

Quercus petraea

Description of model and ensemble projections

The current distribution of *Quercus petraea* is modelled to cover most of the Swiss Plateau and the Northeastern Jura region. In addition, the species also is modelled to grow in the Valais, the Anterior Rhine valley and abundantly in the Ticino. Some projected regions of high habitat suitability are likely slight over-predictions by the model (e.g. Anterior Rhine valley, Hasli, and Upper Reuss valley), although there are some scattered observations in these regions.

Under projected climate change using the A1B scenario, most combinations of statistical and regional climate models predict a rapid spread of *Q. petraea* on the Plateau, in all valleys of the Alps and in the Ticino, meaning that these regions represent soon current climate conditions, under which *Q. petraea* is currently not being observed.

The species migrates to higher altitudes, but doesn't lose suitable habitats at low altitudes by the end of the Century.

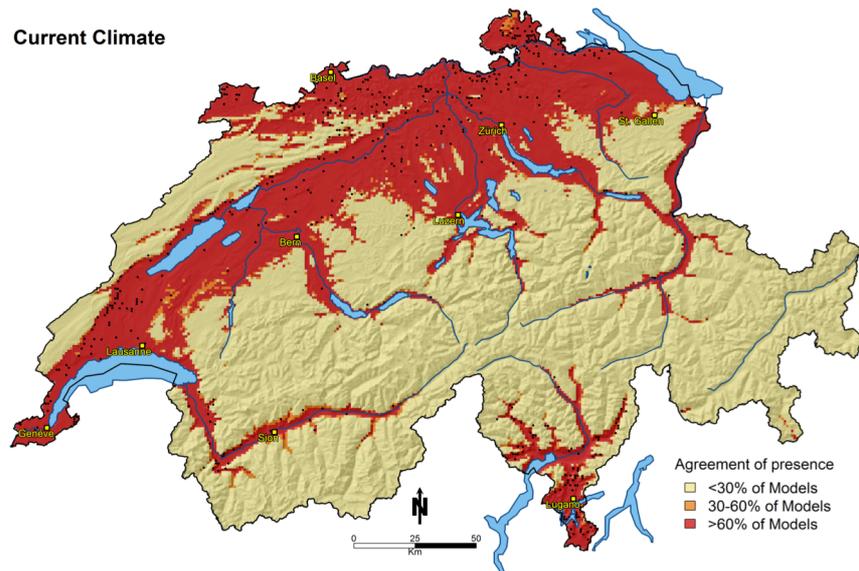


Figure 1. Current distribution (black dots) from the Swiss National Forest inventory (LFI 1) and simulated habitat suitability under current climate as calibrated from LFI forest inventory data of Switzerland.

Synthesis and Conclusions

The model fits the distribution of *Quercus petraea* well, and can be considered a credible model to project the future habitat suitability of *Q. petraea*. The ensemble models project a 100% overlap between the current and the future range in Switzerland and still comparably high overlaps (52%) in Europe. This is a much higher overlap than previously modeled (45%, Zimmermann *et al.* 2006). The difference mostly originates from using less extreme climate scenarios in this report. Here we used the A1B scenario, which is a moderate warming scenario from the fourth IPCC assessment report (IPCC 2007). The previous simulations were based on the 3rd assessment report (IPCC 2001), where the A1FI scenario was much more extreme compared to the current A1B scenario.

Also, the species will expand by the end of the Century its range of suitable habitats in Switzerland (+68%), and still largely maintain its European habitat suitability range (-5%). The species colonizes dry and warm habitats, but occasionally also dominates on more mesic conditions (given it is warm). It does not grow on very wet soils (such as e.g. *Q. robur*). Many oak forests are of human origin. Oaks in general tolerate disturbance by (frequent) cutting (coppicing), which favors oaks over other, less tolerant species such as beech or maple. Yet, on drier and variably dry sites, the species can dominate due to its tolerance to variable drought levels. *Q. petraea* interbreeds frequently with both *Q. robur* and *Q. pubescens*.

The species can be considered a winner of climate change. It is one of the likely future species on the Swiss Plateau by the end of the Century given the projected warming. Under this warming scenario, the species will not require human assistance, and will likely be one of the canopy trees. It is already widely present, although not in high abundance. From these locations (near ridges, at forest edges, or at shallow and rocky sites) it can spread onto deeper soils harboring currently more mesic site conditions during the warming of the current Century. Due to the abundant animal dispersal of seeds, it will likely be able to colonize these regions without much assistance from humans. Both the close-by distance and the high overlap between current and future range guarantee that the species will likely be able to adjust to the ongoing climate change. Yet, the species requires protection from browsing during the regeneration phase.

Range change statistics

| | CH | Europe |
|--|--------|---------|
| Current range size [km²] | 13'891 | 131'264 |
| Future (2080) range size | 23'406 | 123'815 |
| Range Change 2080/2000 [%] | 168% | 94.3% |
| Overlap 2000/2080 [km²] | 13'891 | 68'053 |
| Overlap/current range [%] | 100% | 51.8% |

References

IPCC (2001) *Climate Change 2001: The Physical Science Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, UK and New York, NY, USA.

IPCC (2007) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, UK and New York, NY, USA.

Zimmermann NE, Bolliger J, Gehrig-Fasel J, et al. (2006) Wo wachsen die Bäume in 100 Jahren? In: *Wald und Klimawandel* (ed. Wohlgemuth T), pp. 63-71. WSL, Birmensdorf, Schweiz.

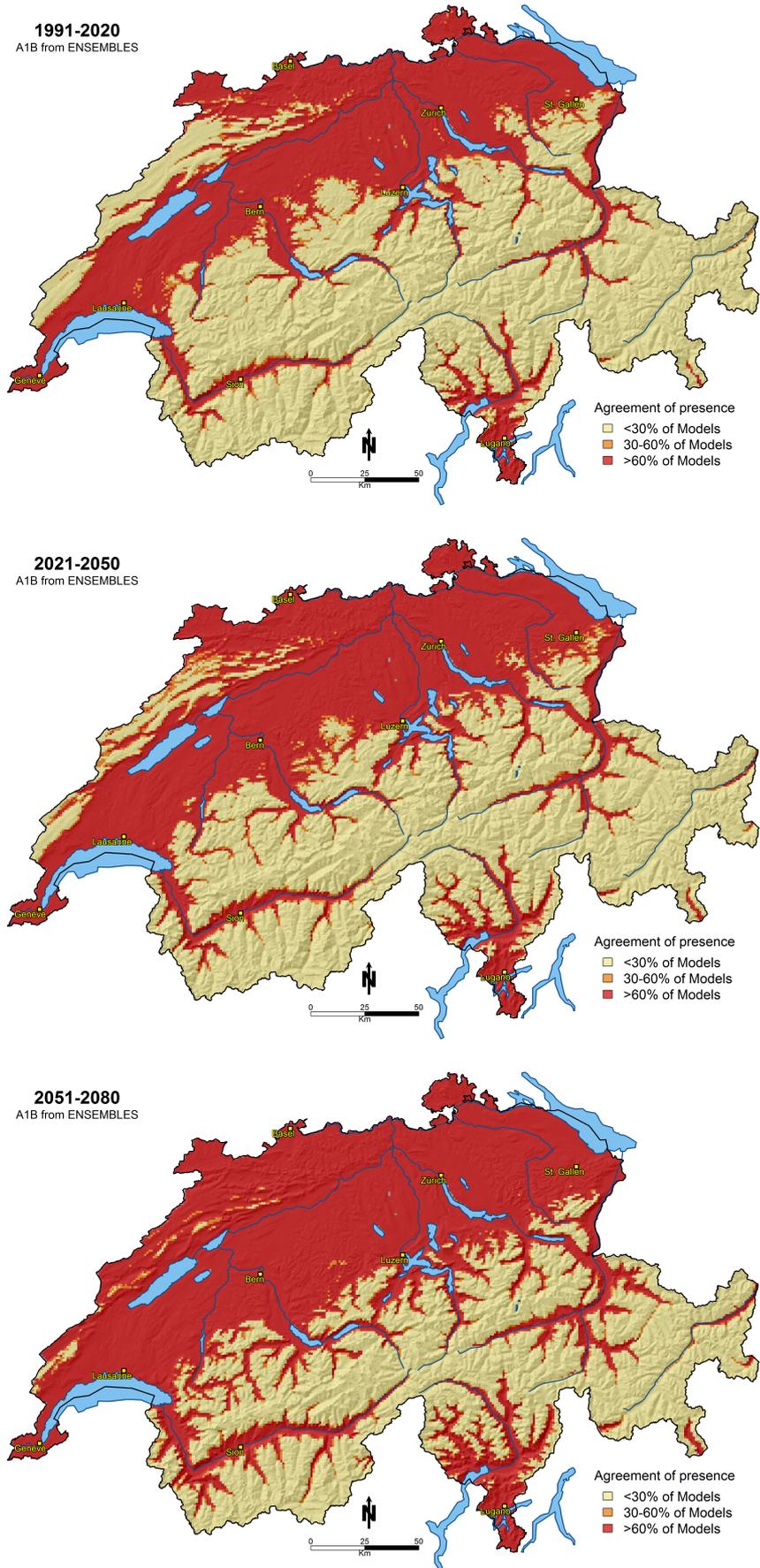


Figure 2: Ensemble of projected future ranges of suitable habitat as modeled from six RCMs and six statistical models. Light yellow colors indicate that all climate & statistical model combinations project absence of the species, while dark red colors indicate presence. Orange colors indicate uncertainty regarding habitat suitability.