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Simulation of hydrologic cycle and phytomass productivity based on a temperature of plant transpiration in cold climate

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This study aimed to identify the governing role of natural selection in the development of plant cover in cold climate regions of the Czech mountains and foothills. Monitored since 1983 the hydrological and soil physical data from 2 field sites sampled in 1987 (the long-term mean season), 1992 (the driest and warmest season since 1983), and 1995 (the season uncommonly rich in precipitation) were used, with soil properties considered for the rooting zone down to 100 cm depth. It was found that plant growth was at maximum productivity if the plant temperature attained the optimum value 25ºC. The questions “Why is the optimum temperature equal to 25ºC in all experimental plots?” and “What mechanism set up the optimum temperature?” are solved using natural selection hypothesis and a simulation of the hydrological cycle and phytomass productivity based on the retention-evapotranspiration unit (RETU) model. The RETU model elucidates how plants control the heat and water circulation in a cold climate depending on the optimum plant temperature. Natural selection hypotheses assume that the plant cover prevailing on the site in long-term stable natural conditions are able to: (1) produce the largest amount of phytomass, and (2) live through unfavourable conditions. Based on these hypotheses, the optimum plant temperature of 25ºC is found because (1) the highest production is reached at this temperature in the critically dry vegetation seasons, and (2) hydrologic extremes that threaten plant survival do not occur during any time during the seasons examined.