

Pinus cembra

Description of model and ensemble projections

The current distribution of *Pinus cembra* is modelled to cover most of the upper subalpine forests in the dry, Interior Alps, and partly also in the Northern Pre-Alps. However, in these regions, the species is less clearly predicted, and many projections are associated with comparably high uncertainty. Compared to the observed distribution, the species is probably over-predicted quite strongly in the Western Pre-Alps, and in the Anterior Rhine Valley, although, in both regions there are pockets of *P. cembra* distributions.

Under projected climate change using the A1B scenario, most combinations of statistical and regional climate models predict a rapid disappearance of *P. cembra* at the altitudes it currently colonizes, meaning that these regions represent soon climate conditions, under which no presence of *P. cembra* is currently being observed. The species “escapes” to higher altitudes. In addition, it primarily retreats to higher altitudes in the two centers of dry climates (Valais and Engadin), while in all other regions, the ensemble projections are very uncertain.

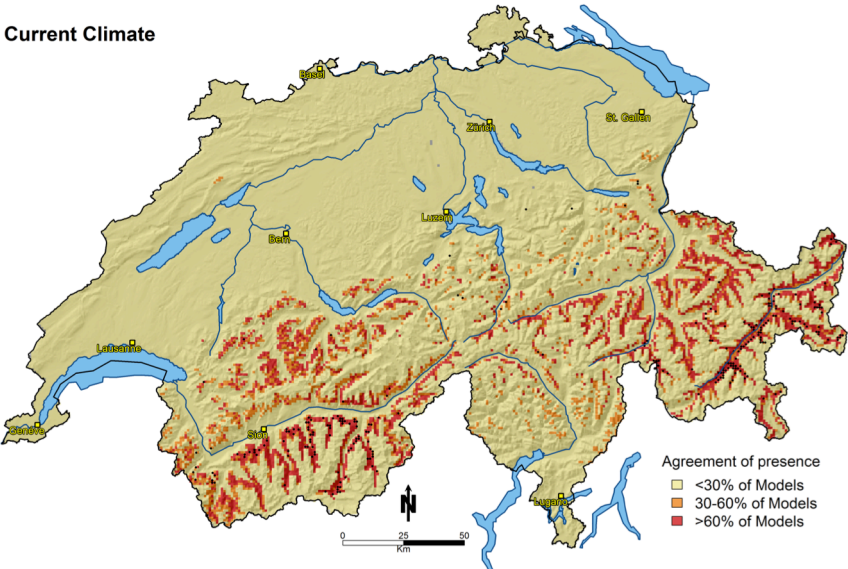


Figure 1. Current distribution (black dots) from the Swiss National Forest inventory (LFI 1) and simulated habitat suitability under current climate as calibrated from LFI forest inventory data of Switzerland.

Synthesis and Conclusions

The model fits the distribution of *Pinus cembra* quite well, and can be considered credible, yet with overestimations in some regions North of the Alps. The ensemble models project only a 1% overlap between the current and the future range in Switzerland, which is one of the smallest of all species modelled in PorTree. Also, the overall range is projected to shrink to 30% of the currently modelled range size. This means that the species is projected to lose significant portions of its range, and that there is a very small overlap only between current and future suitable habitat range. This originates primarily from the fact that the thermal niche of the species is very narrow, and because there is not much land area above the current range of the species.

The species grows very slowly, is not very shade tolerant, and depends on nutcrackers and small rodents for seed dispersal. This fact means that it can likely track climate change at a sufficient pace, due to the short distances from current occurrences to projected future suitable habitats by this “animal-assisted migration”. Also, the “loss” of suitable habitats at lower altitudes is likely not caused by physiological stress, but rather by competition from upward moving spruce trees. Yet, such competition dynamics will take hundreds if not thousands of years. In summary, despite the strong

Pinus cembra is listed in the IUCN Red List database (Farjon 2013), and listed there under “least concern”. This low concern originates from the view that the species currently is: (a) well protected in many reserves, and (b) expanding upslopes and increasing in populations size.

Range change statistics		
	CH	Europe
Current range size [km²]	2'952	–
Future (2080) range size	848	–
Range Change 2080/2000 [%]	28.7%	–
Overlap 2000/2080 [km²]	31	–
Overlap/current range [%]	1.1%	–

References

Farjon, A. 2013. *Pinus cembra*. The IUCN Red List of Threatened Species. Version 2014-2. <www.iucnredlist.org>. Downloaded on 22nd September 2014.

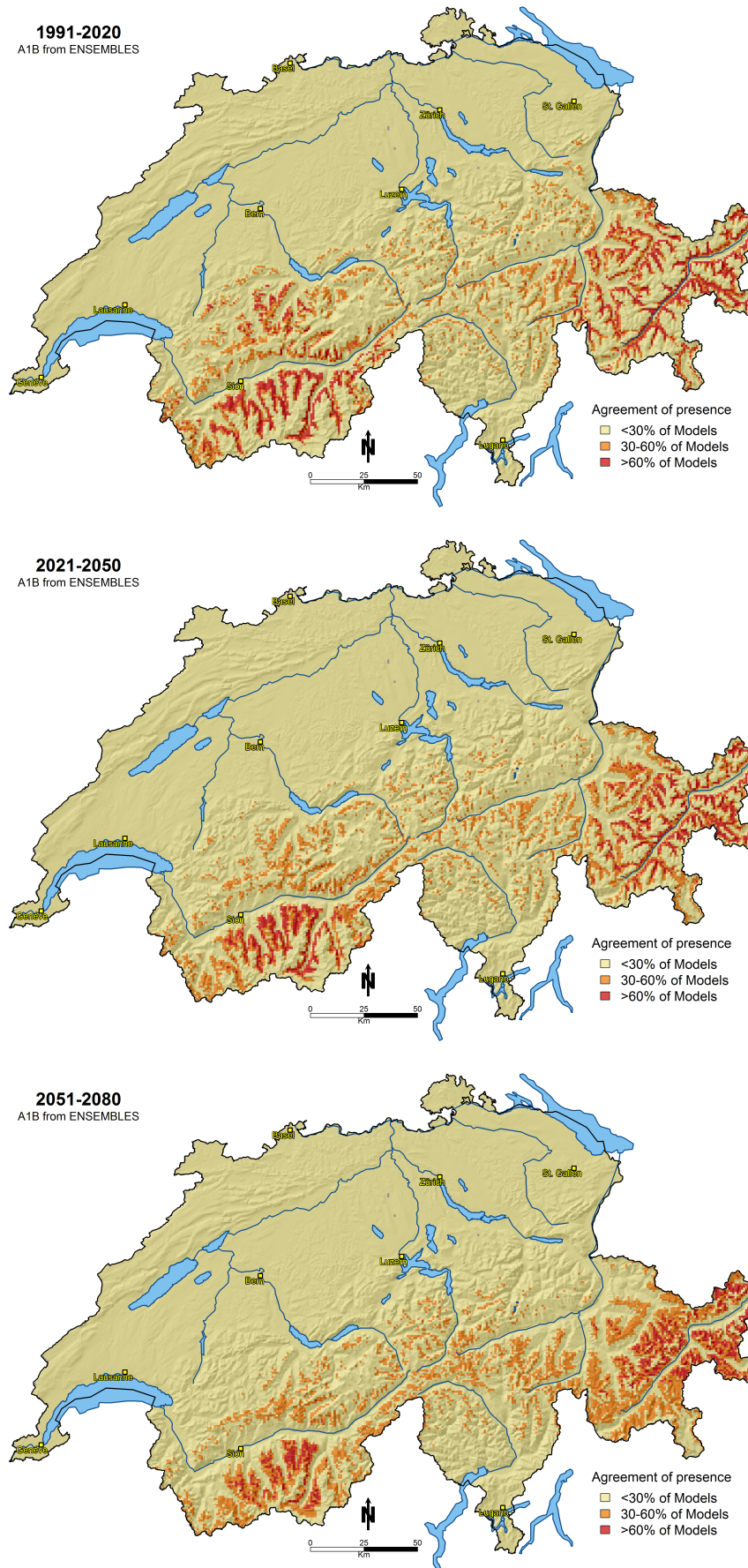


Figure 2: Ensemble of projected future ranges of suitable habitat as modeled from six RCMs and six statistical models. Light yellow colors indicate that all climate & statistical model combinations project absence of the species, while dark red colors indicate presence. Orange colors indicate uncertainty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