Alpine drought impact chains for sector-based climate-risk assessments

Stefano Terzi[1], Mathilde Erfurt[2], Ruth Stephan[2], Kerstin Stahl[2] and Marc Zebisch[1]

INTRODUCTION

Droughts are slow and silent natural hazards that can lead to long-lasting environmental, societal and economic impacts.

Mountain regions are experiencing climate change effects more rapidly than other places and reducing water availability downstream.

This study is part of the **Alpine Drought Observatory (ADO)** Interreg Project and aims to better understand factors which influence drought risk in the agricultural sector in an Alpine case study.

OBJECTIVE

We explore the application of **impact chains** (IC) to identify important factors which influence agricultural drought risk in Alpine regions.

An IC is a conceptual and analytical framework based on the IPCC AR5 risk concept, which includes the components **hazard**, **exposure** and **vulnerability**. IC help to understand, systemize and prioritize the main factors driving risk processes in a selected system.

We combine quantitative and qualitative data to compare and better understand the importance of individual risk factors. We further test and compare different weighting methods for the vulnerability component.

STUDY AREA

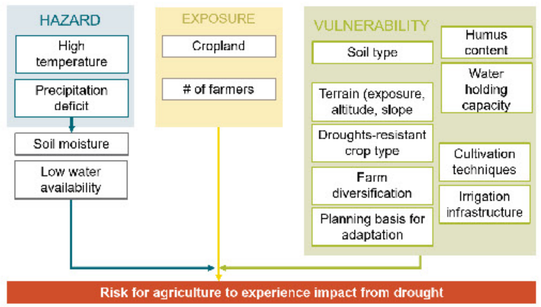
We focus on agricultural drought risk in **Canton Thurgau,** Switzerland.

METHODS

1 Impact chains development and factor identification

a) Collection of preliminary information on drought impacts to create an agricultural specific IC.
b) IC refinement together with experts from Canton Thurgau, Switzerland.
c) Questionnaire to local stakeholders to assign weights to vulnerability factors for agricultural drought risk.

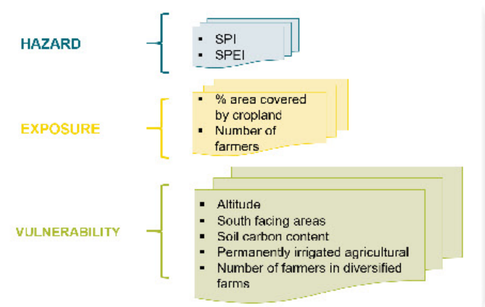
Impact chain for agricultural drought risk, including the risk components and **factors**.



2 Identification of indicators and data collection

For each identified factor, belonging to hazard, exposure and vulnerability, we selected a synthetic indicator as a trade off between data availability and indicator's priority from the questionnaire.
The collected data stem from various portals such as the Swiss Federal Office for Statistics or Copernicus Land Monitoring Service.

Identified **indicators** for the three risk components hazard, exposure and vulnerability in Thurgau.

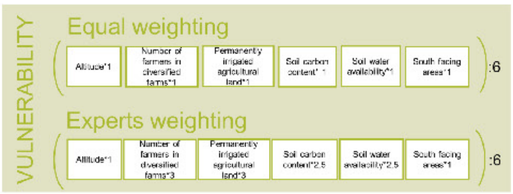


3 Weighting of vulnerability indicators

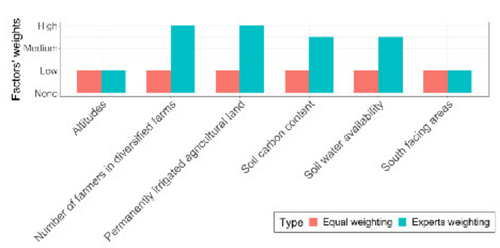
In drought risk assessments, vulnerability indicators are usually normalized and then aggregated. Here we test and compare different weighting methods for the vulnerability factors: equal weighting and expert weighting.

Aggregation of indicators following equal and expert based weighting in a) and their contribution to final vulnerability in b).

a)



b)

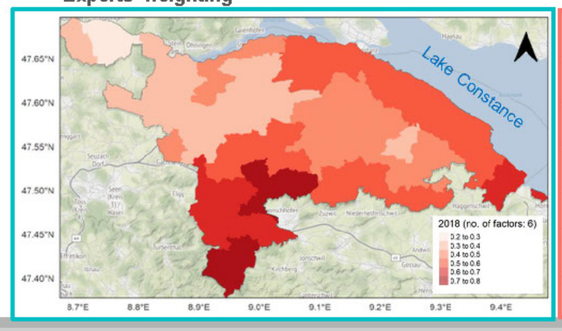


RESULTS

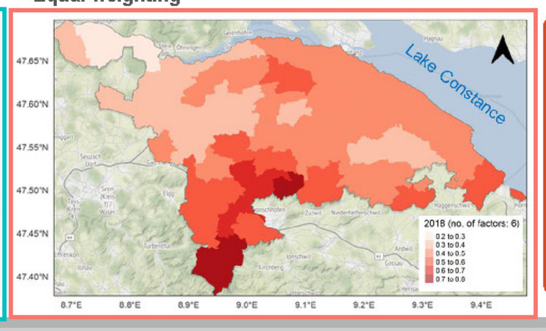
4 Vulnerability maps for agriculture drought risk in Thurgau

- The vulnerability component varies over a rather small region
- Southern parts of the Canton Thurgau showed similar high vulnerability in both methods
- The vulnerability maps also show differences: for example, areas along the lake were found more vulnerable since the experts assigned the highest weight to the permanently irrigated agricultural land and to the diversified farms factors which have there their lowest value.

Experts' weighting



Equal weighting



OUTLOOK

In a next step, we will combine the vulnerability maps with the hazard and exposure maps resulting in a risk map, which will be validated on recorded impact data. The final validated maps can be used for (i) extrapolate risk to other regions in the Alpine Space and (ii) inform drought management and planning regionally.

[1]Institute for Earth Observation, Eurac Research, Bolzano, 39100, Italy; stefano.terzi@eurac.edu
[2]Environmental Hydrological Systems, University of Freiburg, Freiburg i. Br., 79098, Germany; ruth.stephan@hydrology.uni-freiburg.de

Interreg Alpine Space
Alpine Drought Observatory