GENERAL INFORMATION

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ABSTRACT

Slow-colonizing forest understorey plants are probably not able to rapidly adjust their distribution range following largescale climate change. Therefore, the acclimation potential to climate change within their actual occupied habitats will likely be key for their short- and long-term persistence. We combined transplant experiments along a latitudinal gradient with open-top chambers to assess the effects of temperature on phenology, growth and reproductive performance of multiple populations of slow-colonizing understorey plants, using the spring flowering geophytic forb *Anemone nemorosa* and the early summer flowering grass *Milium effusum* as study species. In both species, emergence time and start of flowering clearly advanced with increasing temperatures. Vegetative growth (plant height, aboveground biomass) and reproductive success (seed mass, seed germination and germinable seed output) of *A. nemorosa* benefited from higher temperatures. Climate warming may thus increase future competitive ability and colonization rates of this species. Apart from the effects on phenology, growth and reproductive performance of *M. effusum* generally decreased when transplanted southwards (e.g., plant size and number of individuals decreased towards the south) and was probably more limited by light availability in the south. Specific leaf area of both species increased when transplanted southwards, but decreased with open-top chamber installation in *A. nemorosa*. In general, individuals of both species transplanted at the home site performed best, suggesting local adaptation. We conclude that contrasting understorey plants may display divergent plasticity in response to changing temperatures which may alter future understorey community dynamics.

MATERIALS & METHODS

study area	5l (seed collection), 5n (open top chambers)
time period	September 2008 – July 2010
goal	Assessment of the effects of temperature on phenology, growth and reproductive performance of multiple populations of slow-colonizing understorey plants along a 1900-2300 km latitudinal gradient. Answer the three research questions: - How do the study species responded to temperature variations? - Do southward transplantation and experimental warming result in a similar

	response? - Do home transplants perform better than away transplants?
set-up	common garden transplant experiment: three sites along a longitudinal gradient experimental warming (OTCs) in one of the common gardens seeds and adult plants in pots
data collection	life-history traits (growing season of 2009 and 2010) - adults: day of emergence, start of flowering, number of adult and fruiting individuals, plant height, number of seeds, seed mass, aboveground biomass and SLA (in 2010), germination trial in growth chamber with seeds (collected in 2010) - seeds: number of seedlings (early & late spring, *A. nemorosa*, 2009 & 2010), number of seedlings + seedling height (2009, *M. effusum*), same measurements as for adults (2010, *M. effusum*) two microclimate data loggers (Sept 2008 – July 2010) - air temperature and relative humidity at 10cm height above the soil surface - temperature of the litter layer at the soil surface - soil temperature at 5 cm below the soil surface
remarks	

RESULTS

The transplant site best explained differences in phenology, growth and reproduction of both species in the common garden experiment. Both emergence time and flowering phenology were delayed with increasing latitude of the transplant site. Plant height, number of individuals and aboveground biomass decreased from the southern to the northern common garden across all populations in *A. nemorosa*, while they increased in *M. effusum*. SLA increased from the northern to the southern common garden in both species. The year of sampling and the latitude of origin also had significant impacts. Plant height, number of individuals, fruiting probability and aboveground biomass decreased significantly with increasing homeaway distance in adult individuals of both species. Individuals that were transplanted closer to the home site performed better than at the other sites or than the other populations at that site.

Experimental warming in the OTCs significantly advanced emergence and flowering phenology and had important effects on growth and reproduction of the transplanted *A. nemorosa* adults. SLA and the number of seeds per individual decreased, while plant height, the percentage of fruiting individuals, seed mass and seed germination increased with experimental warming. Germination rates of the wild-collected seeds originally sown into the pots were not affected by experimental warming.

The day of leaf emergence, flowering start, plant height and germination percentage of seeds of *A. nemorosa* adults showed a similar response to increasing temperatures with experimental warming and southward transplantation, while the percentage of fruiting individuals, SLA and number of seeds displayed a different response to temperature variations when results of the experimental warming and transplant approach are compared. The temperature differences between open-top chambers and control plots were much smaller than between the northernmost and southernmost transplant site.