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High resolution climate data supporting success of bioeconomy

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In a forested country, like Finland, forest-based bioeconomy is planned to have a major role in promoting the low-carbon and resource-efficient society and sustainable economic development. This ambitious objective becomes readily achievable, because in northern Europe the climate warming is predicted to substantially increase forest growth and harvesting potential. While advancing versatile utilization of forest resources, the recreational values and, e.g., conservation of old forests must be considered, acknowledging the role of forests as a carbon sink. Variable weather conditions and high-impact events such as wind storms, excess snow loads, drought and fires have a negative influence on the productivity of forests, further exposing trees to biotic hazards. Thus, efficient forest risk management requires comprehensive climate data depicting current and future climate variations and change at relevant spatial scale. Such data enable, for example, optimal selection of tree species for the planted areas, planning of risk minimizing forest thinning and harvesting patterns and helps to reduce superfluous use of fertilizers. As a component of the project "Sustainable, climate-neutral and resource-efficient forest-based bioeconomy, FORBIO" (http://www.uef.fi/web/forbio; @FORBIOproject) the Climate Service Centre in the Finnish Meteorological Institute produces climate datasets urgently required by the forest and environment researchers, planners, administrators and forest industry. These datasets contain information about the spatial variation of multiple key factors causing damages to forests in current and future climate conditions: snow load, return levels of maximum wind speed, drought, and forest fire risk and soil frost. The atmospheric reanalysis data (ERA-Interim) and climate scenarios were downscaled onto unprecedented high spatial resolution (20-100m) using GIS –software and sophisticated statistical-mechanistic modelling approaches. For example, whereas spatial variation of snow load can be mostly explained by elevation, for wind speed local topography and surface roughness are the key forcing factors. Modelling of local soil frost dynamics is of paramount importance due to its effects on soil bearing capacity; frozen soil enables transport of timber from locations that during summertime can be inaccessible. In addition, frozen soil reduces wind damage risk due to anchorage of tree roots. The produced datasets form a solid basis to support Finland's bioeconomy strategies in the upcoming decades and will be made freely available for public.