Project WaSAlp*: Forest expansion in the Swiss Alps

(National Research Program NRP 48 "Landscapes and Habitats of the Alps")

NFP 48 Landschaften und Lebensräume der Alpen
PNR 48 Paysages et habitats de l'arc alpin
NRP 48 Landscapes and Habitats of the Alps

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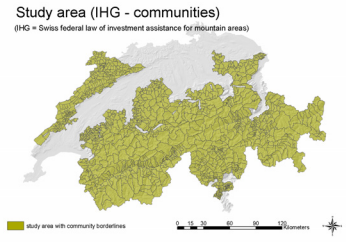
WSL

Methods and first results: Total area approach (TAA)



TAA is the first study approach in our NRP48 project that aims to investigate regeneration of forest on abandoned agricultural land in the Swiss Alps. Two different statistical approaches will be used to identify and quantify driving forces.

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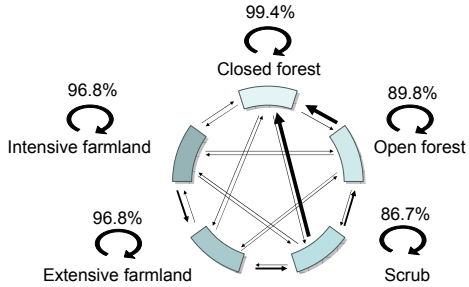
Forest dynamic transition model

PhD student Gillian Rutherford

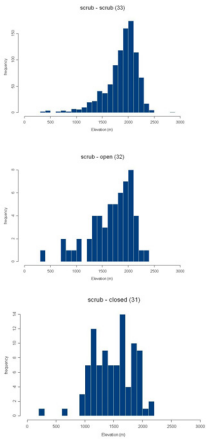
Aim of the succession transition model: The aim of this study is to explain the causes of forest expansion using a transition model.

Data: Transition data derived from the areal statistics was combined with potential explanatory variables in a GIS.

Methods: Using **multinomial log-linear regression**, transition probabilities between land-uses and ultimately a landscape development model can be calculated.



First results: Exploratory univariate data analysis can already reveal important relationships between our explanatory variables and measured forest expansion.



Three possible transitions are shown here with the respective frequency **distributions** along the possible elevations of their occurrence.

e.g. the scrub -> scrub transition is more concentrated around 2000m in elevation than the transitions scrub -> open forest or scrub -> closed forest (note the **distribution** c.f. frequency).

Spatial econometric model

PhD student Mario Gellrich

Aim of spatial econometric model: The aim of this study is to explain causes of land abandonment and forest expansion using an economic model.

Data: Hypotheses and variables are derived from agricultural economics. 19 variables are included in the modelling process.

Methods: A spatial econometric model using **logistic regression analysis** is performed to model the probability of land abandonment and forest expansion (Code 1) between 1985 and 1997.

First results: Cost and yield related variables are the most important driving factors of land abandonment and forest expansion. ***Tab.1*** shows results of one spatial econometric model. ***Fig.1*** illustrates predicted probabilities of occurrence of forest expansion on abandoned land. ***Fig.2*** shows areas, where one of the the best models (Model 3) tends to predict new forest areas correctly and incorrectly. Best models predict more than 80% of abandoned and regenerated agricultural parcels of land correctly.

Economic model
Number of observations (2831)

Variables	Parameter Estimates	Std. Error	Wald Chi-Square	Pr > Chi-Square
INTERCEPT	11.674	2.8002	17.38	< 0.0001
DEGREE DAYS	-0.00047	0.00011	17.01	< 0.0001
PRECIPITATION	**0.00062**	**0.00017**	**0.12**	**0.7234**
RADIATION	-0.00003	0.00001	5.12	0.0236
DISTANCE TO FOREST EDGES *	-0.0162	0.00097	274.57	< 0.0001
DISTANCE TO FOREST EDGES -SQUARED *	3.06E-06	3.33E-07	84.64	< 0.0001
SLOPE *	0.0926	0.0135	46.99	< 0.0001
SLOPE-SQUARED *	-0.0011	0.00024	20.58	< 0.0001
DISTANCE TO ROADS *	-0.00044	0.00011	13.72	0.0002
NUMBER OF PARCELS PER FARM (1985)	0.0147	0.00531	7.68	0.0056
LABOR FORCE PARTICIPITATION RATE (LFPR)	-0.2933	0.0927	9.99	0.0016
LFPR-SQUARED	0.00247	0.00077	10.08	0.0015
PROPORTION OF EMPLOYEES IN THE PRIMARY SECTOR	**0.00409**	**0.00409**	**1.00**	**0.3168**
RATE OF CHANGE OF POPULATION (1930-1990)	**0.0578**	**0.0916**	**0.39**	**0.5285**
DISTANCE TO URBAN PLANNING ZONES	**-0.00003**	**0.00004**	**0.63**	**0.4257**
NUMBER OF FULLTIME FARMS 1985	-0.0181	0.00275	43.47	< 0.0001
RATE OF CHANGE OF NUMBER OF FARMS (1939-1985)	0.2322	0.0618	14.12	0.0002

* robust covariates contained in all models

Model fit:		Prediction accuracy	
log likelihood	2663.74	Optimal correct classification rate %	77.40%
R-squared	0.3594	**Spatial autocorrelation of residuals (Moran-test)**	
Goodness of fit:		Correlation	0.0346
Likelihood ratio test	1260.82 (p<0.0001)	p-value (2-sided)	8.24E-13
Multicollinearity condition number	418		

Tab.1

Predictions of Model 3: probability of occurrence of Code 1

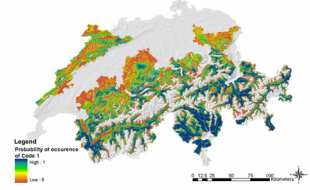


Fig.1

Areas where Model 3 tends to predict Code 1 incorrectly and correctly

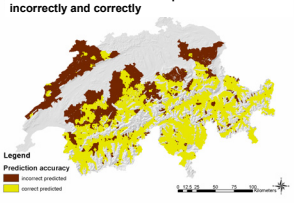


Fig.2

For regular updates refer to the WaSAlp homepage: http://www.wsl.ch/projects/WaSAlp

***Waldausdehnung in den Schweizer Alpen**