

Modelling Critical Levels of Ozone for the Forested Area of Austria

Modifications of the AOT40 Concept

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Abstract: The ozone risk impact for trees has been calculated by modelling the AOT40 for forest areas based on the Austrian Forest Inventory, ozone measuring data 1993 (120 monitoring sites), meteorological data and an elevation model. However, the **basic AOT40 approach** does not reflect the health status of Norway spruce in Austria. Therefore, additional thoughts are outlined in the following approaches taking into consideration the adaption of trees to the longtime ozone level and the ozone uptake into the sub-stomata cavity.

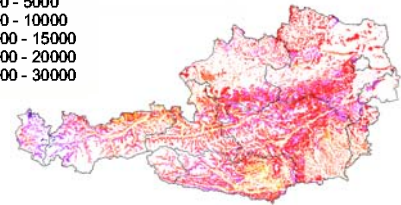
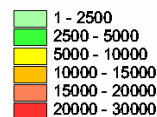
The **1st approach** modifies the AOT40 based on the assumption that forests have adapted to the pre-industrial levels of ozone, which increase with altitude. Thus the AOT level has to be defined as altitude-dependent gradient instead of a fixed AOT40 threshold.

The **2nd approach** modifies the AOT40 according to the ozone concentration in the sub-stomata cavity as response to light intensity and water vapour saturation deficit, which affect stomatal uptake.

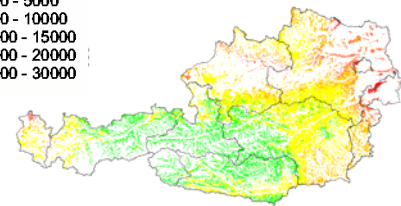
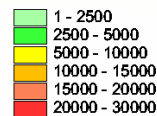
The **3rd approach** combines the other two approaches and includes forest hemeroby: The 1st approach (considering pre-industrial ozone levels) has been applied to autochthonous ("natural") forests, the 2nd (ozone uptake) approach to non-autochthonous ("altered") forests which have not been adapted to higher ozone levels at higher altitudes.

Conclusions: The approaches revealed that a plausible result concerning the ozone impact on spruce forests in Austria could only be reached by combining pre-industrial ozone levels, ozone flux into the spruce needles and the hemeroby of forests.

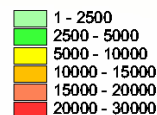
Basic approach: Accumulated ozone exposure exceedances of 40ppb



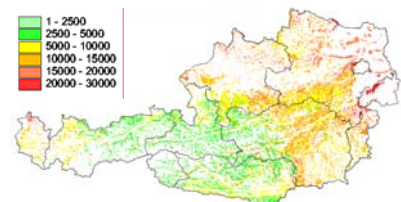
1st approach: Exceedances of an elevation-dependent gradient (32 to 57ppb.h)



2nd approach: Exceedances considering climatic factors that are influencing stomata opening



3rd approach: AOT elevation gradient applied for "natural forests" and climate influence on stomata opening for "altered forests"



AOT40 (UN-ECE 1994) = Accumulated exposure over a threshold of 40ppb. Provisional Critical Level for ozone, an AOT40 value of 10ppm.h.