoi*) and of brown bear (*Ursus arctos*) in Albania (Laze 2013)

What else…?

We incorporated respectively:

1. a process-based land use variable like forest cover change from 2000 and 2007 (see Example) into the first-ranked HSM of lynx and of brown bear of Laze (2013)
2. The first-ranked HSM of lynx and of brown bear, into the first-ranked model of forest cover change composed of policy and institutional determinants of Laze (2013)

- to test the performance of HSM and forest change models in terms of model selection (corrected Akaike Information Criterion, AICc) and of model accuracy (Receiver Operating Characteristic Curve, AUC)
- to investigate effects of incorporated explanatory variables on dependent variables

Conclusions

The performance of HSM and forest cover change models increased in terms of model:

- selection by receiving lower values of AICc and of Moran’s I of residuals
- accuracy of HSM by showing higher values of AUC (see Results)

Accessibility of forests showed, respectively, a negative relationship with estimated habitat of lynx and of brown bear

Forest cover change showed, respectively, a positive relationship with estimated habitat of lynx and of brown bear

Research relevance

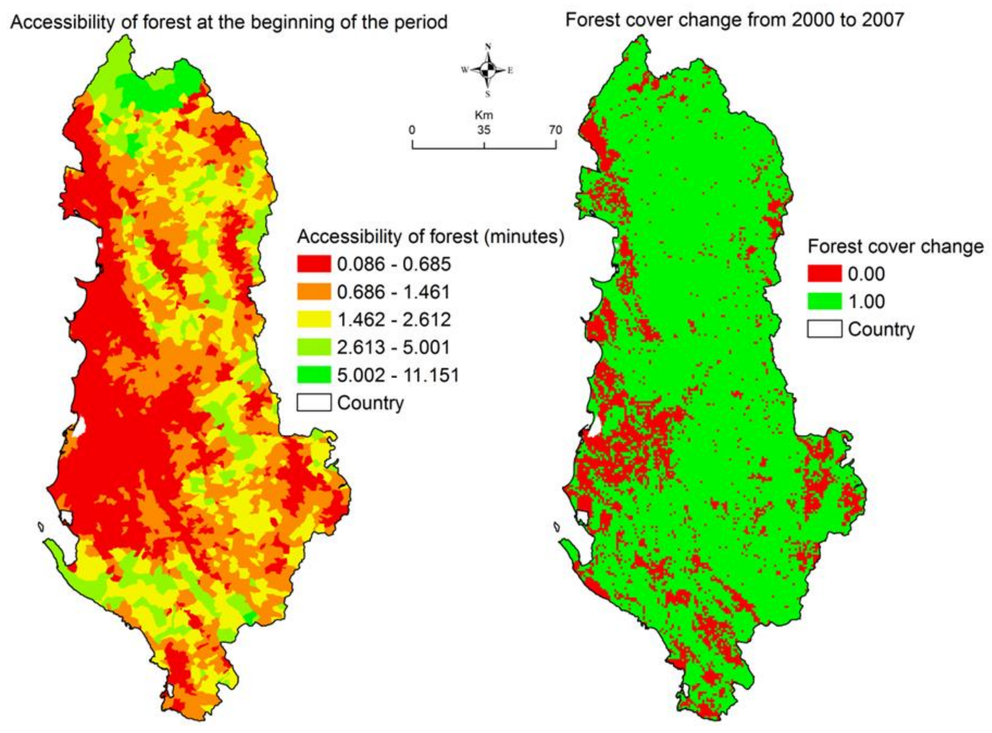
Process-based land use variables may be used to calibrate HSMs

HSMs may be used to calibrate land change models

Effects of forest cover change can be further investigated by using either deforestation or reforestation into HSMs as well as by employing new species data

New variables derived from satellite image data can be used to calibrate and reduce the uncertainties of land change models and HSMs

Example: Process-based land use variables

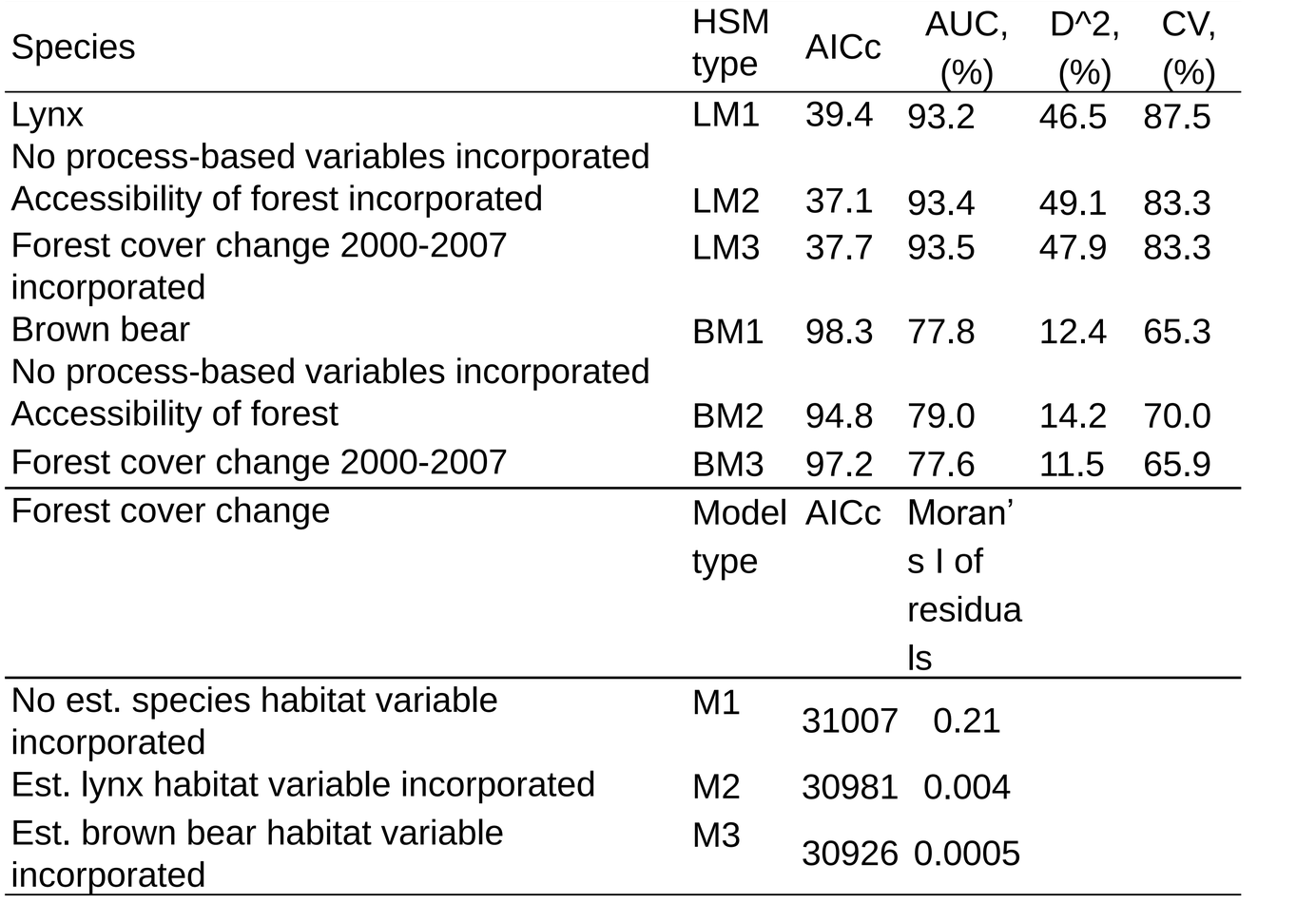


Results

Species	HSM type	AICc	AUC, (%)	D^2, (%)	CV, (%)
Lynx No process-based variables incorporated	LM1	39.4	93.2	46.5	87.5
Accessibility of forest incorporated	LM2	37.1	93.4	49.1	83.3
Forest cover change 2000-2007 incorporated	LM3	37.7	93.5	47.9	83.3
Brown bear No process-based variables incorporated	BM1	98.3	77.8	12.4	65.3
Accessibility of forest	BM2	94.8	79.0	14.2	70.0
Forest cover change 2000-2007	BM3	97.2	77.6	11.5	65.9

Forest cover change	Model type	AICc	Moran’s I of residuals
No est. species habitat variable incorporated	M1	31007	0.21
Est. lynx habitat variable incorporated	M2	30981	0.004
Est. brown bear habitat variable incorporated	M3	30926	0.0005

Note: AICc = corrected Akaike’s Information Criterion, AUC= Receiver Operating Characteristic Curve, D^2=Deviance Explained, CV=cross validation, Lynx models are LM1, LM2 and LM3. Brown bear models are BM1, BM2 and BM3.



Note: Lynx models are LM1, LM2 and LM3. Brown bear models are BM1, BM2 and BM3.

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Results and Examples (maps) shown in this poster are submitted as an article numbered PLUS-D-16-00942 to SpringerPlus journal.

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