DISCUSSION PLAN

Intro paragraph summarising results:

Variable hypotheses generally not well supported; env conditions explain most of the variation in spp richness and exotic abundance, but not functional diversity

untangling different drivers

Did the study confirmed the importance of hydrology as a control on diversity in riparian plant communities? Hydrological metrics were in every model. Interesting that flow mod was really important for species richness but nothing else.

We have a bunch of correlations, but given the strong correlations between hydrology and other environmental variables can we really pinpoint flow regime as the dominant driver? At least with species richness, there’s some evidence to support hydrology as the dominant environmental control on species richness, since sprich increased with M\_MinM, and also increased when M\_MinM was artificially increased. In the case of C\_MinM, the degree of direct modification (i.e. C\_MinM.mod) had no relationship with spp rich, but spp rich did increase as MDFMDFDry was upregulated, which would increase constancy. It isn’t possible to be conclusive about whether flow regime is indeed the dominant control diversity, since this effect was only observable for a few hydrological metrics out of the full set of 22. Nevertheless, the inclusion of hydrological metrics in models of species richness, exotic abundance FRic.SES and FDis.SES lends weight to the case.

Discuss results in relation to hypotheses

Spp richness

Richness highest along rivers which experience regular seasonal patterns of low flows. What’s more, increasing species richness is also associated with increasing flow modification – where the effect of the modification is to increase seasonal regularity of low flows. Richness decreased with high spell mean duration (makes sense if long flood duratons are an environmental filter selecting for inundation tolerance more than a form of ‘heterogenising disturbance’) but also decreased with variability in HSMeanDur – perhaps indicating an influence of extreme events (i.e. the odd 10 day inundation wipes out a bunch of species from the pool – maybe doesn’t make a huge amount of sense given high immigration rates in riparian environments – unless the landscape is highly fragmented…). Land use also didn’t decrease species richness – only ‘significant’ relationship was with dryland land use and was unimodal. All other relationships were monotonic.

Exotics

The rationale for our hypothesis was that or hydrological heterogeneity should result in structural complexity of habitat and therefore limit competitive exclusion by invasives. A contrasting explanation for the observed relationships reads as follows: disturbance associated with heterogeneous flows opens habitat up for exotics spp. with acquisitive / ruderal / pioneer life history strategies, however. Important to note the temporal sequence inherent in response to disturbance regimes: it is important when the communities were sampled, in terms of the amount of time elapsed since the last flood. Should be plenty of literature about disturbance / environmental variability and invasion…

FRic

Interesting that sp richness increases with soil\_soc but FRic decreases. Seems to indicate that that niches are getting closer together in traitspace, although the effect could be stochastic given that we don’t have that much data in the upper reaches of the gradient (actually I was looking at the FDis.SES graph.)

FDis

So the environmental conditions we tested in this study really didn’t explain all that much of functional diversity.

Arthington et al. found: hydrology didn’t account for a very large amount (14%) of the variation in riparian tree and shrub assemblages. Of the hydrological metrics which did show significant relationships with veg metrics, CVDry was the most important: most metrics of structure and diversity had a negative relationship with CVDry. Measures of flood intensity were also predictive of vegetation assemblages. They only have 32 points in their graphs, and they only used tree and shrub data… They found that strongly regulated sites had lower species richness (comparing dams to reference sites), but (like this analysis) found that sites with lower dry season flow variability had higher richness. They couldn’t find any patterns with exotics and flow (probably because they were just doing reference-modified comparisons.

Are different processes at play here than in previous Lawson et al. study? Diversity driven by consistent patterns of resource availability (in this study – is that quite what happened with the Colwell’s indices?) (Lundholm 2009 found that energy availability was much better predictor of spp. richness than env. Var) vs diversity as driven by environmental variability in previous study…

Is there a distinction between ‘homogenising disturbance’ and ‘heterogeneising disturbance’ and can this explain our results?

Species richness was affected by homogenising disturbance but not FDis or FRic

What do patterns of functional diversity reveal about riparian plant community assembly along environmental gradients?

What do FDis.SES (functional divergence) and FRic.SES (?) actually mean, and what can they say about the way communities are assembled? what are the implications of the patterns we found for community assembly?

Fairly low % variance explained by env variables for FRic (although better for FDis), esp compared with Lawson et al. study (hydrology explained 80% of FDis). Undescribed environmental conditions, neutral processes, and small scale land management practices control the rest of community assembly.. (if you stay within environmental niche ecology). phylogenetic conservation of traits is another possibility but we didn’t test it (?)

* Jardine et al. said environmental filtering (well, niche optimisation) is only relevant in rhythmic rivers and that communities in arrhythmic should be structured by neutral processes but I don’t agree. Environmental filtering for conservative strategies has been shown in arrhythmic environments. In any case they measured NPP rather than diversity but the two things are interrelated.
* Mouillot et al 2013 suggested that environmental filtering would compress traitspace as disturbance increases.

What about resilience and ecosystem functioning, can I say anything about that? I can refer back to my info about effect traits and their relationships with ecosystem functioning. FD & ecosystem multifunctionality

Interactions between env variables?

Belowground traits, categorical data types that allow multiple category membership

The traits I chose must have been at least half way decent at capturing variation in ecological response to hydrological conditions.

What are the implications for conservation?

Are environmental flows likely to be a useful tool in conservation in this landscape?

Depends how they’re structured – to generate disturbance or to simulate a modelled pre-development flow regime. Interesting to note that species richness actually \*increased\* in response to increased regularity imposed by dams (and there was no corresponding increase in exotic spp. to account for the extra richness).

Are there perhaps some sensitive systems where multifunctionality is naturally low?

Relationships between spp rich, FDis, FRic and exotic abundance?

Significant log relationship with spp. richness (steep at low exotic abundance)

Can’t really say much about whether exotics are the cause of reduced spp. richness or whether they’re both passengers of the same processes.

Nothing significant with FDis or FRic. Not really that much data at high exotic abundance…