Cut sections of Diss

**Introduction – species distributions are a fundamental question**

Understanding the behind species distributions is a fundamental ecological question \citep{Clements1916, Gleason1926, Thomas and Lennon 1999 ; Colwell et al., 2008 ; Lawler et al., 2010 ; Summers et al., 2012}.

**Introduction – we should make policy decisions based on species future ranges**

Policy decisions over protected species and protected areas should reflect predictions of species future condition after migration, in order to most effectively allocate limited funding (REF).

**Introduction – what is happening in the andes according to climate envelope modesl**

Predictions of biodiversity loss in forests along the Andes-Amazon corridor, vary between 8 and 100\%, dependent on whether the observed niche is equal to that of either the realised niche (including non-climatic migration controls), or the fundamental niche (excluding non-climatic migration controls) \citep{Feeleysilman2010a}. Considering this region comprises the `hottest' biodiversity hotspot on Earth \citep{Myers2000}, the need to accurately predict this change in biodiversity is far from trivial (REF).

**Results:**

Variation in D.FvFm was explained equally by four models, the best fitting of which is a model incorporating all biotic environmental predictors ($R\_C^2 = 0.322$). The full model was only 29\% more likely to be the best model than a fixed effects model which only incorporated the effect of species. In isolation, log(ISI) accounted for 15.9\% of the variation in D.FvFm, as compared to LAI (0.9\%) and herbaceous plant density (0.7\%). While a model incorporating random slopes between species for all fixed effects explained \textasciitilde 52\% more variation in D.FvFm than the most parsimonious model (full model), it was by far the least parsimonious and it's fixed effects account for only 4.9\% of the variance in D.FvFm/.\\

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% Date and time: Thu, Apr 07, 2016 - 11:02:02

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& model\\_name\\_AIC\\_D.FvFm & AIC\\_D.FvFm & $wi\_i$ & $R\_C^2$ & $R\_M^2$ \\

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1 & full\\_model\\_D.FvFm & $$-$578.573$ & 0.29 & 0.322 & 0.141\\

2 & Species\\_D.FvFm & $$-$577.945$ & 0.28 & 0.138 & 0.138 \\

3 & Comp\\_adult\\_D.FvFm & $$-$576.882$ & 0.12 & 0.202 & 0.159 \\

4 & full\\_model\\_D.FvFm\\_with.coll & $$-$576.793$ & 0.12 & 0.305 & 0.124\\

5 & Elev\\_D.FvFm & $$-$576.422$ & 0.10 & 0.242 & 0.078 \\

6 & randeffects\\_model\\_D.FvFm & $$-$575.644$ & 0.07 & 0.193 & NA \\

7 & Canopy\\_D.FvFm & $$-$575.235$ & 0.05 & 0.213 & 0.009\\

8 & Comp\\_seed\\_D.FvFm & $$-$574.998$ & 0.05 & 0.202 & 0.007 \\

9 & full\\_fixedeffects\\_model\\_D.FvFm & $$-$566.742$ & <0.01 & 0.514 & 0.514 \\

10 & null\\_model\\_D.FvFm & $$-$564.449$ & <0.01 & NA & NA\\

11 & full\\_model\\_D.FvFm\\_elevslope & $$-$564.233$ & <0.01 & 0.619 & 0.026 \\

12 & full\\_model\\_D.FvFm\\_int\\_all & $$-$542.389$ & <0.01 & 0.846 & 0.049\\

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SPAD was best predicted by a model of only log(ISI) being 76\% more likely to be the best model than the full model. However, all fixed effects, either in combination or isolation, performed poorly, except species, which accounted for 27.9\% of the variation in SPAD. All model permutations explained more variance than the null model.

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& model\\_name\\_AIC\\_SPAD & AIC\\_SPAD & $w\_i$ & $R\_C^2$ & $R\_M^2$ \\

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1 &log(ISI) & $1,316.954$ & 0.761 &0.320 & 0.066\\

2 & full\\_model\\_SPAD & $1,319.278$ & 0.238 & 0.311 & 0.024\\

3 & full\\_model\\_SPAD\\_elevslope & $1,331.634$ & <0.01 & 0.190 & 0.043\\

4 & full\\_fixedeffects\\_model\\_SPAD & $1,351.923$ &<0.01 & 0.080 & 0.080 \\

5 & full\\_model\\_SPAD\\_int\\_all & $1,362.505$ & <0.01 & 0.923 & 0.004\\

6 & Species\\_SPAD & $1,528.566$&<0.01 & 0.356 & 0.279 \\

7 & randeffects\\_model\\_SPAD & $1,540.676$&<0.01 & 0.348 & NA\\

8 & Canopy\\_SPAD & $1,540.725$&<0.01 & 0.366 & 0.008\\

9 & Elev\\_SPAD & $1,541.424$&<0.01 & 0.328 & 0.024\\

10 & Comp\\_seed\\_SPAD & $1,541.822$ &<0.01 & 0.352 & 0.003\\

11 & null\\_model\\_SPAD & $1,599.357$&<0.01 & NA & NA \\

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Leaf thickness was best predicted by a model incorporating all biotic environmental variables and was 92\% more likely to be the best model than the next most parsimonious model, which allowed the effect of elevation to vary by species. Despite this, the fixed effects of the full model accounted for only 12.2\% of the variance in leaf thickness. In isolation, biotic environmental variables predicted leaf thickness poorly.

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% Date and time: Thu, Apr 07, 2016 - 11:45:51

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& model\\_name\\_AIC\\_Leaf.thick.mean.mm & AIC\\_Leaf.thick.mean.mm & $w\_i$ & $R\_C^2$ & $R\_M^2$ \\

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1 & full\\_model\\_Leaf.thick.mean.mm & $$-$449.052$ & 0.92 & 0.759 & 0.122 \\

2 & full\\_model\\_Leaf.thick.mean.mm\\_elevslope & $$-$444.018$ & 0.08 & 0.705 & 0.147\\

3 & Comp\\_adult\\_Leaf.thick.mean.mm & $$-$436.431$ & <0.01 & 0.739 & <0.001\\

4 & Canopy\\_Leaf.thick.mean.mm & $$-$428.491$ & <0.01 & 0.688 & 0.031\\

5 & Elev\\_Leaf.thick.mean.mm & $$-$425.803$ & <0.01 & 0.701 & 0.073\\

6 & randeffects\\_model\\_Leaf.thick.mean.mm & $$-$414.842$ & <0.01 & 0.687 & NA\\

7 & Comp\\_seed\\_Leaf.thick.mean.mm & $$-$413.969$ & <0.01 & 0.691 & 0.002 \\

8 & full\\_model\\_Leaf.thick.mean.mm\\_int.all & $$-$412.396$ & <0.01 & 0.966 & 0.022\\

9 & Species\\_Leaf.thick.mean.mm & $$-$388.675$ & <0.01 & 0.700 & 0.660\\

10 & full\\_fixedeffects\\_model\\_Leaf.thick.mean.mm & $$-$277.079$ & <0.01 & 0.222 & 0.222\\

11 & null\\_model\\_Leaf.thick.mean.mm & $$-$192.104$ & <0.01 & NA & NA\\

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& model\\_name\\_AIC\\_Height.leaf.ratio & AIC\\_Height.leaf.ratio & $w\_i$ \\

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& full\\_model\\_Height.leaf.ratio & 1,102.762 & 0.54 \\

& full\\_model\\_Height.leaf\\_elevslope & 1,103.196& 0.43 \\

& Comp\\_adult\\_Height.leaf.ratio & 1,108.904 & 0.025 \\

& full\\_model\\_Height.leaf\\_int.all & 1,129.670 & <0.001 \\

& full\\_fixedeffects\\_model\\_Height.leaf.ratio & 1,226.963 & <0.001 \\

& Species\\_Height.leaf.ratio & 1,246.211 & <0.001 \\

& Canopy\\_Height.leaf.ratio & 1,266.766 & <0.001 \\

& randeffects\\_model\\_Height.leaf.ratio & 1,274.882 & <0.001\\

& Elev\\_Height.leaf.ratio & 1,275.896& <0.001 \\

& Comp\\_seed\\_Height.leaf.ratio & 1,276.882 & <0.001 \\

& null\\_model\\_Height.leaf.ratio & 1,435.545& <0.001 \\

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& model\\_name\\_AIC\\_Leaf.area & AIC\\_Leaf.area & $w\_i$ \\

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& Comp\\_adult\\_log\\_leaf\\_area & 560.783 & 0.86 \\

& full\\_model\\_Leaf.area & 564.673 & 0.12\\

& full\\_model\\_leaf\\_area\\_elevslope & 568.186 & 0.021 \\

& full\\_model\\_leaf\\_area\\_int.all & 600.257 & <0.001 \\

& Species\\_log\\_leaf\\_area & 633.232 & <0.001 \\

& randeffects\\_model\\_log\\_leaf\\_area & 656.830 &<0.001 \\

& Comp\\_seed\\_log\\_leaf\\_area & 658.219 & <0.001\\

& Canopy\\_log\\_leaf\\_area & 658.448 & <0.001 \\

& Elev\\_log\\_leaf\\_area & 658.805 & <0.001 \\

& full\\_fixedeffects\\_model\\_log\\_leaf\\_area & 659.284 & <0.001 \\

& null\\_model\\_log\\_leaf\\_area & 758.484 & <0.001\\

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& model\\_name\\_AIC\\_stem\\_vol & AIC & $w\_i$\\

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& full\\_model\\_stem\\_vol & 632.710 & 0.61 \\

& full\\_model\\_stem\\_vol\\_elevslope & 633.632 & 0.38 \\

& Comp\\_adult\\_stem\\_vol & 641.615 & 0.0071 \\

& full\\_model\\_stem\\_vol\\_int.all & 658.160 & <0.001 \\

& full\\_fixedeffects\\_model\\_stem\\_vol & 717.866 &<0.001 \\

& Species\\_stem\\_vol & 735.569 &<0.001 \\

& Elev\\_stem\\_vol & 754.380 & <0.001 \\

& Canopy\\_stem\\_vol & 755.390 & <0.001 \\

& randeffects\\_model\\_stem\\_vol & 757.908 & <0.001 \\

& Comp\\_seed\\_stem\\_vol & 759.757 & <0.001 \\

& null\\_model\\_stem\\_vol & 860.894 & <0.001 \\

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\begin{table}[!htbp] \centering

\caption{Number of trees per hectare and $C\_R$ for each plot.}

\label{tab:Trees\_ha}

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Plot name & Trees ha\textsuperscript{-1} & $C\_R$\\

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PA400 & 475 & 9 \\

PA800 & 690 & 8 \\

VC & 645\footnote{\centering Estimated from linear regression of number of trees ha\textsuperscript{-1} with respect to plot elevation of other sites (Figure \ref{fig:Trees\_ha}).} & 8 \\

SP1500 & 860 & 7 \\

SP1750 & 887 & 7 \\

TRU08 & 954 & 6 \\

TRU07 & 1,060 & 6 \\

TRU06 & 1,101 & 6 \\

TRU04 & 1,287 & 6 \\

TRU02 & 1,417 & 5 \\

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