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Learning from the past – Forest back-casting as a tool to improve hydrological and climate modelling

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Forests, covering large areas in many regions of the world, play an important role in the hydrological cycle and have a strong influence on climate. Their importance is widely recognized and are now integrated into most climate and hydrological models. The calibration of hydrological models require historical data about the spatial distribution of forest cover and structure. While hydrological time series that span several decades are not uncommon, land cover (and forest) information is usually considered static; that is, it is assumed that the forest remains at the same development stage, i.e. without harvest or growth, for the whole time series. This assumption is unrealistic and can lead to biased models and spurious conclusions. Although land cover data is not widely available before the advent of satellite data on a large scale, it can be estimated through the integration of current land cover data and historic information from national forest inventories (NFIs).

We present a tool to reconstruct historical forest cover and structure based on its present day state. That is, the model can back-cast estimates of volume, biomass, dominant species, height and other structural variables based on the available present-day information provided by NFIs. The model applies changes to the different variables for successive time steps by integrating information coming from national forest inventories. Further, it also allows the possibility of reconstructing forests plots that have been clear cut based on several expert criteria.

This presentation aims to explain the model, the method used for the definition of the growth rates and the results obtained by the application of the model to the Norwegian forests. Results are applied to calibrate a hydrological model run for several catchments in Norway. The empirically-based method was applied to study the historical impacts of Norwegian forest management on large-scale hydrological cycling and will be applied to future research impacts of historical forest management on climate.