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Climate change and socio-economic scenarios, land use modelling implications on water resources in an inner alpine area, Switzerland

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The MontanAqua project aims to study the water resources management in the region Sierre-Montana (Valais, Switzerland). Land use is known to have an influence on the water resources (soil moisture dynamic, soil sealing, surface runoff and deep percolation). Thus land use modelling is of importance for the water resources management.

An actual land use map was produced using infrared imagery (Niklaus 2012, Fig.1). Land use changes are known to be mainly drived by socio-economic factors as well as climatic factors (Dolman et al. 2003). Potential future Land uses was separatly predicted according to 1-. socio-economic and 2-. climatic/abiotic drivers :

1. 4 socio-economic scenarios were developped with stakeholders (Schneider et al. 2013) between 2010 and 2012. We modeled those socio-economic scenarios into a GIS application using Python programming (ModelBuilder in ArcGIS 10) to get a cartographic transcription of the wishes of the stakeholders for their region in 2050.

2. Uncorrelated climatic and abiotic drivers were used in a BIOMOD2 (Georges et al. 2013) framework. 4 models were used: Maximum Entropy (MAXENT), Multiple Adaptive Regression Splines (MARS), Classification Tree Analysis (CTA) and the Flexible Discriminant Analysis (FDA) to predict grassland, alpine pasture, vineyards and forest in our study region. Climatic scenarios were then introduced into the models to predict potential land use in 2050 driven only by climatic and abiotic factors

The comparison of all the outputs demonstrates that the socio-economic drivers will have a more important impact in the region than the climatic drivers (e.g. -70% grassland surface for the worst socio-economic scenario vs. -40% of grassland surface for the worst climatic models). Further analysis also brings out the sensitivity of the grassland/alpine pasture system to the climate change and to socio-economic changes.

Future work will be to cross the different land use maps obtained by the two model types and to use them to implement soil moisture and evaporation data for the near-future in the region Sierre-Montana.

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