

No risk – no fun: Sensing the optimal time to leaf-out

Frederik Baumgarten¹, Jacqueline Oehri² & Yann Vitasse¹



1. CONTEXT

- Timing the leaf-out is crucial for the fitness of deciduous trees inhabiting temperate and higher latitudes.
- Warmer temperatures promote plant development which in turn advances spring phenology.
- This shift increases the probability of frost occurrence, which could put plants at a higher risk for frost damage.



Fig. 1: Frost damages on oak (left) and beech (right)

3. PRELIMINARY RESULTS

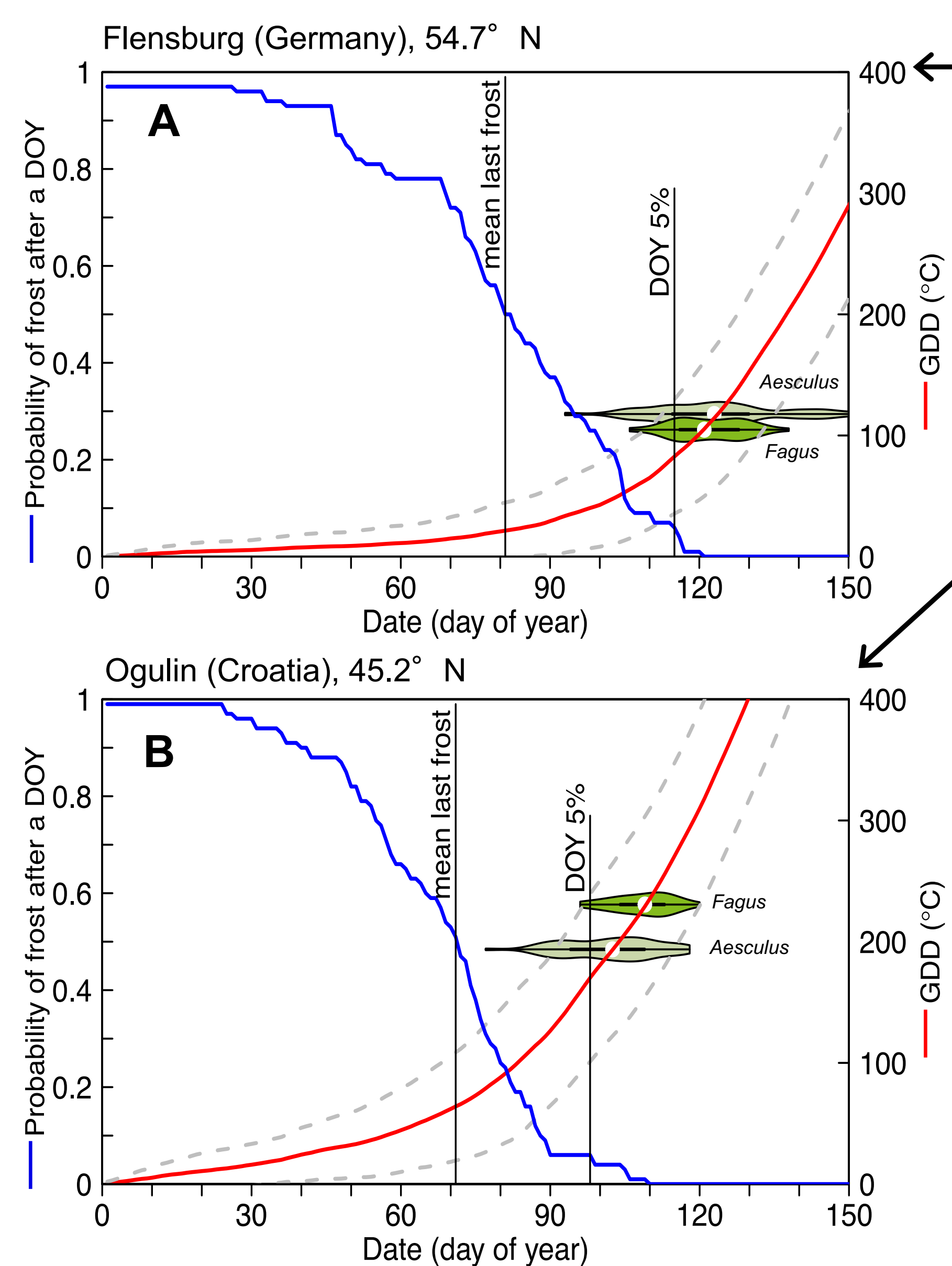


Fig. 3: Frost occurrence and growing degree days in relation to leaf-out (violin diagramm) for the northern (A) and southern (B) distribution range of beech (*Fagus sylvatica*) and horse-chestnut (*Aesculus hippocastanum*)

2. METHOD

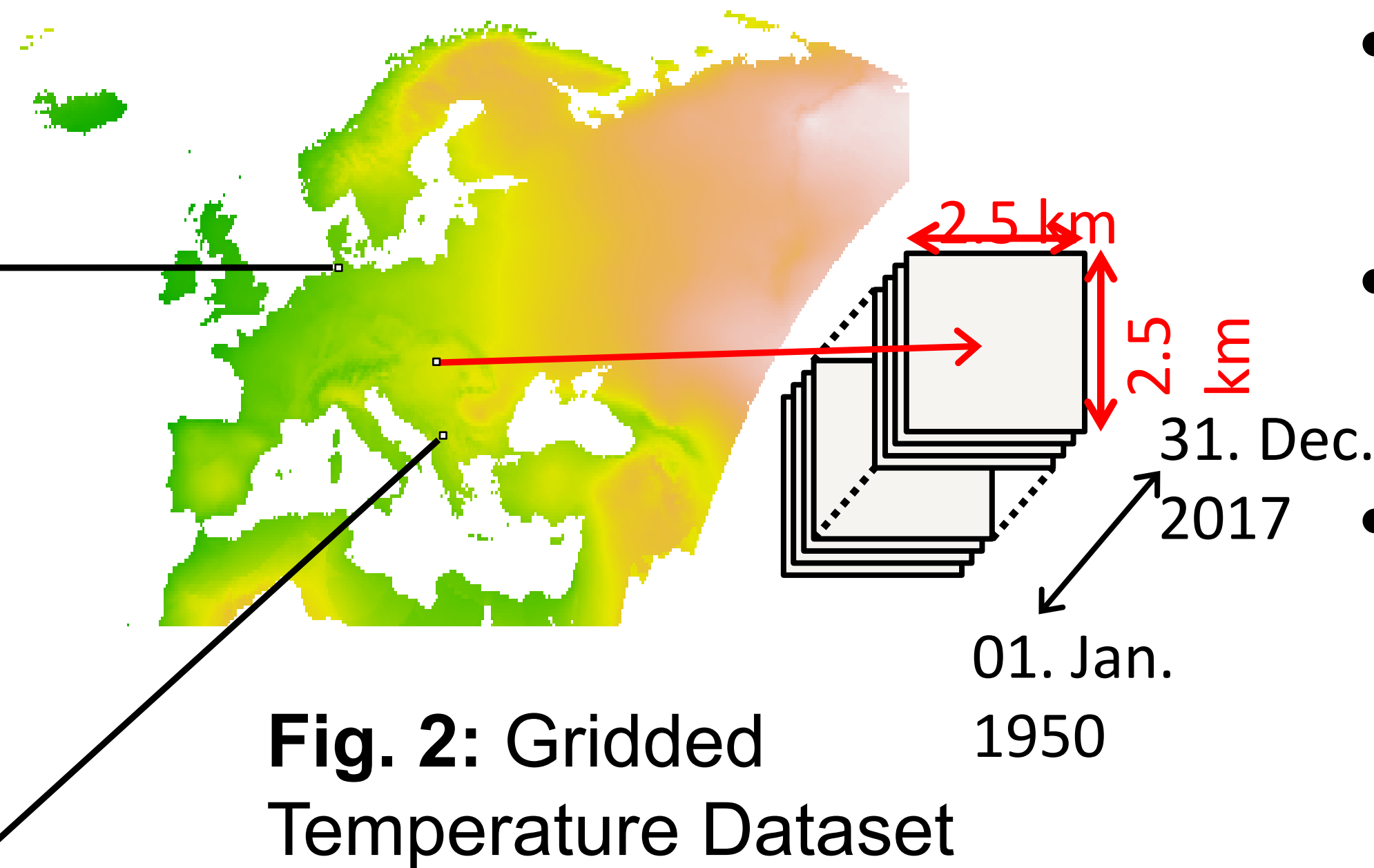


Fig. 2: Gridded Temperature Dataset

- Probability of frost occurrence
→ Daily absolute min. air temp.
- Growing Degree Days (GDD)
→ Daily mean air temp.
- leaf-out phenology
→ Long-term series of the European Phenological Database (PEP725)

TAKE HOME MESSAGE

- The probability of frost (DOY 5%) over Europe has advanced at higher latitudes and elevations, but delayed for some lowland regions.
- The warmth (GDD) of oceanic climates promotes plant development and potentially puts plants at higher risk for freezing damage.

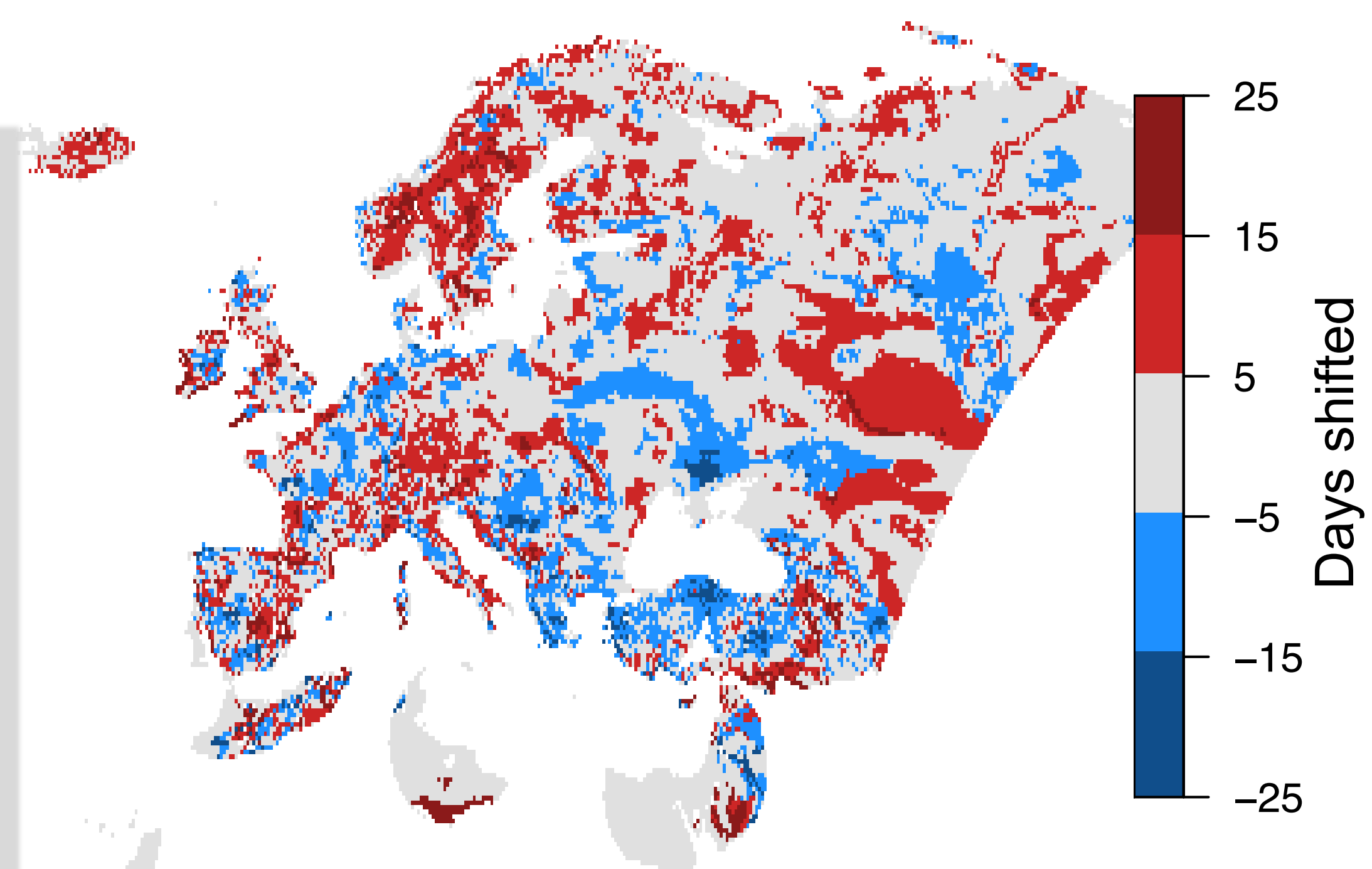


Fig. 4: Shift of late frost events (DOY 5%) between 1950-80 and 1981-2017

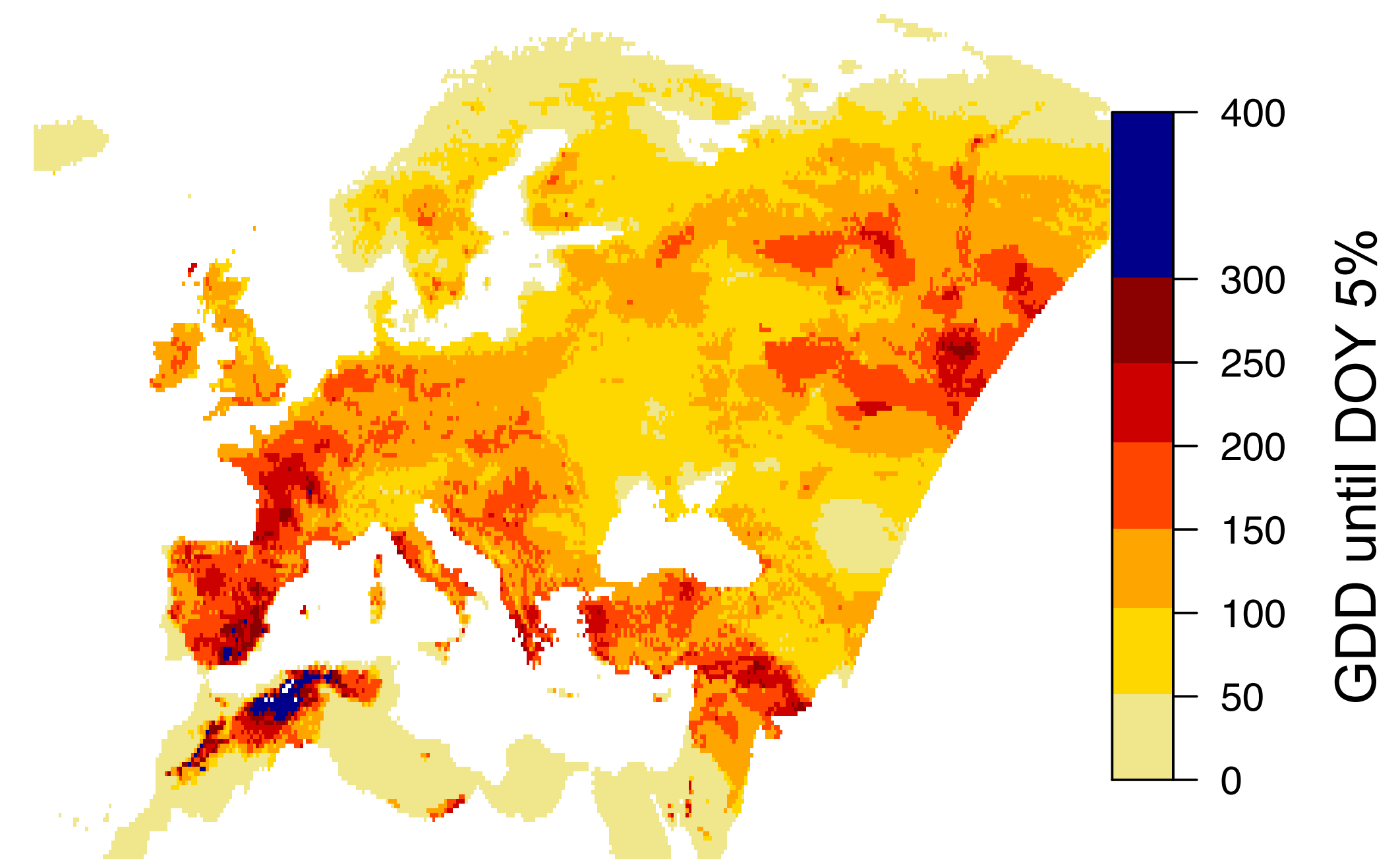


Fig. 5: Growing degree days (GDD) from 1. Jan. until reduced risk of frost (DOY 5%)

4. NEXT STEPS & PERSPECTIVES

- Do tree populations follow different strategies along a continentality gradient and across species
- Conduct experiments to quantify the penalty of freezing damage