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An integrated Modelling framework to monitor and predict trends of agricultural management (iMSoil)

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Agricultural systems lay at the interface between natural ecosystems and the anthroposphere. Various drivers induce pressures on the agricultural systems, leading to changes in farming practice. The limitation of available land and the socio-economic drivers are likely to result in further intensification of agricultural land management, with implications on fertilization practices, soil and pest management, as well as crop and livestock production. In order to steer the development into desired directions, tools are required by which the effects of these pressures on agricultural management and resulting impacts on soil functioning can be detected as early as possible, future scenarios predicted and suitable management options and policies defined. In this context, the use of integrated models can play a major role in providing long-term predictions of soil quality and assessing the sustainability of agricultural soil management. Significant progress has been made in this field over the last decades. Some of these integrated modelling frameworks include biophysical parameters, but often the inherent characteristics and detailed processes of the soil system have been very simplified. The development of such tools has been hampered in the past by a lack of spatially explicit soil and land management information at regional scale.
The iMSoil project, funded by the Swiss National Science Foundation in the national research programme NRP68 “soil as a resource” (www.nrp68.ch) aims at developing and implementing an integrated modeling framework (IMF) which can overcome the limitations mentioned above, by combining socio-economic, agricultural land management, and biophysical models, in order to predict the long-term impacts of different socio-economic scenarios on the soil quality. In our presentation we briefly outline the approach that is based on an interdisciplinary modular framework that builds on already existing monitoring tools and model components that are currently in development: (i) the socio-economic agent-based model SWISSland; (ii) a land management downscaling approach that provides crop rotation, fertilisers and pesticides application rates for each land management unit, and (iii) the agro-ecosystem model EPIC, which is currently being calibrated with long-term soil measurements and agricultural management data provided by the Swiss Soil Monitoring Network. Moreover, the IMF will make use of land cover information derived from remote sensing to continuously update predictions. The IMF will be tested on two case study regions to develop indicators of sustainable soil management that can be implemented into Swiss policies.