



## **Constraints of Predicting Land Cover Changes from Bioclimatic Models – with Special Regard to Forest Cover**

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The determination of “climatic envelopes” of biota and especially of forests has attained a sudden actuality in the context of expected climatic changes, as zonal vegetation types serve as convenient climate indicators. Studies on bioclimatic modelling and on climate change-triggered vegetation shifts are abundant and have been considered also in the fourth report of IPCC. Present and predicted distribution of forest biota provide an illustrative impression of shift of potential land cover changes. There are, however, certain assumptions which remain often unmentioned, and which – if left unconsidered - may compromise the outcome. The bioclimatic models of actual biome or species distributions may be biased, because:

- (1) Present “natural” vegetation cover types are in most part of the world under strong human influence. In Europe, even the few remaining close to natural landscapes are the results of long lasting human interference of the past which continue also in the present.
- (2) It is a well known ecological rule that actual ranges of species and biota are regulated by complex, often hidden interactions which may modify distributions. Physiologically (more accurately: genetically) set potential limits may be per definitionem wider than the realized, actual ones. To include extrazonal outliers in bioclimatic models may cause errors.
- (3) The longevity and persistence of forest trees may be deceptive for climatic modelling at the retreating, xeric limits. The climatic zones move usually faster than the land (forest) cover indicating those zones.
- (4) Climate envelopes use standard (mean) climate parameters. It is however the effect of the sequence of consecutive extreme weather events and linked biotic damages which will concretely decide over survival or mortality. Therefore the use of climate means should be regarded only as surrogates for weather extremes.
- (5) The change of climatic environment may alter the phenologic behaviour which cannot be tested in advance. This affects also consuming and pathogenic organisms. Forecasts are unreliable, especially because up to date negligible or unknown pests and diseases may become virulent. Environmental shifts may also lead to changing interactions between hosts and consumers.

The described and other factors may lead to overestimate progress at the front, and to possibly too pessimistic forecasts at the retreating (xeric) end of distributions.