# Potential European bison habitat in the Caucasus

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## Background

### Introduction

- European bison (*Bison bonasus*), the largest land mammal in Europe, went extinct in the wild at the beginning of the 21st century
- Today, after a number of successful reintroductions, around 3,200 bison roam freely in 40 herds across 8 countries
- Yet, existing herds are small and isolated and identifying suitable habitat for viable metapopulations is key for their survival
- Habitat is often only mapped for one season (summer) although winter habitat may be more critical for survival
- Additionally, mapping areas of potential conflict with people is important for the long term success of reintroductions

### Research questions

- How is suitable habitat of European bison distributed across the Caucasus?
- Where are areas where bison would likely come into conflict with people?
- Where are candidate sites for potential reintroductions?


**Fig. 1: The Caucasus ecoregion.** Top: a European bison. Photo: B. Bleyhl.

### Approach

- Maximum entropy species distribution modeling (Maxent) to map habitat suitability
- Seasonal herd ranges from all Caucasian bison populations (Fig. 1)
- Two sets of predictor variables characterizing environmental conditions (e.g., land cover) and human disturbance (e.g., distance to roads)
- Two habitat models for summer and winter, respectively, parameterized separately with the two predictor sets: an environmental model and a human-disturbance model
- Overlaying resulting habitat maps to reveal refined habitat categories (Fig. 2)
- Identification of candidate sites for potential reintroductions based on the seasonal habitat refinement

## Seasonal bison habitat

### Results

- Suitable habitat was mainly distributed in mountainous areas in the Greater Caucasus, but also in some areas in the Lesser Caucasus (Fig. 3)
- Much of the potential suitable habitat occurred in areas of considerable risk of conflict with people (e.g., 38% of potential summer habitat was attractive sink-like area)


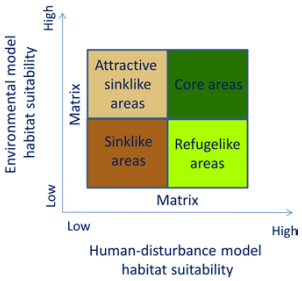


**Fig.2: Approach for the habitat refinement:** (1) Core areas (good habitat in both, the environmental and the human-disturbance model), (2) Refuge-like areas (sub-optimal habitat in the environmental model, good habitat in the human-disturbance model), (3) Attractive sink-like areas (good habitat in the environmental model, sub-optimal habitat in the human-disturbance model), (4) Sink-like areas (suboptimal habitat in both models; Figure adapted from De Angelo et al., 2013).

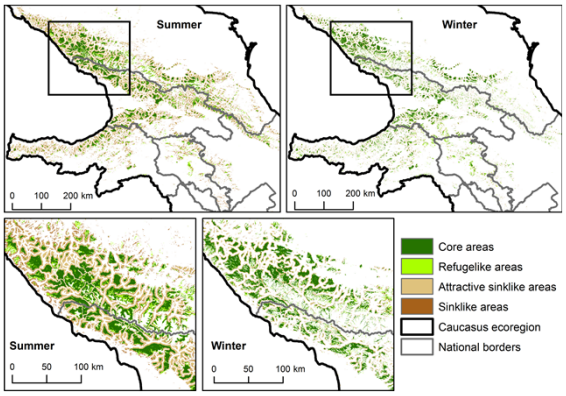


**Fig. 3: Habitat refinement maps** for summer and winter (top) with detailed views of the western Greater Caucasus (bottom). White areas indicate unsuitable habitat (matrix). Iran and the northern part of the ecoregion only entail very small portions of potential habitat and are therefore not shown here.

## Candidate sites for reintroduction

- Candidate sites for reintroduction included summer core areas with adjacent winter core areas for at least the size of the smallest current herd range (60 km²)
- We identified 69 such candidate sites (mean size: 150 km², overall: 10,200 km²; Fig 4)
- Most candidate sites occurred in the western part of the Greater Caucasus, but we found also potential habitat for reintroductions in the Lesser Caucasus (currently no herd)
- About 39% of the area is currently protected and 13% located in strict nature reserves or national parks (IUCN categories I and II)
- Many highly suitable habitat patches may be threatened through skiing sites and potentially resurging armed conflicts (e.g., the Russo-Georgian War in 2008)

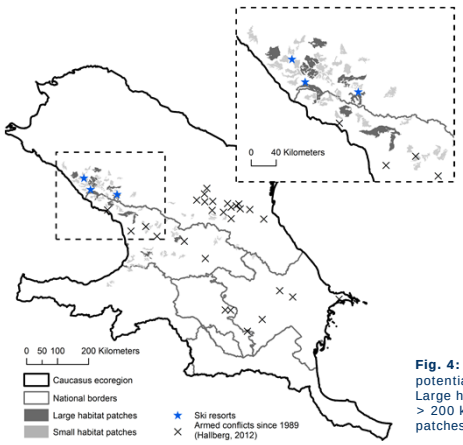


**Fig. 4: Candidate sites** for potential reintroductions. Large habitat patches are > 200 km², small habitat patches > 60 km².

### Conclusions

- A range of currently unoccupied suitable habitat patches exist in the Caucasus that include winter habitat and show a low risk for conflict with people
- The Caucasus holds the potential for more and larger bison populations
- Yet, areas with potential for human-bison conflict are widespread
- The seasonal maps of the four identified habitat categories and the candidate sites can be a starting point for future conservation planning

**References**
De Angelo et al. (2013) Biol. Conserv., 159, 422-433
Hallberg (2012) Confl. Manag. Peace Sci., 29, 219-232

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