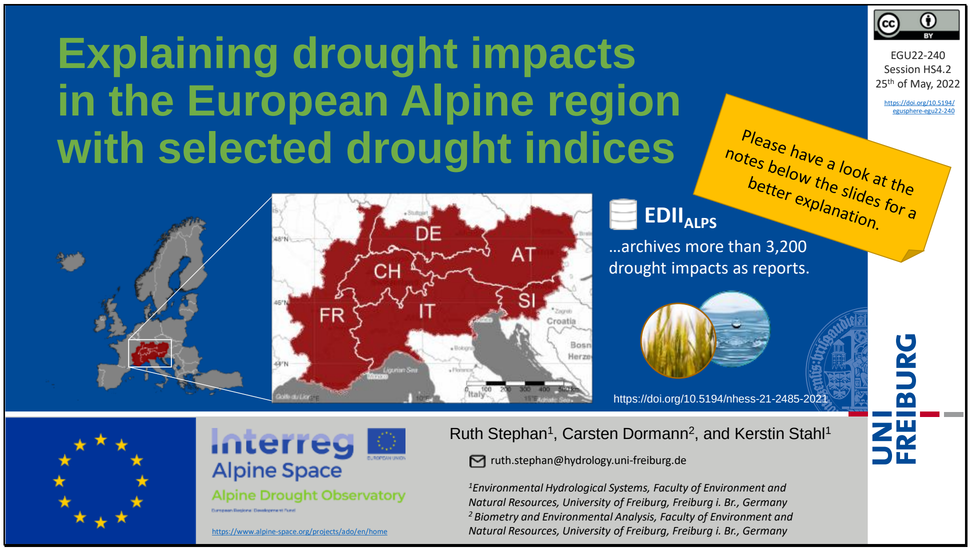
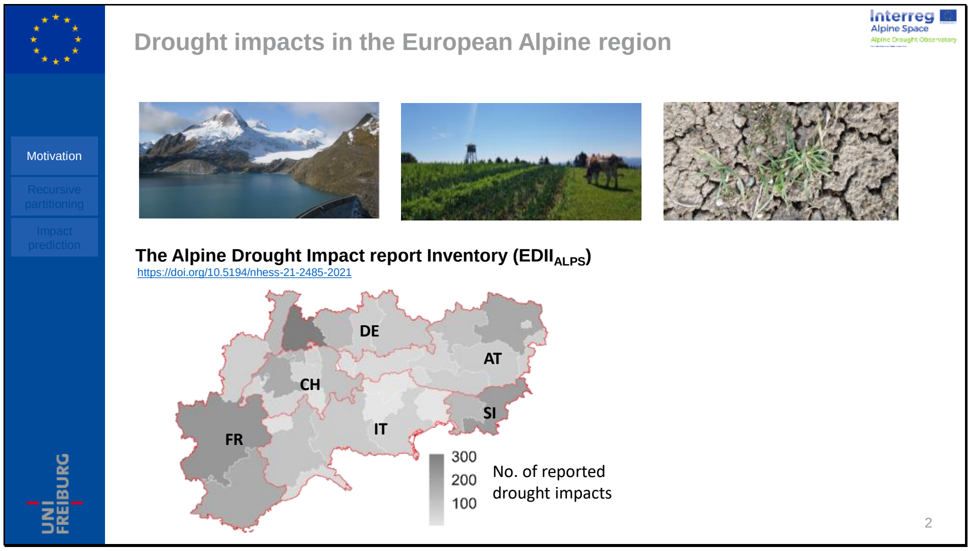
Slide 1



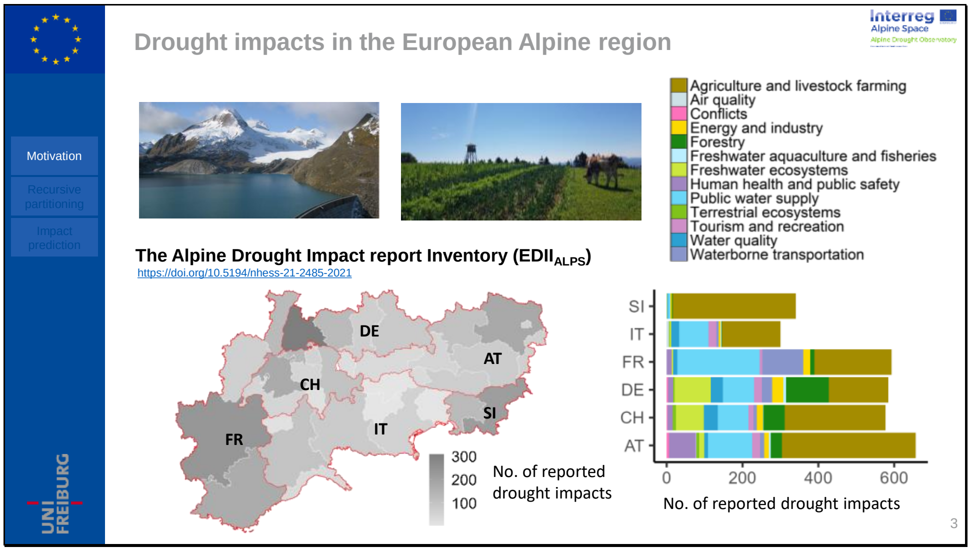
Welcome to this presentation about explaining drought impacts in the European Alpine region with selected drought indices.
The presented study is based on the $EDII_{ALPS}$ - the Alpine Drought Impact report Inventory - a database that archives drought impacts as text-reports across the here shown *Alpine Space* region.

Slide 2



The European Alpine region is typically associated as water-rich, e.g with large reservoirs. Despite, drought affects the region. This is confirmed by the EDII$_{ALPS}$ mapping impacts across all countries covered by the *Alpine Space* region.

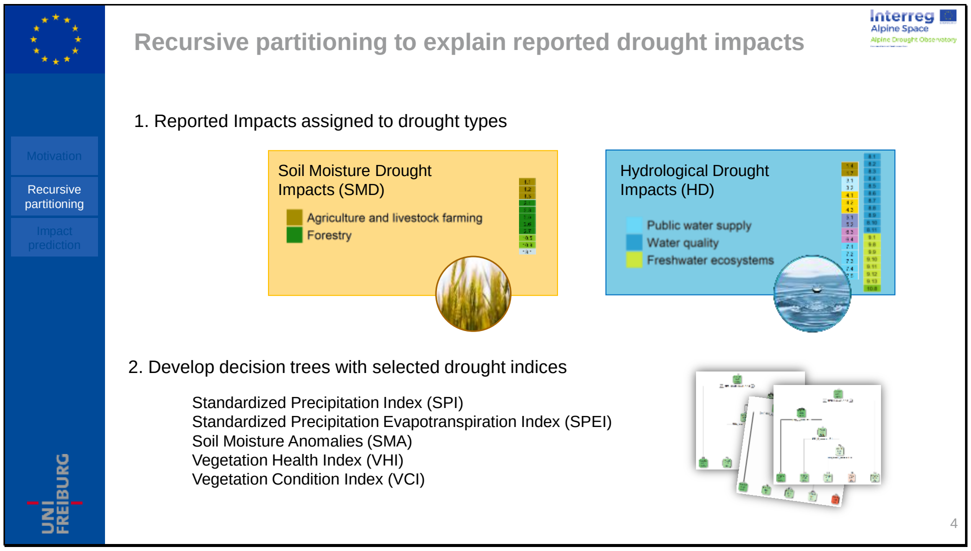
Slide 3



The European Alpine region is typically associated as water-rich, e.g with large reservoirs. Despite, drought affects the region. This is confirmed by the EDII$_{ALPS}$ mapping impacts across all countries covered by the *Alpine Space* region.

In addition, EDII$_{ALPS}$ classifies the reported impacts according to affected sectors, such as Agriculture and livestock farming shown in brown or Public Water supply shown in blue. In the EDIIALPS these sectors are the most affected, even with some variation across the shown countries.

Slide 4

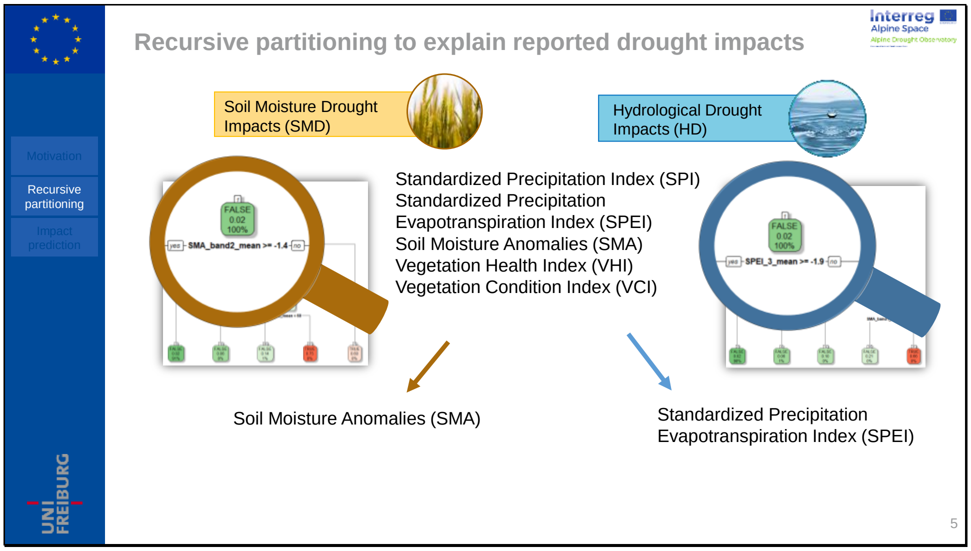


In order to get an understanding what drives the impacts, so in order to explain drought impacts, we first developed a different perspective. We assigned them to drought types - most likely triggering these impacts.
We assigned specific impact types to soil moisture droughts with a majority from the sectors *Agriculture and livestock farming* and *Forestry*. Additionally, we assigned specific impacts to hydrological drought with a majority from the sectors Water supply. Water qualitiy and Freshwater ecosystems. The so established impact groups are soil-moisture drought (SMD) impacts and hydrological drought (HD) impacts. Fur further details see subtypes shown by the labelled bars in drought type group and read Stephan et al, 2021.

Secondly, we developed decision trees with recursive partitioning. As exploraty variables, leading to the decisions of true or false impact occurrence we used a set of standardized drought indices that are commonly used to identify abnormal dry and warm periods. For example, we used the *Standardized Precipitation and Evapotranspiration Index*, *Soil moisture Anomalies*, and the *Vegetation Health Index*.

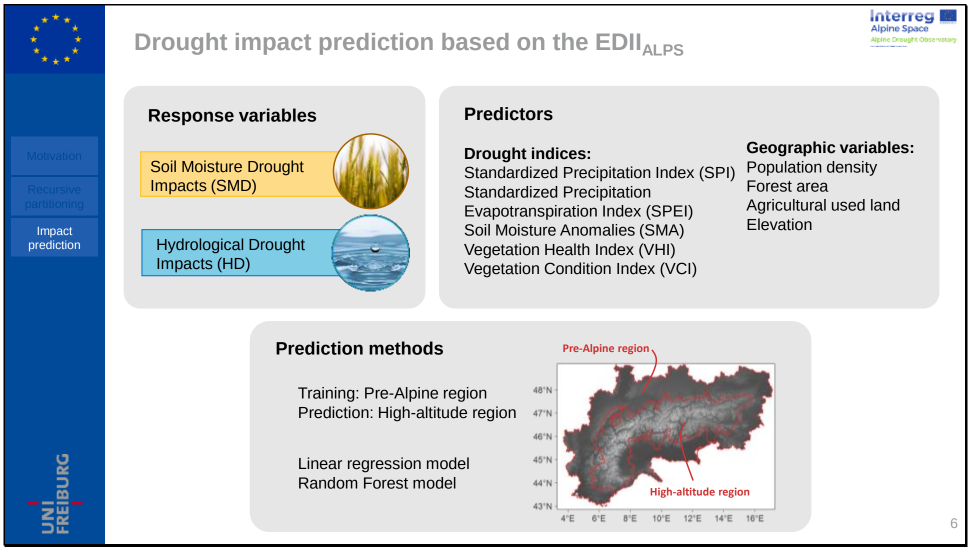
With the help of these decision trees, we assessed which of these drought indices is ranked first for a decision of true or false Impact occurrence. We developed trees for SMD and HD impacts and in dfferent subregions across the Alpine Space.

Slide 5



This analyses identified the *Soil Moisture Anomalies* to be most important regarding SMD impacts and the *Standardized Precipitation Evapotransipration Index* to be most important regarding HD impacts. Subsequently, it is beneficial to use and compare different drought indices (or drought drivers) in order to explain manifold impact types.

Slide 6

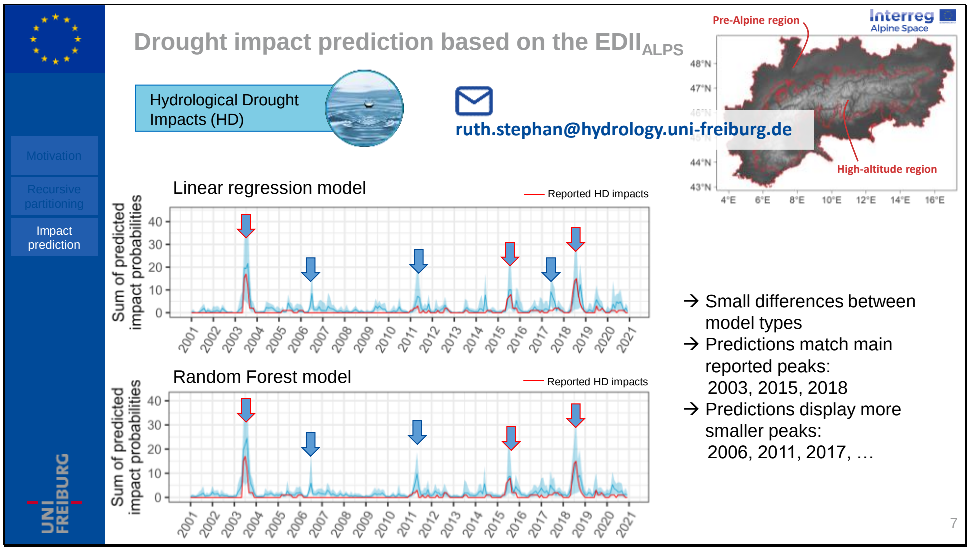


Currently, we want to take this one step further and develop impact prediction models. Usually drought models predict the hazard itself (e.g. with anomalies in precipitation and temperature.), but they typically do not predict the consequences respectively the impacts. We aim to improve the knowledge of impact predictions with model based on the text-reports by the $EDII_{ALPS}$.

The response variables we predict are SMD and HD impacts. As predictors we used the drought indices and as well geographic variables to better describe spatially the heterogeneous mountain terrain. Thus, the models used the predictors population density, forest area, agricultural used land, and elevation.

We applied various prediction methods. The one presented here trains the model with all data in the pre-Alpine region to predict impacts in the high-altitude region. This way we test, if the models are aswell applicable in regions, where no impact data is available. We applied two different model types a classic linear regression model and a random forest model using machiene learning.

Slide 7



This Figure displays the prediction results for the hydrological drought impacts in the high-altitude region aggregated over time. The top row presents the prediction by the LM model in blue and the reported impacts by the $EDII_{ALPS}$ in red.
Accordingly, the bottom row presents the predictions by the random forest model.

In general, the plot presents rather small differences between the model types. Then, the predictions match the main peaks that are as well reported by the $EDII_{ALPS}$, such as the summer months in 2003, 2015, and 2018. In addition, the predictions display more smaller peaks, although the $EDII_{ALPS}$ does not report them, for example in 2006, 2011, and 2014 etc.

For further details and feedback, please contact me per mail.