Climate Hazards

Lizzie & Isabelle

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Some current issues

- See `howto_phenofit` for one place I am stuck.
- What site and species do we want to use?
  - Ideally one with an existing model we do not have to spend a long time verifying?
  - Both historical climate and future climate ... so we can compare
  - But also one where some events (frost, heat damage) may have shifted at the same time that growing season length or seasonal warmth has had an impact.
- High temperatures?
- What do we want to measure?
  - Phenological shifts related to end/start of season and particular damage events
  - Tissue or ideally reproduction lost due to each event type
  - Reproduction changes due to longer/warmer season
  - What else?
- What *in silica* experiments do we want to run?
  - Historical climate
  - CMIP future climate scenario (maybe) – characterize future climate: what is mean shift, what is variance shift?
  - Historical climate + 2C?
  - Historical climate with increased variability in spring (and summer?)
  - Historical climate + 2C? with increased variability in spring (and summer?)
  - We want to test how phenological shifts x extremes matter, so I wonder if there is a scenario where we can try to hold phenology more constant and layer on climate variability? Not sure what that will show us ... YES: Can do this – when initializing you can do this, 'activate the date files' – give it specific dates (see methods Duputie et al. 2015 on plasticity GCB). Not sure if it works for Phenofit 5 (see Gauzere Evolution Letters 2020 .... new standing variability in phenology may make this hard).

Meeting notes

9 mars 2023

1. Sites
   (a) Previously discussed: Southern beech forest as site (Massan and sites in Pyrenees) may not be ideal as lengthening of growing season is not happening in southern range (because drought is shortening the length of the growing season; senescence now in August sometimes). That's the REAL world though, the current PhenoFit shows it lengthening (Isabelle has a postdoc starting in May who may try to work on the drought aspect to fix this)
   (b) Right now the model (Phenofit 4; Delpierre) does not include drought effect on senescence ... just temperature and daylength affect senescence
   (c) But do we need specific sites? Only if we want to compare to what is happening.... But we do need for some climate data.
   (d) But be sure to pick a site that is FLAT (because using climate re-analysis)
2. Adding heat damage: Need good experimental data ... 60C at surface for adult leaves, lower for young leaves (June 2019 saw leaf damage, even on Holm Oak) – so no, don't add.
3. Species
   (a) There are parameterized models for 20 species or so, could use one of these. Or, an artificial species – make up parameters.
   (b) Work with a broadleaf and an evergreen needleleaf.
   (c) Quercus robur and patraea are basically the same species.
   (d) Actually do these three (based on comparisons and having well parameterized models for them) Do querob/quepet (pick one), fagsyl, and pinsyl. Look at the overlay distributions for somewhere flat and not too far south. Look at the new European atlas (European atlas of forest trees) .... https://forest.jrc.ec.europa.eu/en/european-atlas/ .. see also SI of Duputie...
4. Phenofit5 is still being parameterizing and tested. Used already for beach and Oak.
5. What we'll measure?
   (a) Phenofit 4 has annual fitness: sum(survival + reproductive success) ... reproductive success is based on ripe fruit by end of season before leaf senescence. Survival has a crude carbon metric. – so fitness is constrained by spring frost and length of season.
   (b) Survival is the product of 3 survival parts (temp, drought, carbon: most of survival is drought).
   (c) MaturationIndex is a metric of if the season was long enough .... so this is a way to measure season length
   (d) FruitIndex and LeafIndex only go below 1 due to frost ... so these are ways to measure frost loss.
   (e) LeafDormancyBreakDate relates to leaf-unfolding and to frost risk.

6. Some notes on climate. ...
    (a) ERA5land model at 10km (includes scenarios and future)
    (b) WHC is hard to calculate – so many want to try across three values (low/medium/high).

Next steps

Solve current issues above!
Start git repo.
Come up with graphs to make ...
Pick a site, ask Florence for climate and start ....