SILVIS Lab
Spatial Analysis for Conservation and Sustainability

Long-term land cover changes and their effects on wildlife in the Caucasus

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Introduction

- Long-term land use legacies shape current land cover
- Habitat loss threatens wildlife populations
- Lack of baselines for historical habitat
- 1960s Corona spy satellite images allow to extend the Earth observations timeline
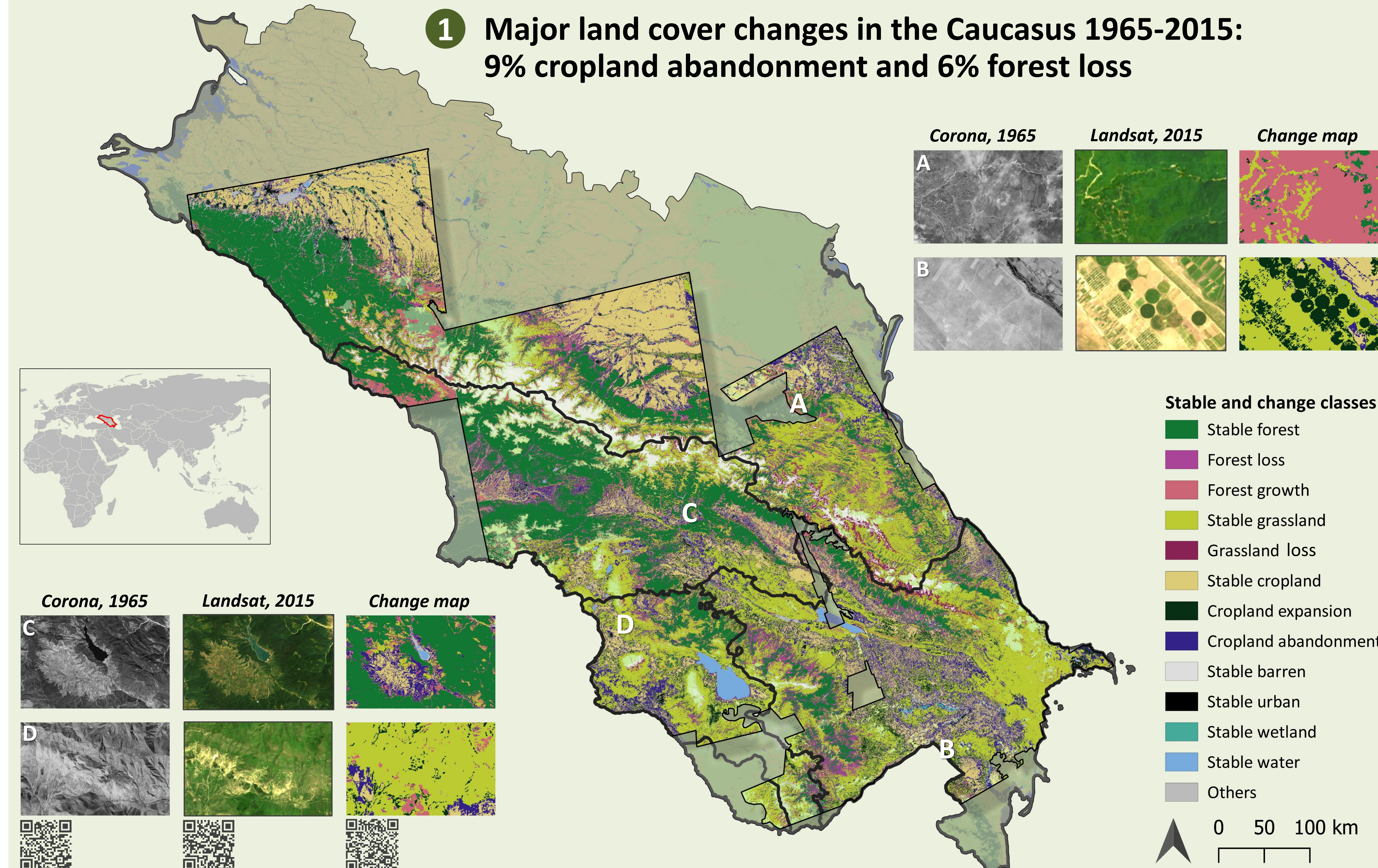- Longer timeline can provide better baselines for conservation planning

Goal

1. Evaluate long-term land cover changes in the Caucasus
2. Assess changes in habitat for large mammals in Azerbaijan

Data & Methods

	Change detection	Habitat suitability
Study area	250,000 km² in the Caucasus	66,000 km² in Azerbaijan
Data	• 1960s Corona spy satellite images • 2015 Landsat land cover map	• Species occurrences • Land cover maps • BioClim • SRTM DEM
Methods	• Orthorectification • OBIA, Random Forest (RF) classifier • Post-classification comparison	• Random Forest habitat model for 2015 • Application of model to 1965 • Presence-absence comparison

Results

1 **Major land cover changes in the Caucasus 1965-2015: 9% cropland abandonment and 6% forest loss**

Corona, 1965 *Landsat, 2015* *Change map*

Stable and change classes
- Stable forest
- Forest loss
- Forest growth
- Stable grassland
- Grassland loss
- Stable cropland
- Cropland expansion
- Cropland abandonment
- Stable barren
- Stable urban
- Stable wetland
- Stable water
- Others

0 50 100 km

- Change map accuracy: 74±2.8%
- In the Caucasus:
  - grassland expansion 11%
  - forest loss 6%
  - cropland abandonment 9%
- In Azerbaijan:
  - Lowland species habitats are stable within protected areas but shifted outside
  - In mountains, grassland gains (4%) but large forest loss (27%) resulting in habitat loss
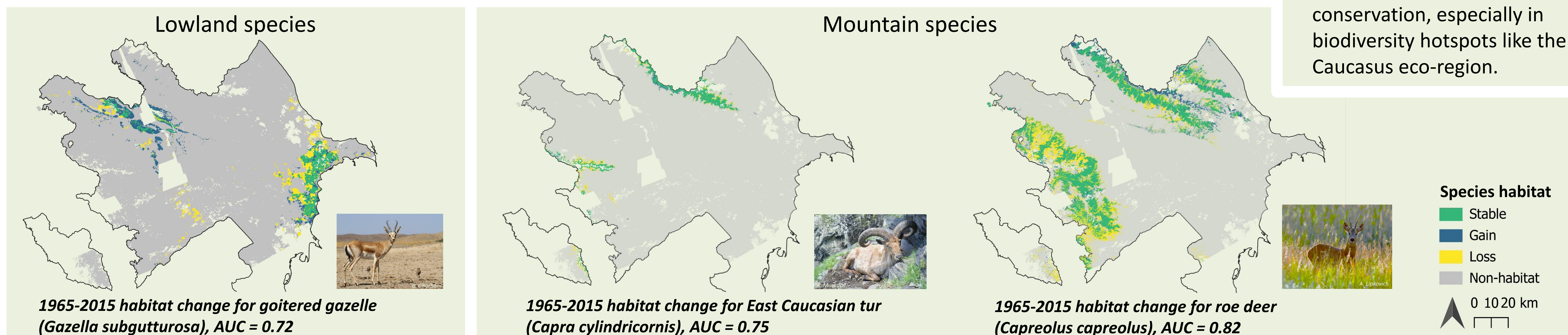
Discussion

- Habitat loss accelerated in the second half of the 20th century:
  - agriculture mechanization
  - green revolution
  - urbanization
  - industrialization

Conclusions

- 1960s Corona spy satellite images allow to assess historical wildlife habitat distributions
- Understanding long-term changes is crucial for wildlife conservation, especially in biodiversity hotspots like the Caucasus eco-region.

2 **In lowlands, goitered gazelle habitat shifted outside of protected areas**
In mountains, roe deer and East Caucasian tur habitat decreased by 18% and 20%

Lowland species

Mountain species

1965-2015 habitat change for goitered gazelle (Gazella subgutturosa), AUC = 0.72

1965-2015 habitat change for East Caucasian tur (Capra cylindricornis), AUC = 0.75

1965-2015 habitat change for roe deer (Capreolus capreolus), AUC = 0.82

Species habitat
- Stable
- Gain
- Loss
- Non-habitat

0 10 20 km

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