



EGU25-16347, updated on 15 Mar 2025
<https://doi.org/10.5194/egusphere-egu25-16347>
EGU General Assembly 2025
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Climate change impacts on Swiss cropland suitability

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The increasing impacts of climate change are causing serious challenges for global food security and sustainable agriculture. A key concern is how changing climate conditions, such as precipitation and temperature, might influence the suitability of croplands and agricultural systems, with significant consequences for future food production and related policies. This issue is particularly relevant in Switzerland, as mountainous regions and lowlands are especially vulnerable to foreseen climate changes, including rising temperatures and changes in precipitation patterns, characterized by reduced summer rainfall and increased winter precipitation. Furthermore, soil properties, such as pH and organic carbon, are also expected to change due to increased aridity and warming. In this study, by establishing relations between soil and climate factors and crop yield, we evaluate the suitability of five major crops produced in Switzerland (namely rye, wheat, barley, vines, and maize) via a data-driven model. We derive spatially explicit results for current and future scenarios. Findings for the reference year 2000 show that the leading drivers affecting the suitability are mostly related to climate rather than soil conditions. The relative effect of precipitation, temperature, and solar radiation varies depending on the crop and its geographic location, highlighting context-specific impacts of climate variations and their interlinkages. Regarding future projections, we assess how shifts in projected temperature and rainfall regimes under three Representative Concentration Pathways (RCPs 2.6, 4.5, and 8.5) translate into spatial variations in crop suitability compared to the year 2000. Regions facing the strongest warming by 2090 are projected to lose suitability for all the crops considered here, with temperature emerging, overall, as the dominant driver of such shifts, particularly in the Swiss lowlands.

How to cite: Bassani, F., Wakjira, M., Peleg, N., and Bonetti, S.: Climate change impacts on Swiss cropland suitability, EGU General Assembly 2025, Vienna, Austria, 27 Apr–2 May 2025, EGU25-16347, <https://doi.org/10.5194/egusphere-egu25-16347>, 2025.