# Modelling Land Cover Change in the Swiss Alps: scenarios for forest expansion on abandoned agricultural land

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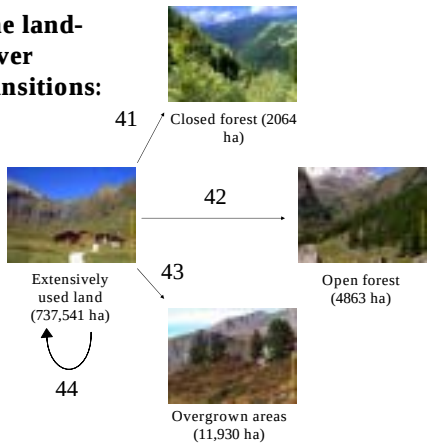
**Aim**: To explain patterns of landscape change over a 12 year period on abandoned agricultural land in the Swiss Alps and to identify the factors that distinguish particular land cover transitions from one another.

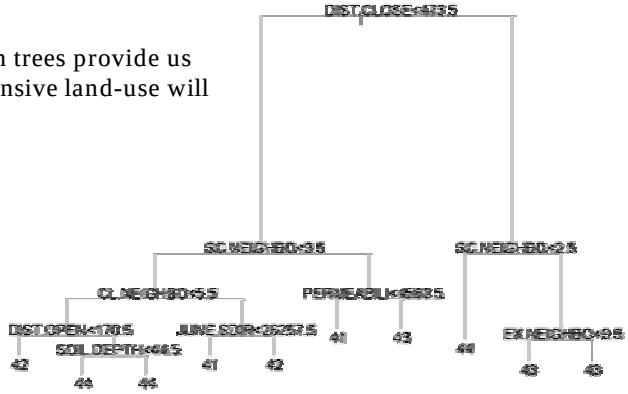
**The land-cover transitions:**




**Methods:** A markovian transition model depicts transition probabilities that are calculated based only upon the initial state. We extended the markovian model by modelling each transition as a function of exogenous and endogenous variables, which can then serve as potential predictors of land cover change.

How did we do this? Using a combination of Generalised Additive Modelling (GAMs) and Generalised Linear Modelling (GLMs) and available national databases of climate, soil, roads, settlements, and other derived variables we estimated a model for each transition. Land cover change data was taken from the Swiss land use statistics for the period 1979/85 - 1992/97.

Classification trees were also used for each group with the same starting state, showing which elements distinguish a particular change from another. The transitions are represented here by the values 41 - 44.



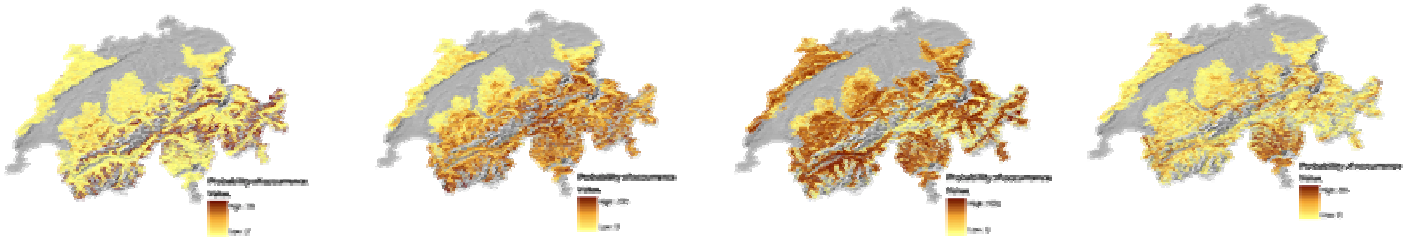

**Results:** Both the GAM/GLM combination and the use of classification trees provide us with some insight into identifying the circumstances under which extensive land-use will remain so or change to one of the other classes presented here.

The likelihood of extensively used land remaining so is higher where:

- Neighbouring land is cultivated
- The soil is less stony
- There is adequate available moisture (but not too much)
- At higher elevations

If these conditions are not fulfilled, a change in land cover can be expected. To what the land cover changes depends on the neighbourhood (as a potential seed source and/or an indication of the process of change already underway), moisture, steepness of the land and the exposure of it, and direct solar radiation.

**Predicted patterns of land cover change for 4 transitions, based on the initial state as well as exogenous and endogenous factors (accuracy of models measured by the AUC, lies between 0.80 and 0.84):**



Extensive land-use ⟶ extensive land-use (44)

Extensive land-use ⟶ overgrown (43)

Extensive land-use ⟶ open forest (42)

Extensive land-use ⟶ closed forest (41)

**Conclusion:** Patterns of forest regeneration on abandoned agricultural land can be identified using spatially-linked statistical models. Factors shown to be important in distinguishing transitions from one another are: neighbourhood, soil 'quality', direct solar radiation, slope and elevation-related variables. Thus under different scenarios of land-form, climate and surrounding land cover, predictions about landscape change can be made.

**Application**: The models are being used in further research as a basis to predict potential future changes under different scenarios:

- The prediction of effects on biodiversity under various scenarios of economic liberalisation, financial support for conservation objectives and business as usual in Switzerland (EU BIOSCENE project)
- Landscape changes under different socio-economic, touristic and climatic scenarios (ALPSCAPE NFP48 project)

WaSAlp Project Homepage: http://www.wsl.ch/projects/WaSAlp/