# Submitted Abstract

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| **Title** | Characterising Non-Stationarity In Predictive Models Of Land Use Transitions In Swiss Mountain Parks To Inform Scenarios For Deliberative Transformation. |
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## Abstract

Investigating pathways for the transformative adaptation of socio-ecological systems (SESs) frequently requires simulating the development of aspects of the system in both space and time, often into the future. In many cases this is achieved through the creation of predictive models which are calibrated and validated using historical data before being applied to generate future projections under the assumption of stationarity (i.e. that the relationships between the phenomena being modelled and its predictors are constant). Of course, this assumption is inherently flawed given that the calibration of models often highlights the presence of clear non-stationarity, for example between different historical periods, indicating systemic change within the SES.

Instead of disregarding non-stationarity this research seeks to demonstrate how characterising it can be used to improve understanding of how a given SES has, and is changing, and thus inform planning for deliberative interventions to encourage transformative adaptation.

Our research will demonstrate this in the context of modelling future Land Use and Land Cover (LULC) change scenarios for several alpine regional nature parks in Switzerland. Specifically, we use Random Forests supervised classification to statistically model the relationships between class-class LULC transitions and a wide set of environmental, socio-economic and neighbourhood predictor variables. Performing this modelling at a regional scale across multiple time periods allows for the identification of both spatial and temporal non-stationarity within the predictors of LULC transitions.

This non-stationarity is characterised through two approaches. Firstly, through changes in the inclusion of predictors in LULC transition models as a result of the feature selection process (filtering to produce the most parsimonious set of predictors by minimising redundancy). Secondly, through changes in the partial dependence plots which visualise the relationships between predictors and the probability of LULC transitions.

Such analysis provides insights into how the relationships between, socio-environmental factors and the likelihood of LULC transitions change over time and space, which should inform the development of scenarios of future LULC change for alpine parks in Switzerland. For example, comparing the degree of temporal non-stationarity exhibited across different LULC transitions, in combination with historical rates of LULC change (unit area per time period), could highlight which transitions are more ‘unstable’ and thus subject to greater uncertainty. This knowledge should be taken into consideration when devising scenarios based around interventions intended to elicit transformative change specifically related to these LULC transitions.