Annex 2. Report 7. Statistical Analysis of Catfield Fen 2007 – 2012 Ellenberg values. RSPB for NE 13.11.13. Richard Mason

Summary

During the meeting between NE, RSPB and BC on 05/11/2013 there was some discussion around the "Analysis of Vegetation Change at Sutton and Catfield Fens between 2007 and 2012" OHES, 2013. To summarise there was ambiguity as to whether the Ellenberg values for Catfield Fen showed a significant change and if this change was indicative of drying or not.

It was agreed that I would ask Lucy Mason to run some statistical analysis of the apparent change in Ellenberg values. This summarises that analysis

What is the analysis?

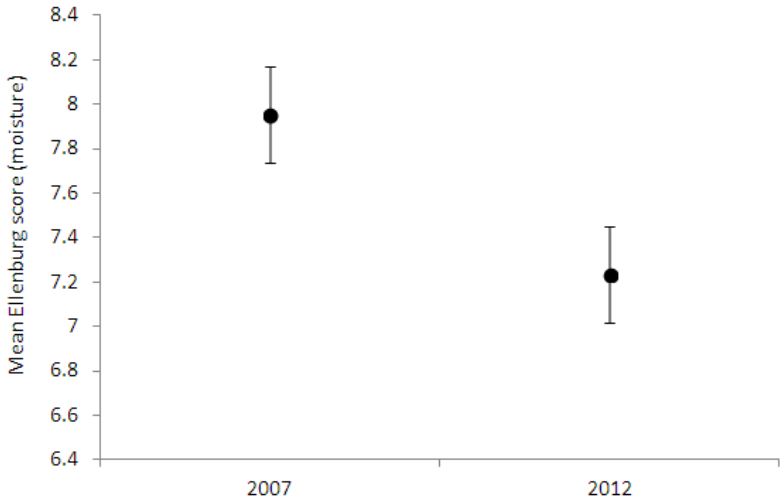
A "repeated measures" analysis that controls for the fact that quadrats are paired between years (i.e. controlling for the fact that they are not independent because the same location or NVC community was surveyed in both years). In very simple terms the analysis takes the difference in the variable of interest (e.g. Ellenberg value) between the two years for each quadrat, then averages across these difference values to indicate the overall mean difference across the site. A bit more complicated than that in reality, but that is the general idea. This method of analysis is stronger and more statistically robust than simply taking the mean difference across the site, because the specific pairing of the quadrats between years is taken into account. 1 anomalous quadrat was removed, this had been located within an incorrect stand in 2012 (C27)

Technical description:

Linear mixed models run using the lme4 package in R (a statistical analysis programme), specifying QUADRAT (categorical, 38 quadrats) as a random intercept term (to control for the pairing of quadrats between years) and YEAR (categorical, 2007 vs. 2012). Significance values were estimated using the pt() function and mean/SE estimates predicted by each model, assuming 1 degree of freedom for the random effect in each case (total df used for each model = 4). Mean and SE estimates for each year were obtained by changing the reference category of YEAR and re-running the models.

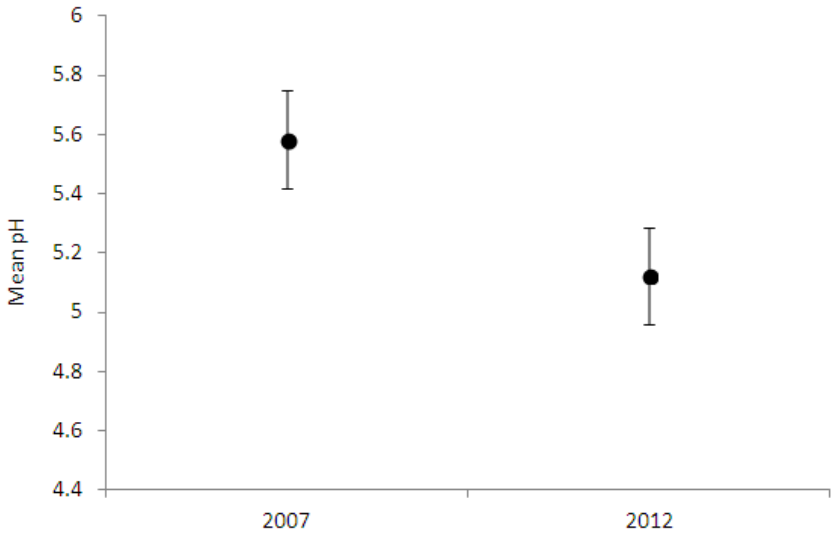
Results:

Moisture (Higher = wetter)



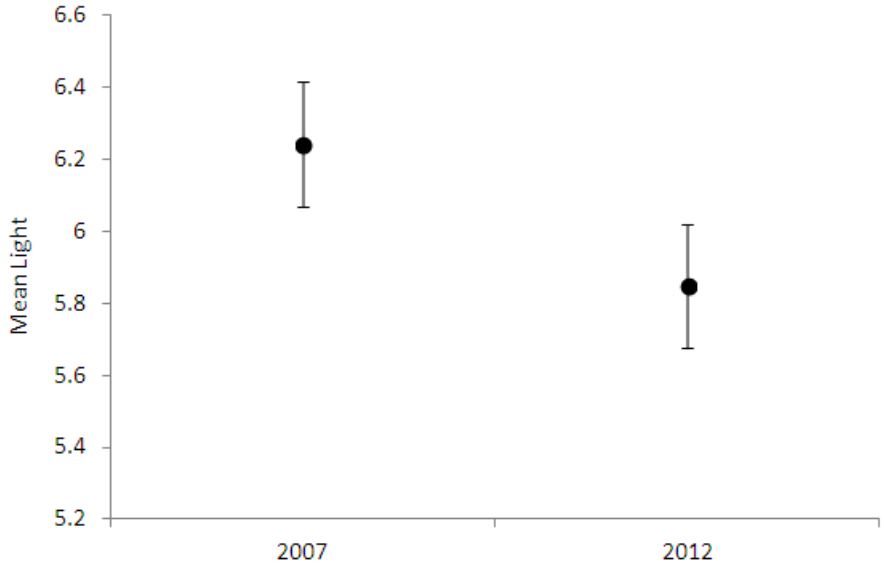
A significant decrease (P<0.0001) from 7.95 to 7.23 with SD 0.22.

Reaction (Higher = more alkaline)



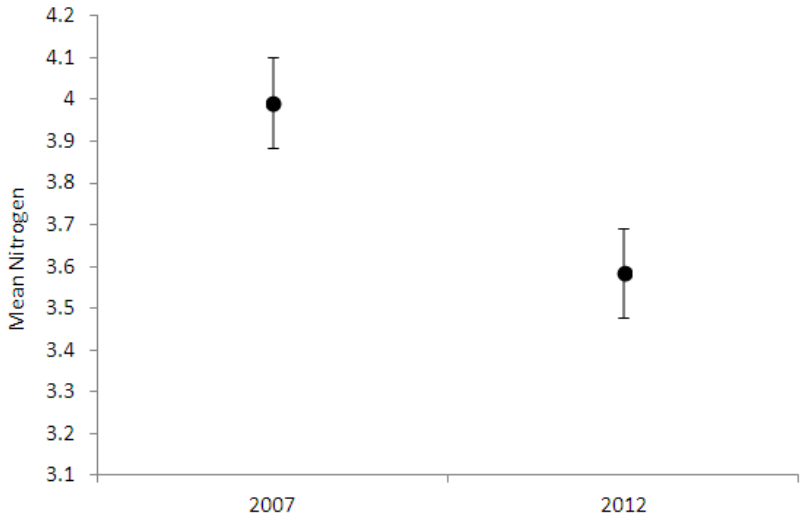
A significant decrease (P<0.001) from 5.58 to 5.12 with SD 0.16

Light (Higher = more light)



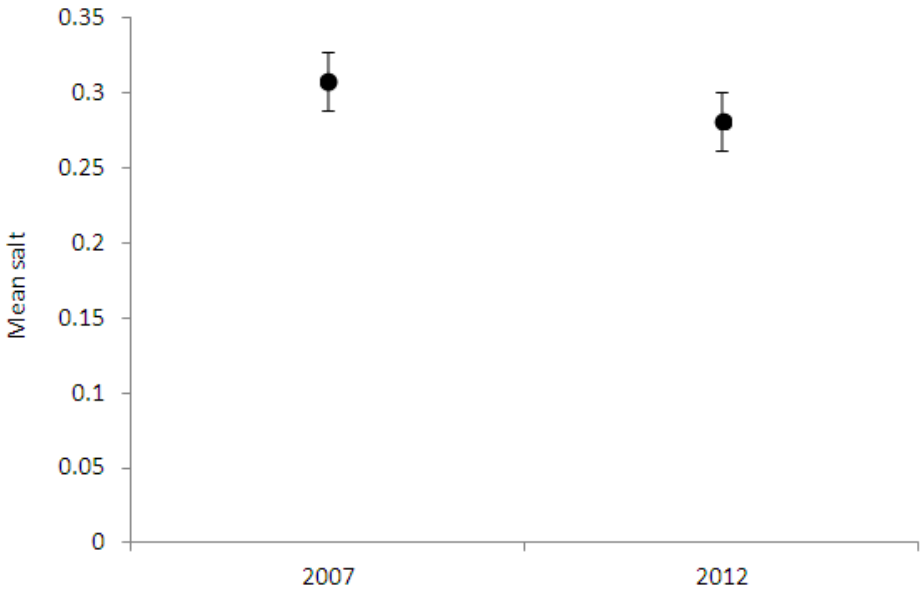
A significant decrease (P<0.01) from 6.24 to 5.85 with SD 0.17

Nitrogen (higher = higher N)



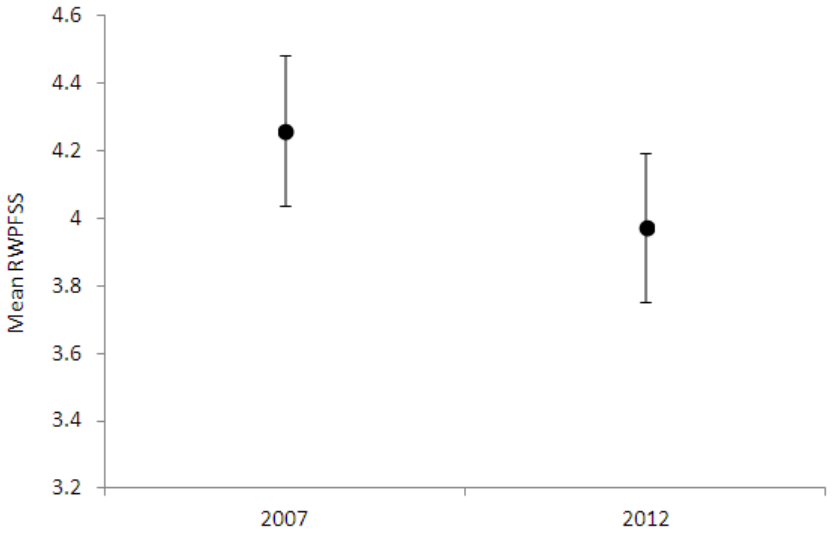
A significant decrease (P<0.0001) from 3.399 to 3.55 with SD 0.11

Salt (higher = higher salt)



No significant change (P<0.114)

Rarity value of plants in quadrats (RWPFSS score)



No significant change (P<0.058)

Summary

This assigns statistical significance to the apparent change between 2007 and 2012. In particular it shows that the Ellenberg values suggest the flora has become: More associated with dry, acidic, low Nitrate and shadier conditions.

This is consistent with water level data and anecdotal evidence of a reduction in water level, a relative isolation from alkaline water input and a drop in nutrient levels as well as the process of succession.

Though not significant, I think it is of note that the average RWPFSS score has dropped, this indicates that the plant communities as a whole are becoming less interesting and 'valuable' from a conservation perspective. Further data collection would be necessary to determine if this apparent change is significant.

Richard Mason, RSPB (Analysis by Lucy Mason, RSPB) 12/11/2013