FLOODING / CO2 INTERACTION EXPERIMENT



**Acacia:**

Marginal effect on photosynthesis (increased), but not carried through to any traits

No effect of treatment on photosynthesis, but strong effects on 5/6 traits. Pairwise comparison is needed to see what the influence of plant age is. For biomass it should be obvious, not so much for other traits.

*dryRootBiomass*: significant treatment difference between flooded and control, flooded and recovery (as expected), but also a significant difference between recovery and control (showing effects of flooding on biomass are real and remain apparent after a refactory period).

*dryShootBiomass*: significant treatment difference between flooded and control and flooded and recovery, but no significant difference between recovery and control, indicating that flooding either had no effect on shoot biomass, or that this effect was rapidly recovered. Observations during the experiment indicate that it had no effect. *Could compare shoot height after flooding?*

*rootFineProportion*: no fx

*SLA:* significant treatment differencebetween flooded and control and flooded and recovery, but no significant difference between recovery and control. The treatment effect of flooding on SLA may be due to plant age or is rapidly recovered. *Something to do with leaf selection for SLA? Didn’t pick any old old leaves but 3 weeks isn’t long and I didn’t pick any young leaves.*

*LDMC*: no difference between flooded and control, but significant difference between recovery – control and recovery – flooded. LDMC was stimulated during the refractory period in response to flooding?

*RMF*: significant differences between all pairs. Flooded – control exhibits biggest difference, RMF ‘recovers’ during refractory period, but recovery is still lower than control. Makes sense… roots die off and then grow back. There’s not really any CO2 effect on root growth either. It looks like there’s an interaction effect in the graph but the stats say no.

fineRootDMC: diff between recovery-flooded. Some complex things going on here though. Looks like there is a mild CO2 effect for control plants but not for other treatments.

SUMMARY: treatment effect was strong on the roots but not on the shoots. CO2 made no difference, despite marginally increased photosynthesis under elevated CO2. So treatment effects on biomass aren’t mediated by differences in photosynthesis??



**Casuarina:**

Significant CO2 effect on photosynthesis (increased). Carried through to interaction on root biomass, and to interaction on shoot biomass. No treatment effect on photosynthesis, although 3/6 traits (biomass and allocation) show very significant treatment effects. Need to look at pairwise comparisons again to tease out role of plant age.

*dryRootBiomass:* treatment, CO2 and interaction all significant. Flooded and control are different, flooded and recovery are different, but recovery and control are not different. If you look at the graph though, control elevated CO2 is sky high and the global comparison doesn’t tell the full story – this is confirmed by a strongly significant pval for the E.control-A.control pair. E.flooded and A.flooded aren’t different and neither are E.recovery and A.recovery, however. So root biomass is recovering in the refractory period, but the CO2 effect hasn’t recovered.

*rootFineProportion*: no FX

*dryShootBiomass:* significant treatment effect and interaction effect. Flooded – control and recovery – flooded are different but recovery – control isn’t different. Indicates that flooding didn’t affect shoot growth or that it recovered quickly during the refractory period. CO2 effect is almost significant (0.08) – if you look at the graph it’s only different for unflooded plants. So the CO2 effect has not returned for the recovered plants.

*SLA:* no FX

*LDMC:* no FX

*RMF:* significant treatment effect. Flooded-control and flooded-recovery are different but recovery-control isn’t different. Indicates a shift away from root production during flooding and recovery during the refractory period. There appears to be a weak CO2 effect increasing root fraction but it is not significant.

*fineRootDMC:* significant CO2 effect. CO2 fertilises fine root DMC.

SUMMARY: strong CO2 effect on control plant biomass and allocation. CO2 effect on photosynthesis recovers after refractory period but does/has not translate/d to biomass. No treatment effect on photosynthesis, indicating that differences in traits are not mediated by changes to photosynthesis??



**Eucalyptus:**

Significant effect of CO2 on photosynthesis (increased) and strong effect of treatment – recovery-control diff is significant, flooded is in the middle and isn’t significantly different from control or recovery. CO2 effect on LDMC, and treatment effect carried through to root biomass and allocation traits. Marginally significant effect of treatment on shoot biomass and SLA.

*dryRootBiomass:* significant effect of treatment between flooded-control and recovery-flooded but not recovery-control. Indicates root biomass wasn’t affected, or recovered quickly. *What did the flooded roots look like? Check photos…* Result note consistent with Photosynth result.

*rootFineProportion:* significant effect of treatment between flooded-control and recovery-control but not recovery-flooded. Flooded plants had much more fine roots(!) and retained them during the refractory period. *These extra fine roots could actually have been small adventitious roots.* This result is consistent with the photosynth results.

*dryShootBiomass:* noFX. Maybe a marginal treatment effect, between recovery and flooded treatments. Result not consistent with Photosynth result.

*SLA:* noFX – recovery was marginally lower than flooded (0.057 in TukeyHSD)

LDMC: significant effect of CO2. LDMC was slightly higher under elevated CO2.

RMF: significant effect of treatment. Flooded-control and recovery-flooded were different. Recovery-control wasn’t significantly different. So RMF dropped with flooding (roots died?) and was re-established pretty quickly.

fineRootDMC: significant effect of treatment – flooded-control significant, recovery-control marginally significant, recovery-flooded not significant. Flooding reduces DMC?

SUMMARY: results are idiosyncratic. Eucs seemed to enjoy the flooding? Or at least be adapted to them pretty well? They made lots of fine roots after flooding but those fine roots seem to have had lower density? Were they adventitious? Total root biomass wasn’t effected post-recovery… RMF fraction went down during flooding however, so perhaps some roots died. There wasn’t really a CO2 neffect, except on LDMC.

Hypotheses:

-eCO2 will be associated with higher photosynthetic rates irrespective of flooding

- acacia, marginally significant overall CO2 effect (0.076), no treatment effect and no interaction effect. No TukeyHSD diff between CO2 effect on flooded and non-flooded treatments. Accept hypothesis.

- casuarina, highly significant CO2 effect, no treatment or interaction effect. However, TukeyHSD says eCO2 control is different from aCO2 control but nothing else is different. Reject hypothesis?

- eucalyptus, significant CO2 and treatment effects, no significant interaction. No differences between. Accept hypothesis.

-Flooding will reduce the stimulation of biomass production by eCO2 (i.e. metabolic costs of flooding tolerance will offset fx of enhanced photosynthesis on biomass)

- acacia, strong treatment effect but no CO2 effect…

- casuarina, CONFIRMED! Significant interaction effect.

- eucalyptus, strong treatment effect but no CO2 effect…

Stimulation of fine root turnover/growth by eCO2 will result in accelerated recovery (of fine root mass) from flooding

* acacia, no stimulation of fine root biomass
* casuarina, DENIED! Strong stimulation of fine root biomass apparent in control inhibited by flooding and has not recovered following the refractory period. Lots of variation in fine root proportion but pattern is that FRP is stimulated under control and also doesn’t recover.