Climate Impact Functions for Assessment of Forest Productivity under Climate Change -Model Study Germany-

INTRODUCTION

- Request for climate impact functions for evaluation of forest productivity to develop management strategies that include risk potential regarding climate change
- Derivation of climate impact functions by a simulation study with the forest growth model ***4C***

METHODS

- Calculation of net primary production (NPP) for 15 year old pure pine, spruce, beech, and oak stands at 2342 climate stations with the forest growth model ***4C*** (Lasch et al., 2005)
- Use of the parameterization for 4 soil types of Germany (Wald-BÜK 1000) arranged by water availability and carbon to nitrogen ratio in poor-low **(PL)**, rich-low **(RL)**, poor-high **(PH)**, and rich-high **(RH)** (Table 1)
- Preparation of linear regression models **(LM)** with climate (annual mean temperature, annual mean radiation, annual sum of precipitation, drought index*) and soil data (water availibility, carbon to nitrogen ratio) as independent variables (Fig.1)
- Application of climate scenarios with stepwise temperature increase of 0.5 K (2007-2060) from the statistical regional climate model ***STAR 2.0*** (Orlowsky et al., 2008) with linear regression model to evaluate impacts

Tab 1: Soil characteristics of the four applied soils

type	symbol	available water [mm]	C_{tot} [gm^{-2}]	N_{tot} [gm^{-2}]	C/N
Cambisol	PL	143	19650	640	31
Cambisol	RL	92	4250	262	16
Cambisol	PH	231	19650	640	31
Cambisol	RH	179	4250	262	16

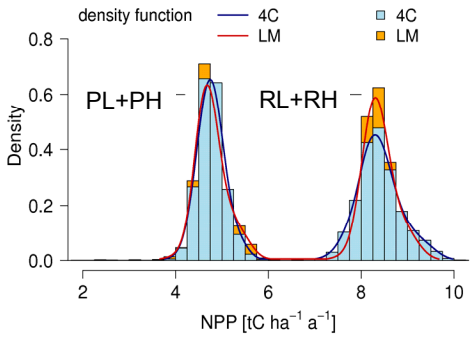

Fig. 1: Comparison of mean annual NPP simulated with 4C and LM at 2342 climate stations

RESULTS

- Regional different pattern of climate change impacts (Fig.2)
- The higher the global temperature increase the higher the risk for decreasing NPP (Fig.3)
- Among the simulated tree species Spruce is most vulnerable in Northeastern Germany

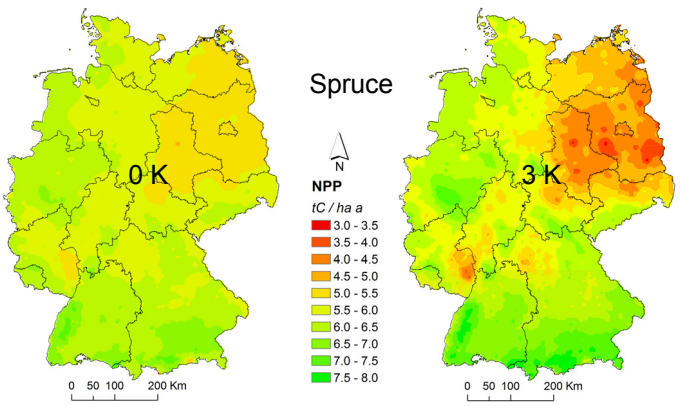

Fig. 2: Impacts of climate scenarios on NPP for spruce, the 0 K and 3 K temperature change (2007-2060)

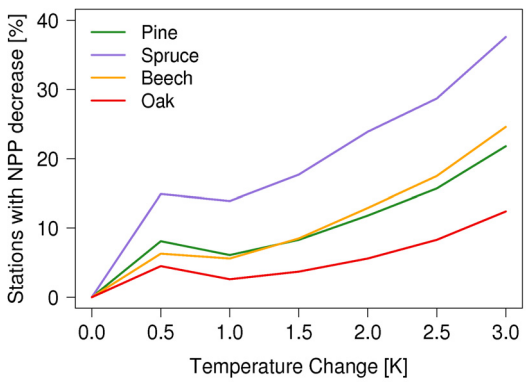

Fig. 3: Relative share of stations with NPP reduction dependent on global temperature increase

*mean annual number of successive days without rain in the growing season

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