

Climate Hazards

Trying to organize results

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1 Historical trends

- *Fagus* is determined mainly by FruitIndex (related to frost damage).
- *Pinus* survival dominates (due to carbon problems)
- *Quercus* is determined mainly MaturationIndex (does not mature in time), but mostly it is fine.

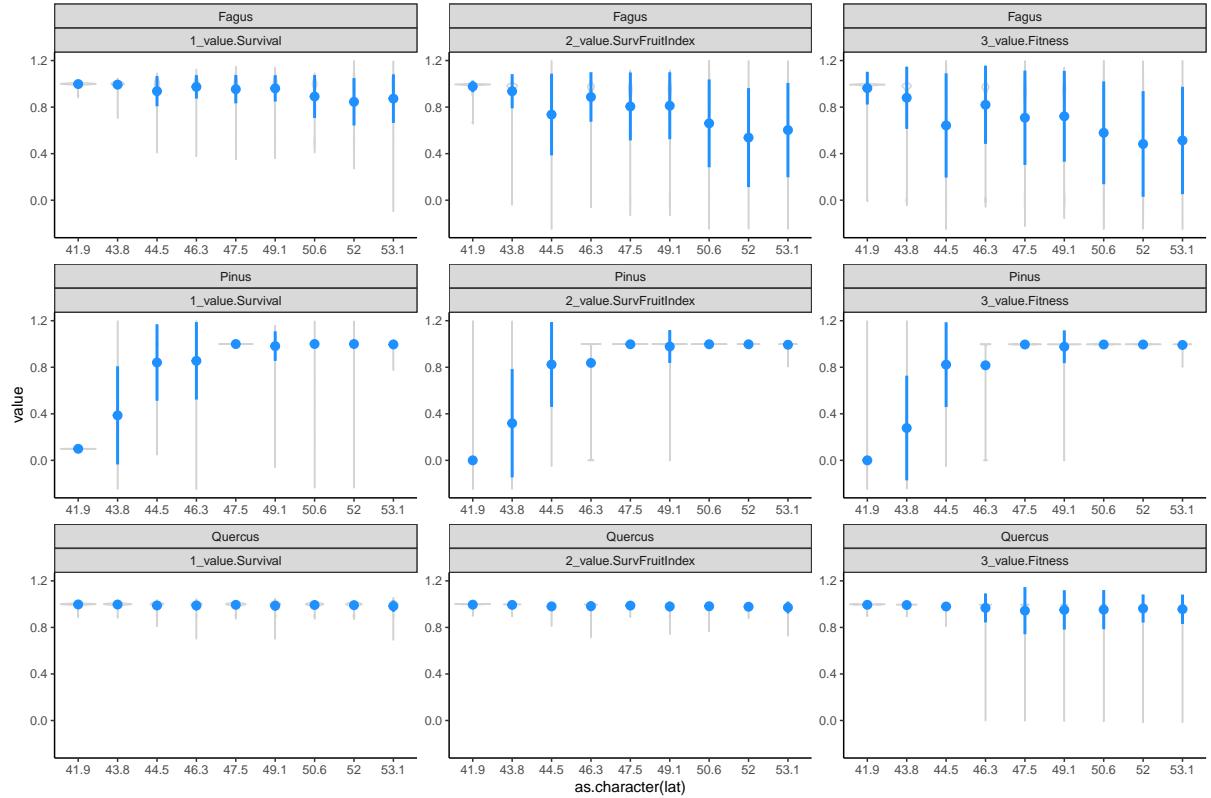


Figure 1: These results build through the multiplicative components of fitness (which are multiplied together): Survival (left), Survival*FruitIndex (middle) and Fitness, which is Survival*FruitIndex*MaturityIndex (right). Given high survival and little change between the middle and right panels we can see that *Fagus* is determined mainly by FruitIndex (this makes sense as it is often affected by frost damage, having a low tolerance of low temperatures). We see next the for *Pinus* survival dominates (often it does not meet the chill requirement for leafout and thus has no carbon and low CarbonSurvival so low total Survival) and finally, for *Quercus* it's MaturityIndex (this makes sense as the fruits are quite large and can take a long time to mature—it doesn't always happen according to this model).

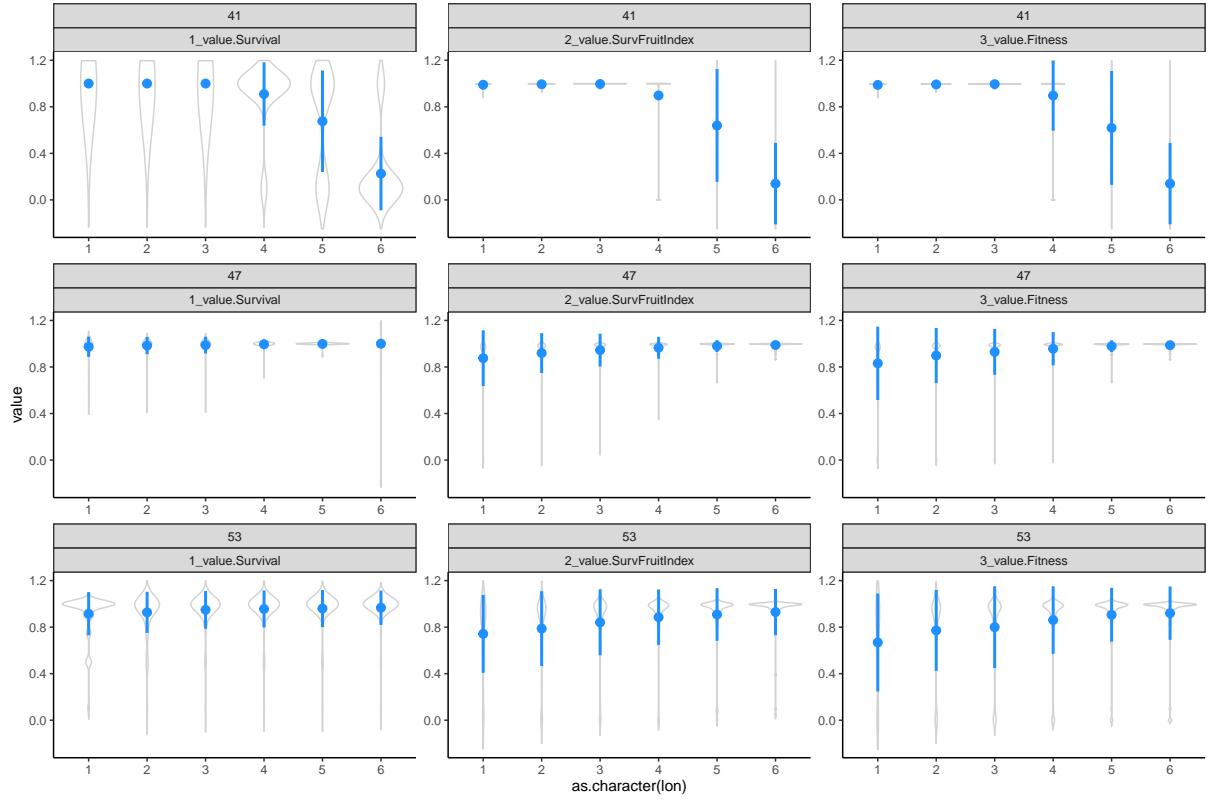


Figure 2: *Fagus* across 0 (1) to +5 (6) meaning warming showing three latitudes. In June 2023, we discussed: at low latitudes (see next figure) that there was reduced CarbonSurvival (not enough cold means late dormancy) and thus FruitMaturationDate gets later. While at higher latitudes (see Fig. 4) there is an increase in the FruitIndex as FruitMaturation is higher.

2 Overview of warming simulation results

2.1 *Fagus* warming results

Next the mean warming simulations. In understanding *Fagus* results (Fig. 2) we discussed how we could see that at low latitudes (Fig. 3) that there was reduced CarbonSurvival (not enough cold means late dormancy) and thus FruitMaturationDate gets later. While at higher latitudes (Fig. 4) there is an increase in the FruitIndex as FruitMaturation is higher.

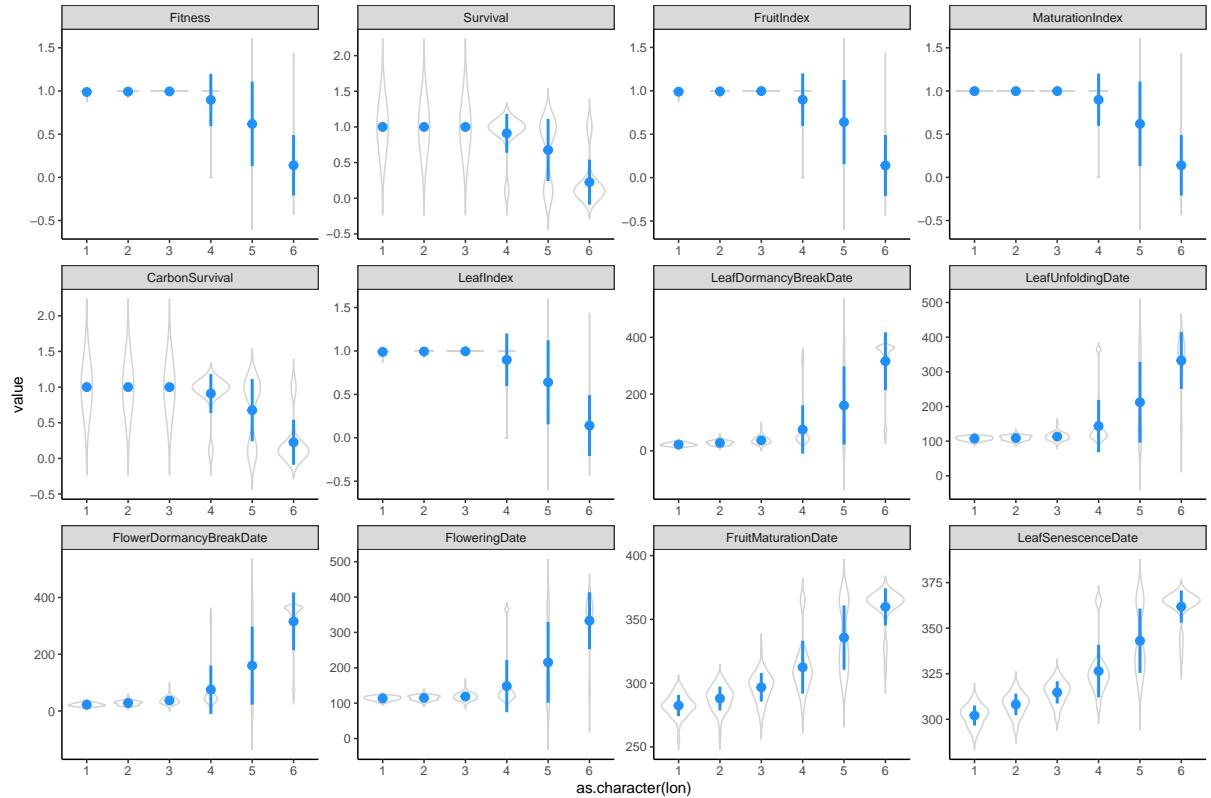


Figure 3: *Fagus* across 0 (1) to +5 (6) meaning warming across fitness components at 41 latitude. Low fitness is driven by low carbonsurvival, which occurs because of late dormancy break date (because leafdormancybreakdate is variable that's the driver; if it were frost, we'd see more constant leafdormancybreakdate and variable in leafindex).

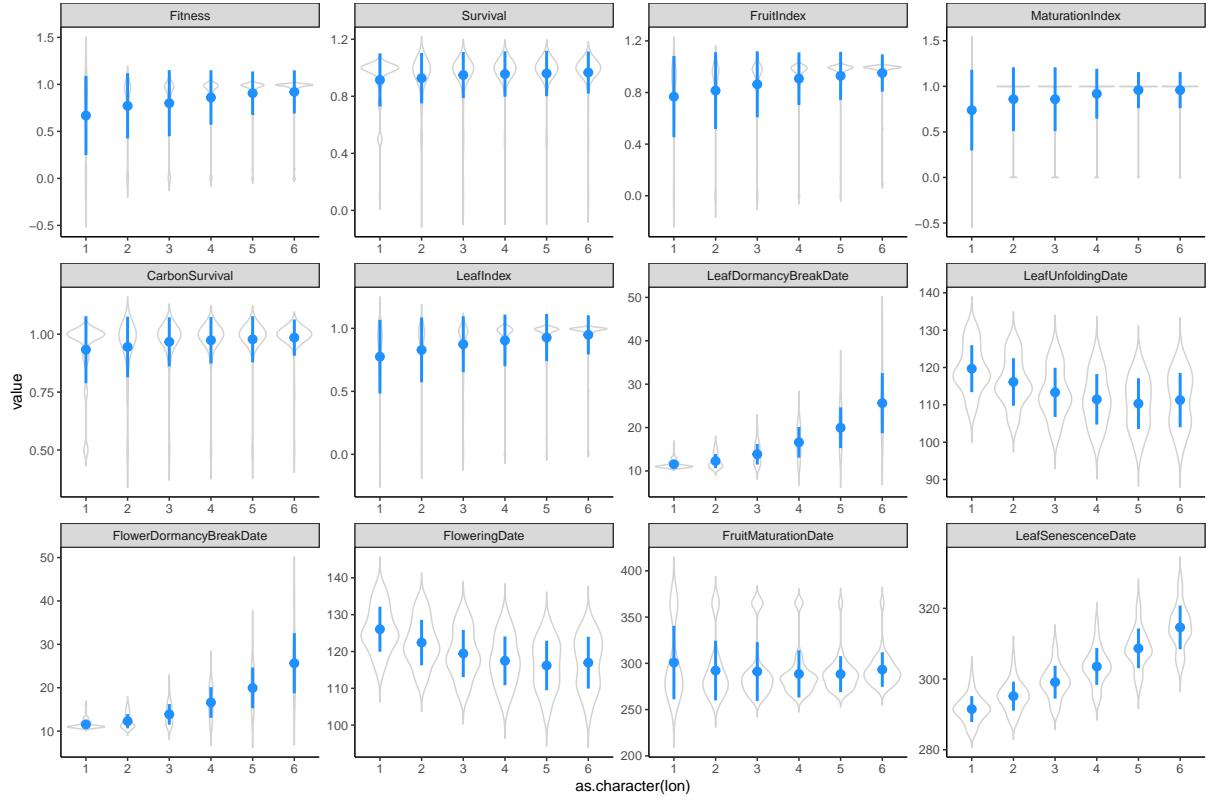


Figure 4: *Fagus* across 0 (1) to +5 (6) meaning warming across fitness components at 53N latitude. Here's warming reduces frost and thus fruitindex goes up and survival goes up. Note that the leafdormancybreakdate also gets a little later but leafunfolding does not because the warming is still enough for get earlier leafout (and there is a buffer where early dormancybreakdate does not matter because it's too cold leaf unfolding to start).

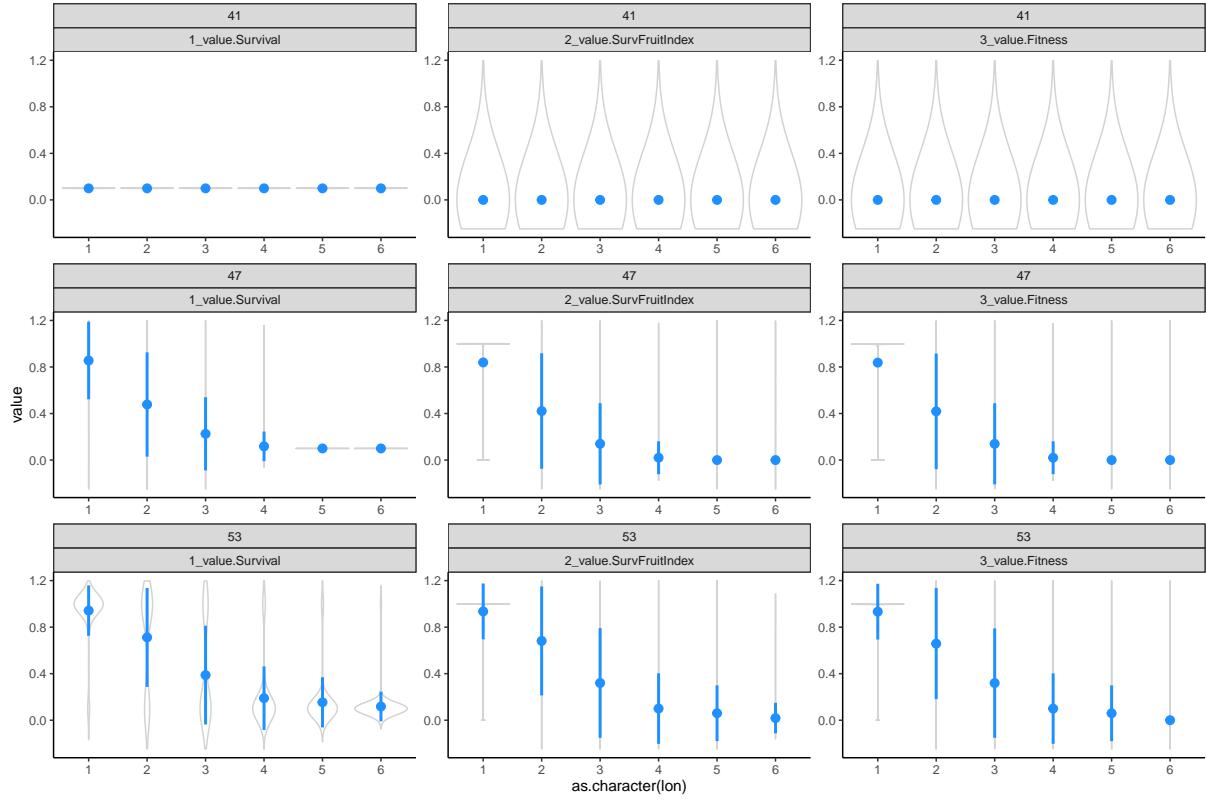


Figure 5: *Pinus* across 0 (1) to +5 (6) meaning warming showing three latitudes. There is no survival at low latitudes, while at higher latitudes (see Fig. 7) there is

2.2 For our mean results for *Pinus*

... ... it looks like carbon could be the issue again, which is close to 0 at low latitudes and declines with warming at the higher latitude.

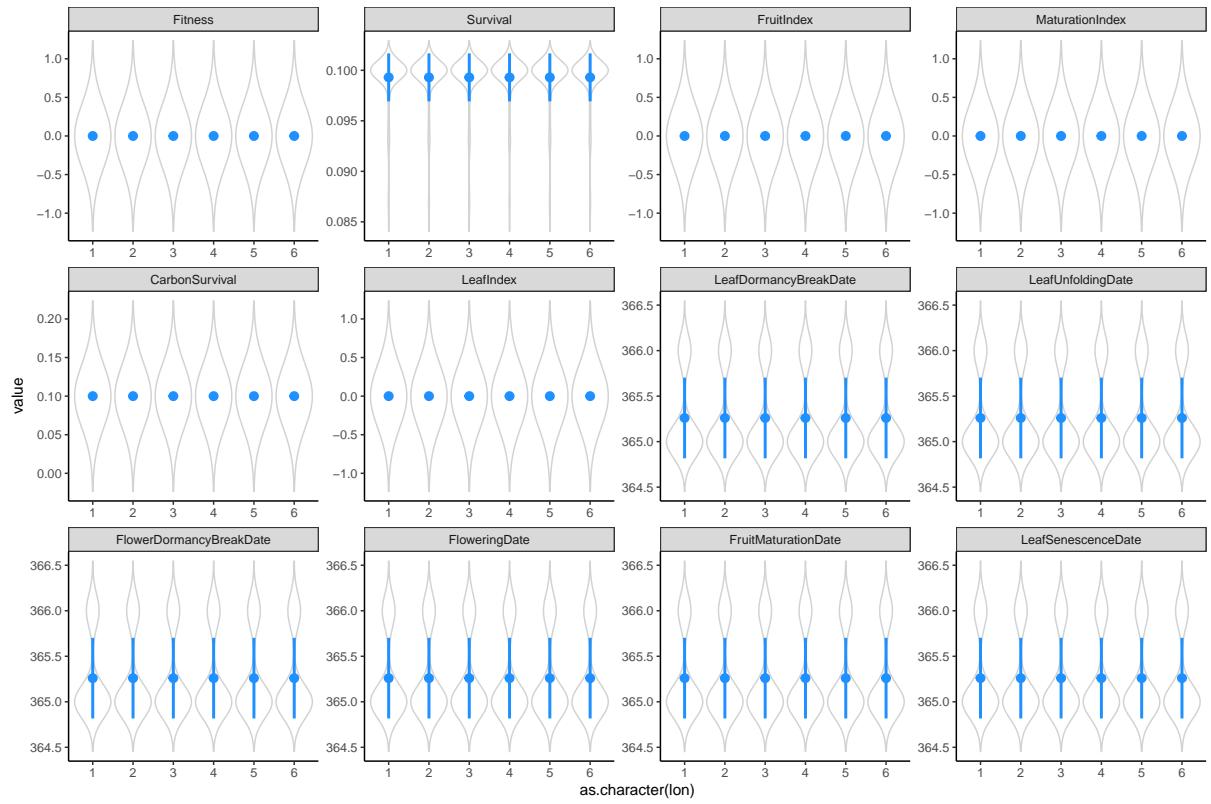


Figure 6: *Pinus* across 0 (1) to +5 (6) meaning warming across fitness components at 41 latitude.

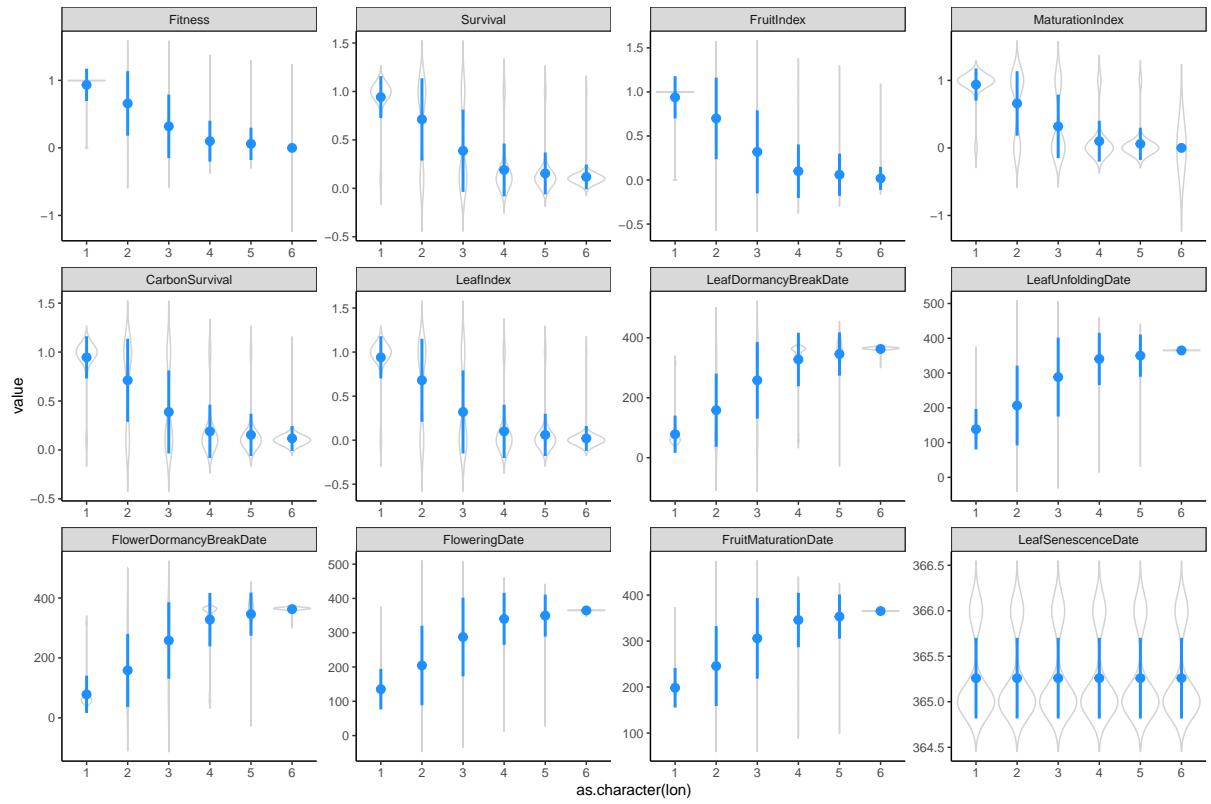


Figure 7: *Pinus* across 0 (1) to +5 (6) meaning warming across fitness components at 53N latitude.

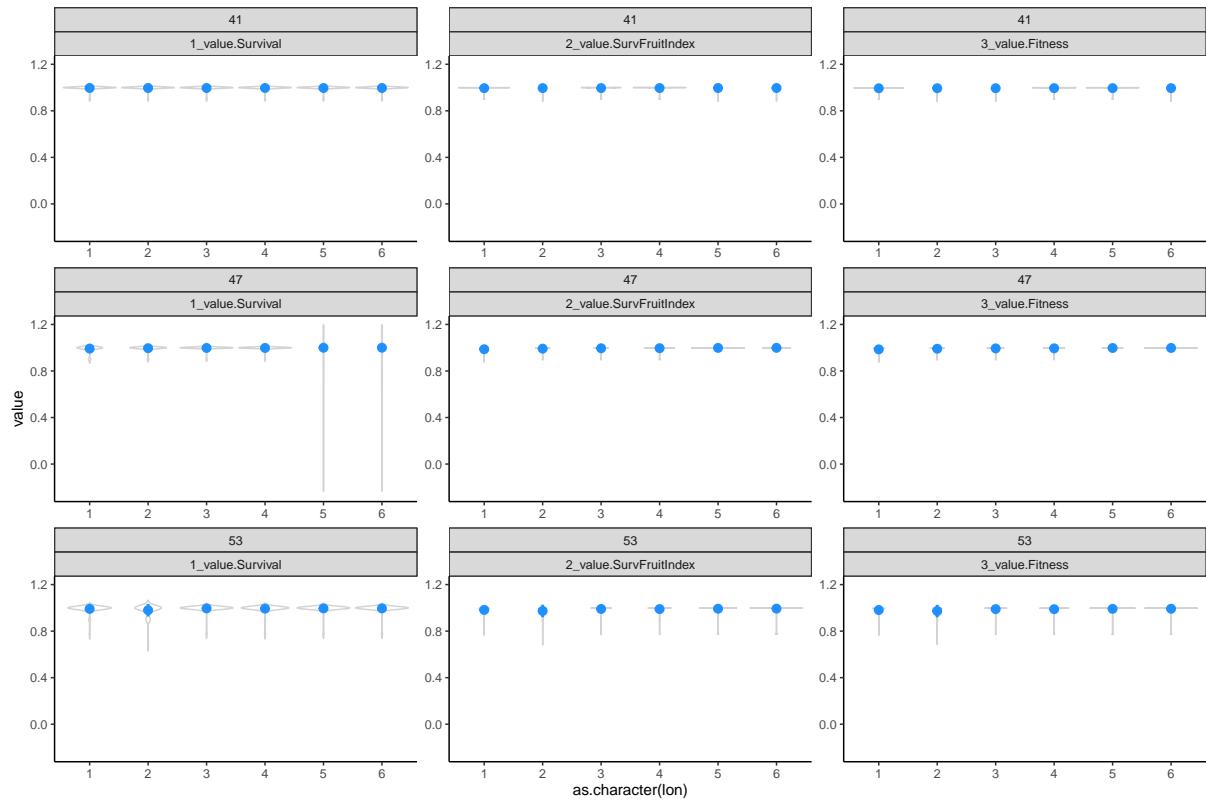


Figure 8: *Quercus* across 0 (1) to +5 (6) meaning warming showing three latitudes.

2.3 For the mean results for *Quercus*

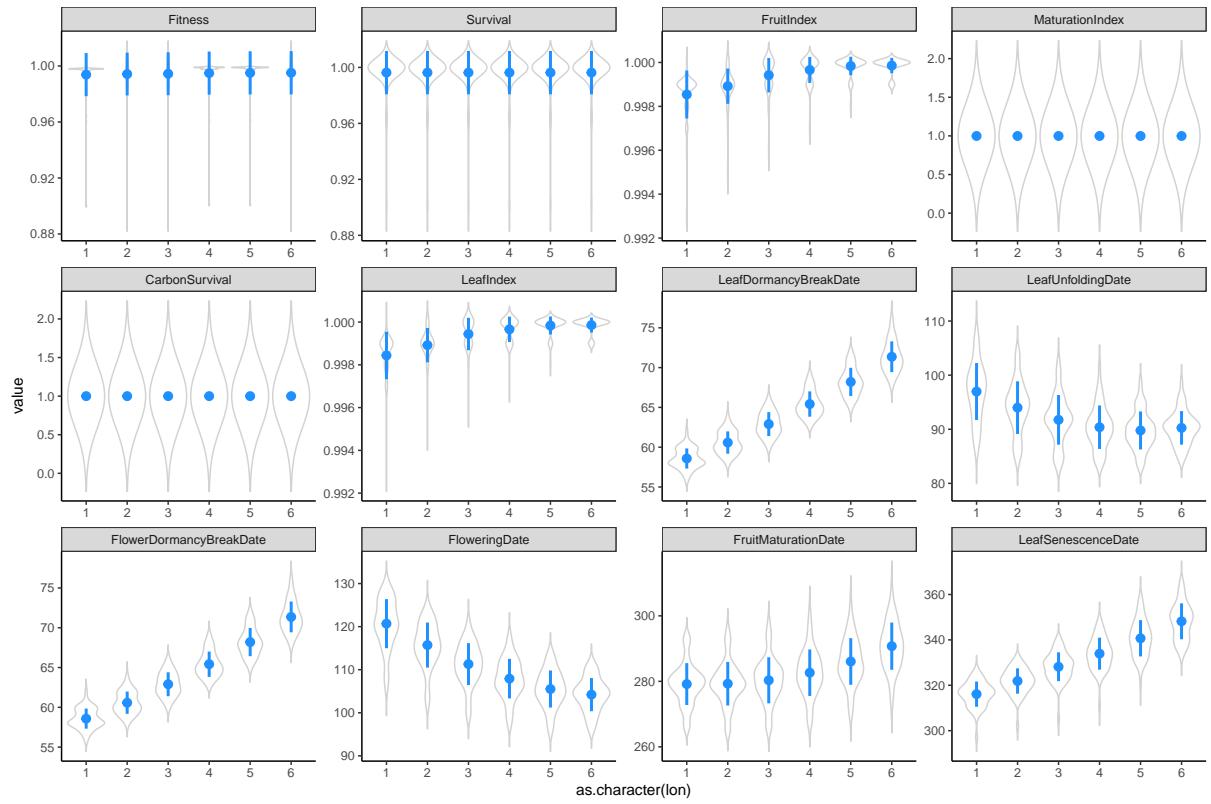


Figure 9: *Quercus* across 0 (1) to +5 (6) meaning warming across fitness components at 41° latitude. .

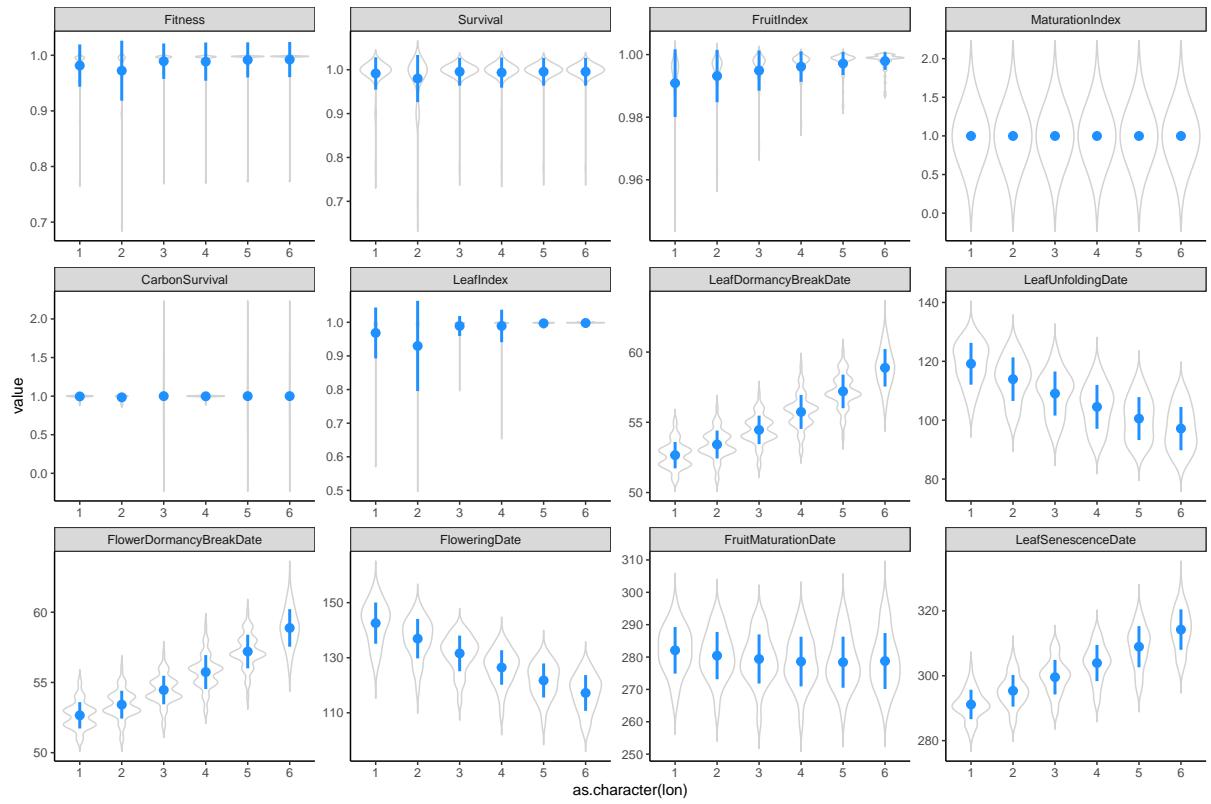


Figure 10: *Quercus* across 0 (1) to +5 (6) meaning warming across fitness components at 53N latitude.

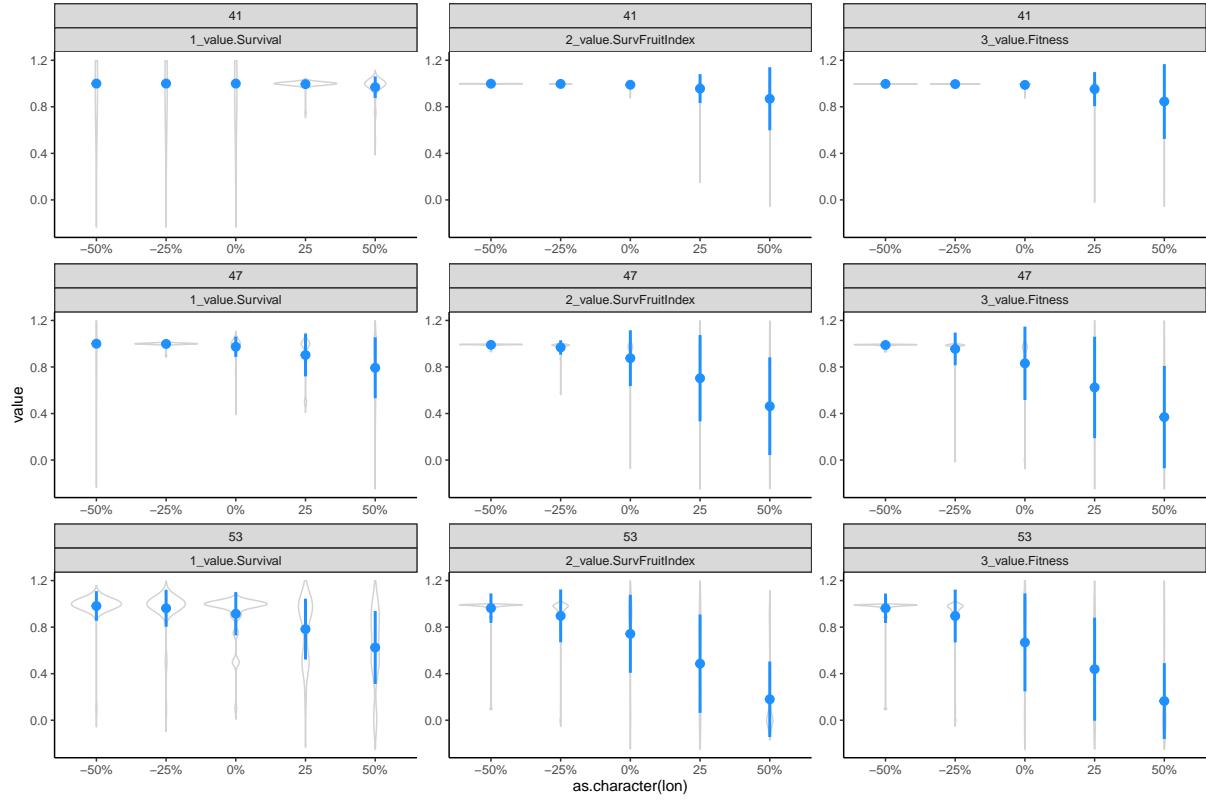


Figure 11: *Fagus* across changing variance showing three latitudes. ...
sd

3 Overview of SD simulation results

- *Fagus* is determined mainly by a combo of damage to leaves and flowers, which increases with increasing variance.
- *Pinus* survival dominates at low latitudes (no carbon survival and variance does not change this), but at highest latitude variance causes damage to flowers and reduces fitness. And: **later leafout.??**
- *Quercus* is ??

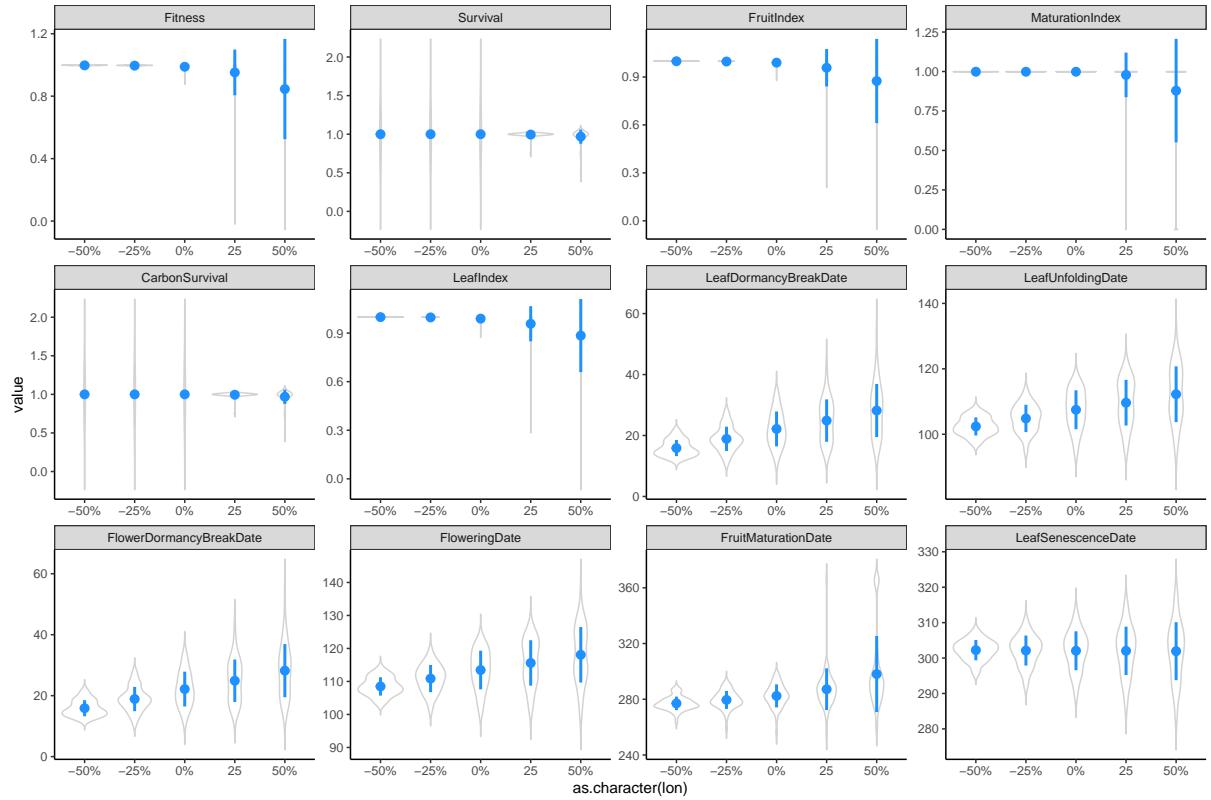


Figure 12: *Fagus* across changing variance across fitness components at 41 latitude. Low fitness is driven by low carbonsurvival, which occurs because of late dormancy break date (because leafdormancybreakdate is variable that's the driver; if it were frost, we'd see more constant leafdormancybreakdate and variable in leafindex).

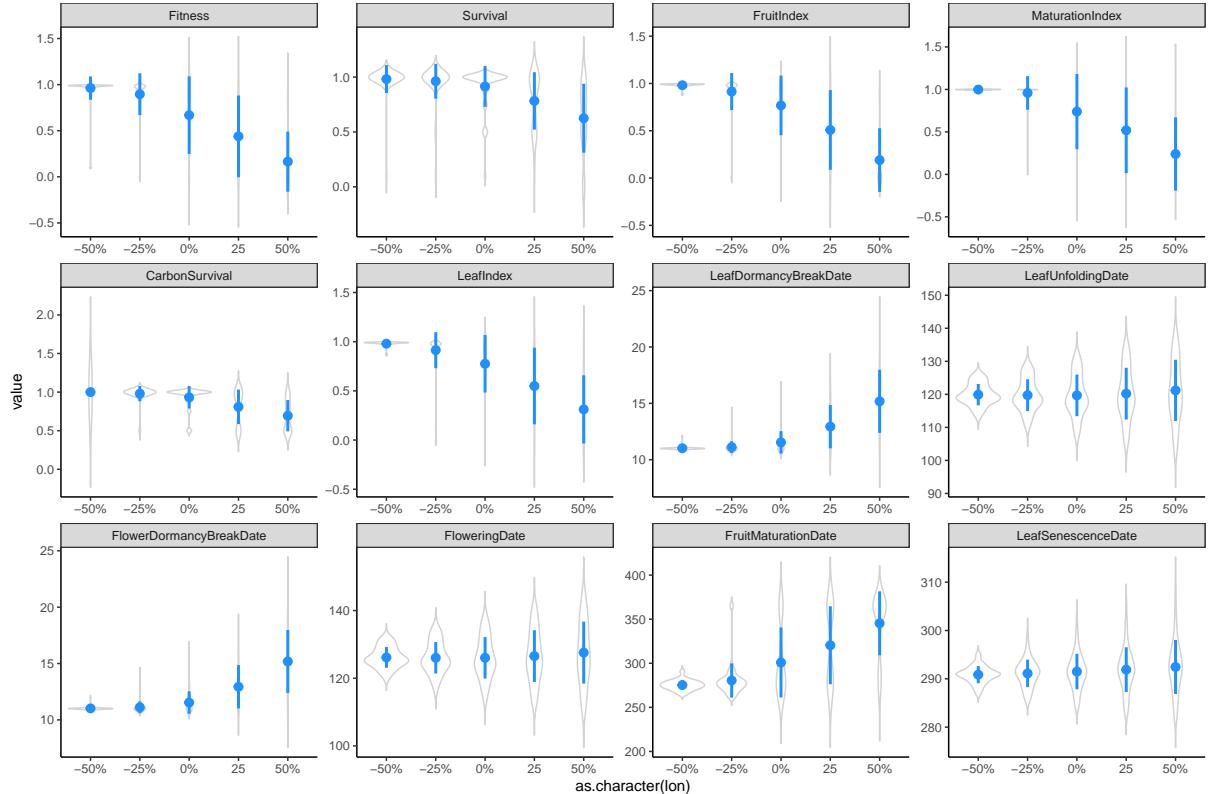


Figure 13: *Fagus* across changing variance across fitness components at 53N latitude. Here's warming reduces frost and thus fruitindex goes up and survival goes up. Note that the leafdormancybreakdate also gets a little later but leafunfolding does not because the warming is still enough for get earlier leafout (and there is a buffer where early dormancybreakdate does not matter because it's too cold leaf unfolding to start).

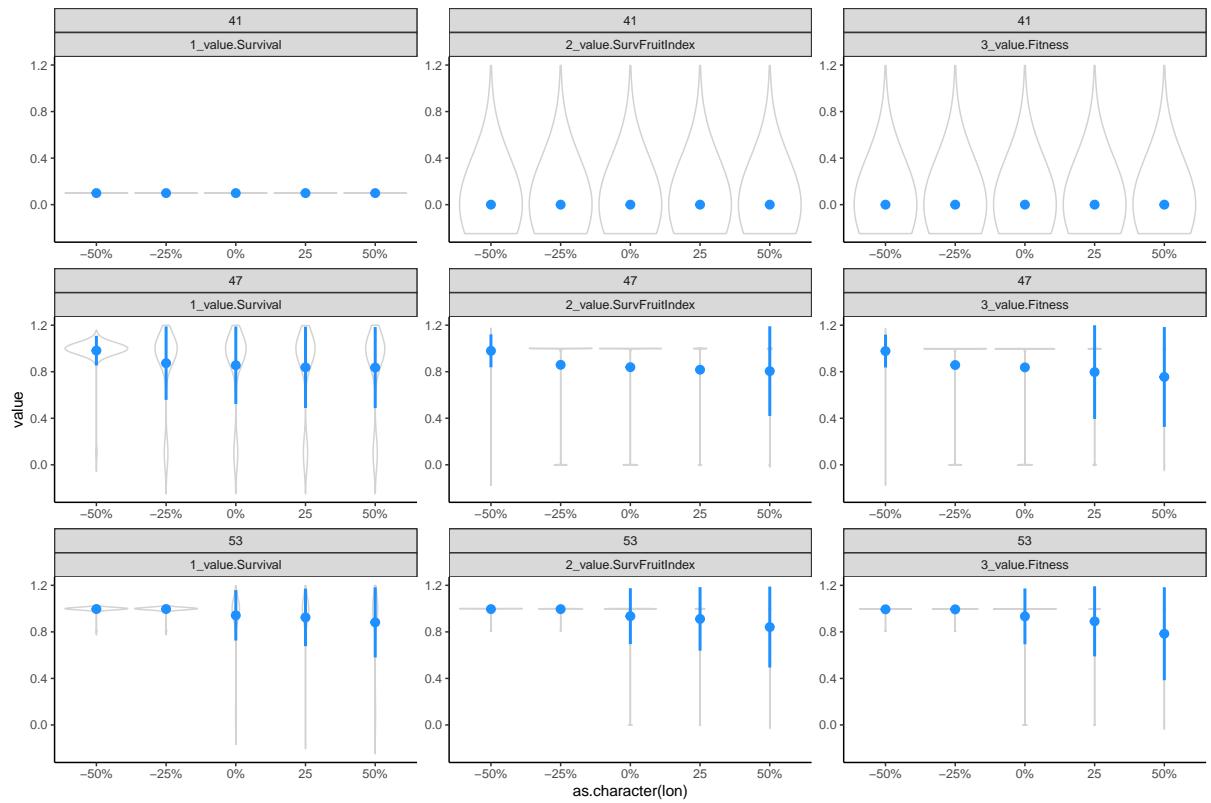


Figure 14: *Pinus* across changing variance showing three latitudes. There is no survival at low latitudes, while at higher latitudes (see Fig. 16) there is

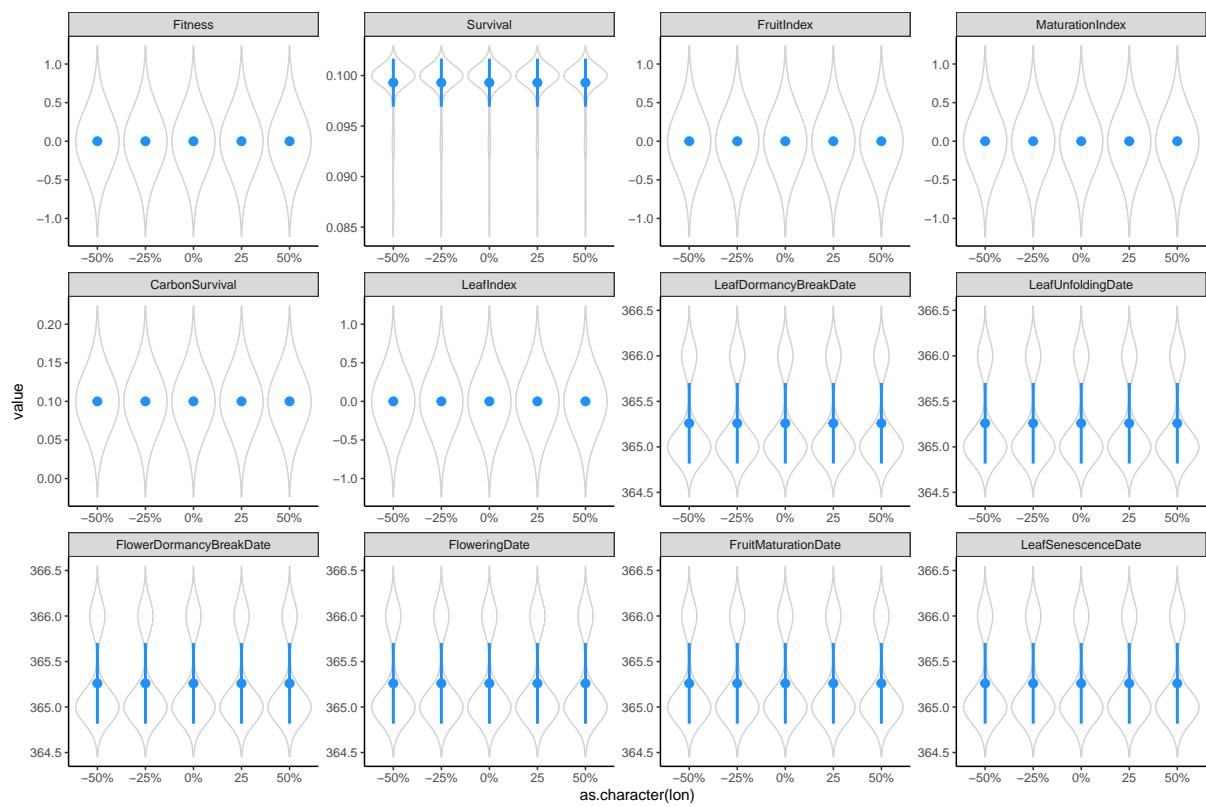


Figure 15: *Pinus* across changing variance across fitness components at 41 latitude. .

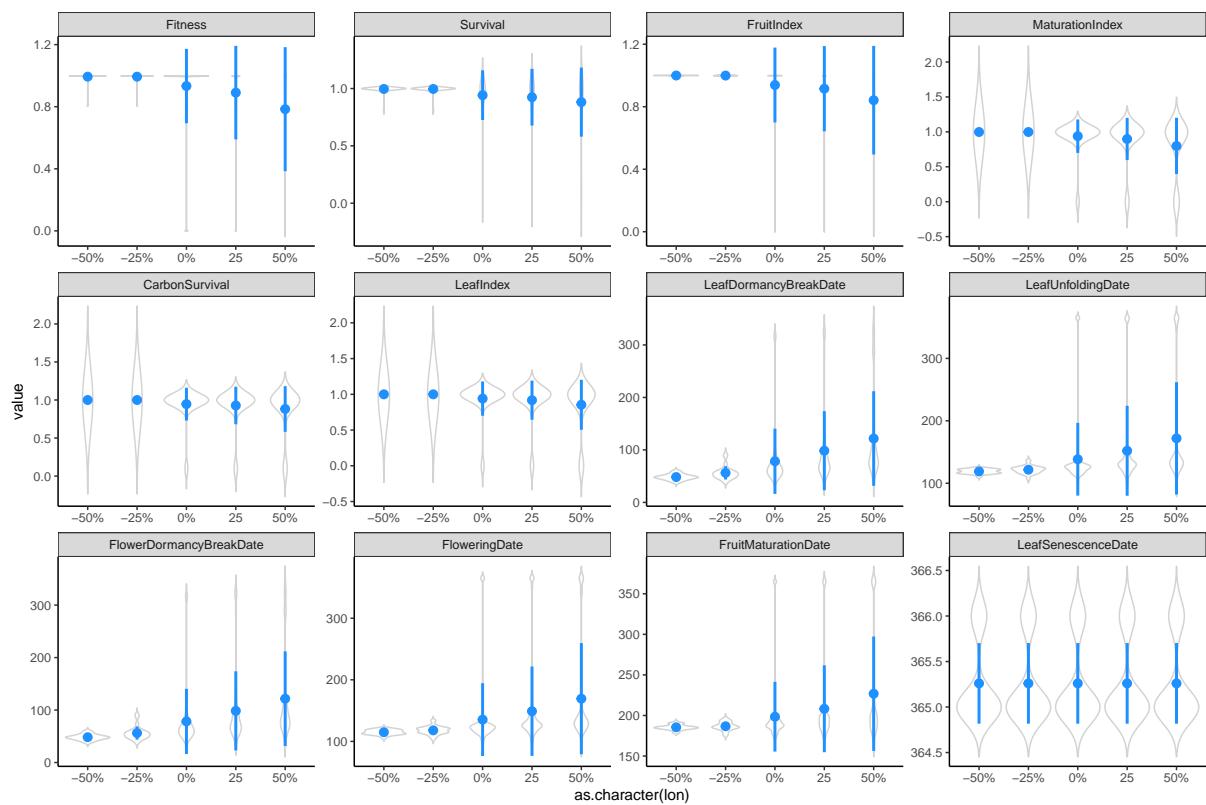


Figure 16: *Pinus* across changing variance across fitness components at 53N latitude.

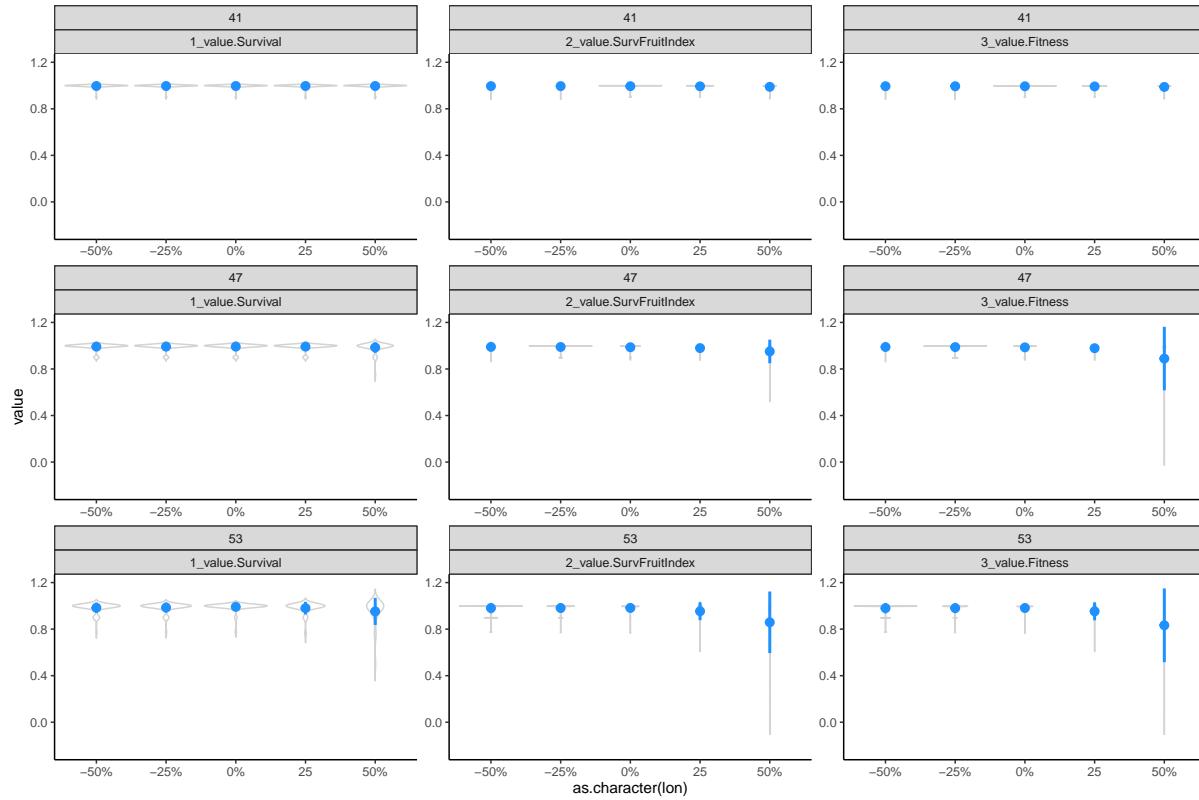


Figure 17: *Quercus* across changing variance showing three latitudes.

For the sd results for *Quercus*

4 Some reminders for Lizzie...

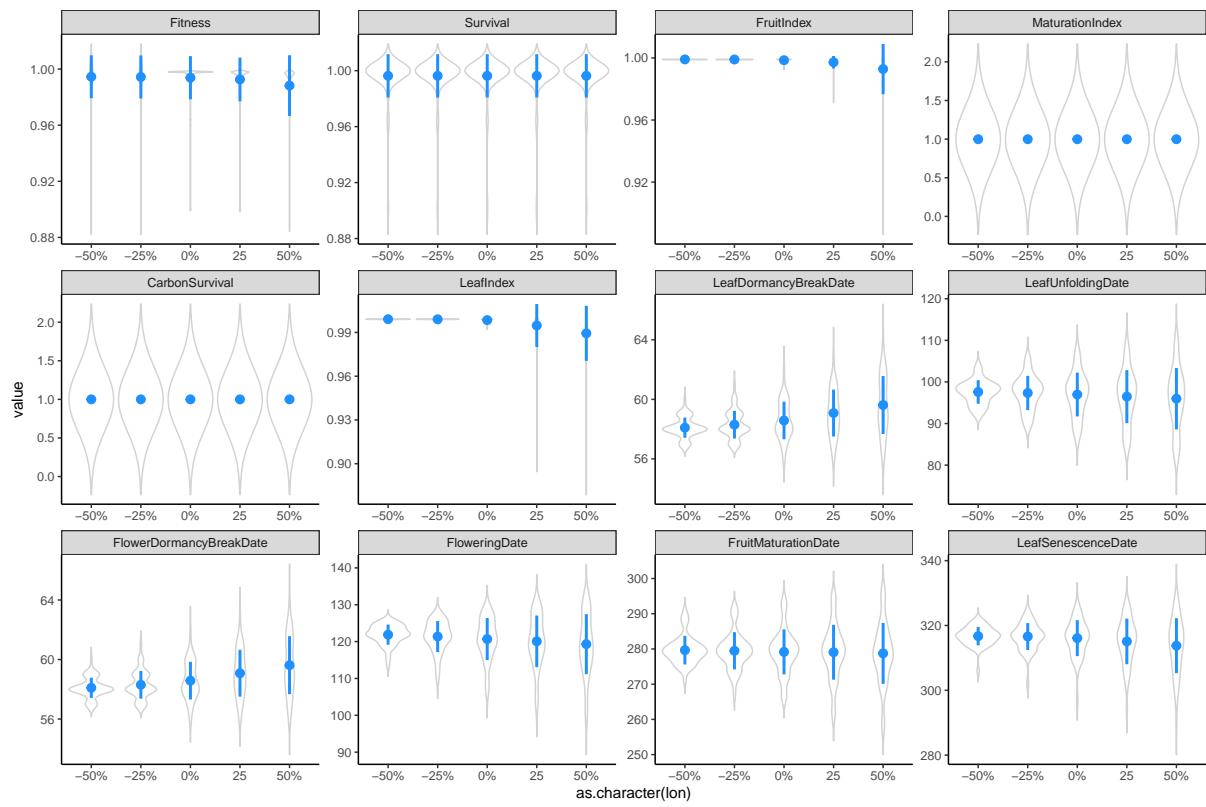


Figure 18: *Quercus* across changing variance across fitness components at 41 latitude. .

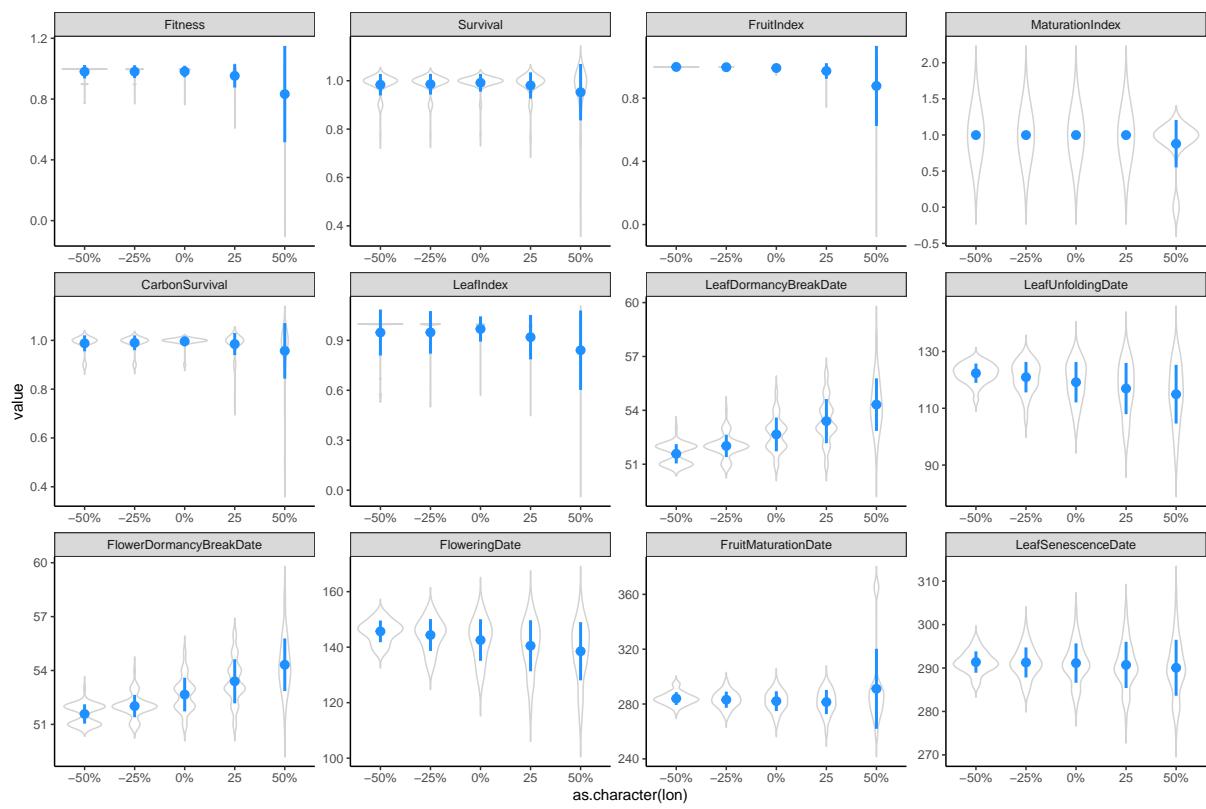


Figure 19: *Quercus* across changing variance across fitness components at 53N latitude.