Monitoring & Evidence Report

Wilder Blean

Biodiversity and Bioabundance: Invertebrate Abundance

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Survey leader: Kora Ross
Survey type: Baseline monitoring
Date(s) of fieldwork: 27th May – 30th September 2021
Date of report: April 2023

1 Project introduction

Wilder Blean is a wilding project in West Blean and Thornden Woods that is reintroducing large grazing herbivores to reinstate natural processes in a woodland ecosystem and monitoring the effects of these animals on the vegetation and the taxa this will in turn influence. The project is designed as an experiment involving three grazing assemblage treatments: 1) 'Bison treatment' containing European Bison, Exmoor ponies and Iron-Age pigs; 2) 'Conservation Grazers treatment' containing Longhorn Cattle (in place of Bison), Exmoor Ponies and Iron-age pigs, and 3) 'Control treatment' which is a control area where no introduced grazing animals will be present. For ease of writing, treatment 2 ('Conservation Grazers') will be referred to as 'Proxy treatment' in this report.

The Blean woodland complex to the north and west of Canterbury forms one of the largest surviving blocks of ancient semi-natural woodland in England. West Blean and Thornden Woods, which forms part of the Blean complex, is a mosaic of different habitat types as a result of extensive replanting. The oldest and most natural types are the oak-hornbeam community and mixed broad-leaved coppice with standards. Of more recent origin are extensive stands of sweet chestnut coppice. During the last 55 years or so, extensive areas of the woodland have been cleared and replaced with conifer plantations, some of which have since been thinned or felled. Within the woodland there are also small areas of heath and a few limited areas of wetland habitat, including natural features as well as man-made ponds.

Due to the Bison's ecology and behaviour, the project is hoping to create more open areas and structural diversity and provide a nature-based, natural process led, and sustainable solution to woodland management in southeast England.

2 Monitoring aims

The aim of this part of the monitoring programme is to establish an invertebrate abundance across all three treatment areas, in order to quantify invertebrate abundance change over the course of the Wilder Blean monitoring programme.

3 Monitoring methodology

15 Sea, Land and Air Malaise (SLAM) traps were deployed across the project area between 27 May and 30 September 2021 at 2m height, five traps per treatment area (bison, proxy, control), one in each habitat (Coppice, Plantation, High Forest, Open, Native Regen). The invertebrates were preserved in propylene glycol and each trap was serviced once a month with new sample bottles and a fresh batch of propylene glycol left in situ.

Volunteers went through all sample bottles between April and October 2022, identified all invertebrates to order and recorded their numbers on a database.

4 Results and analysis

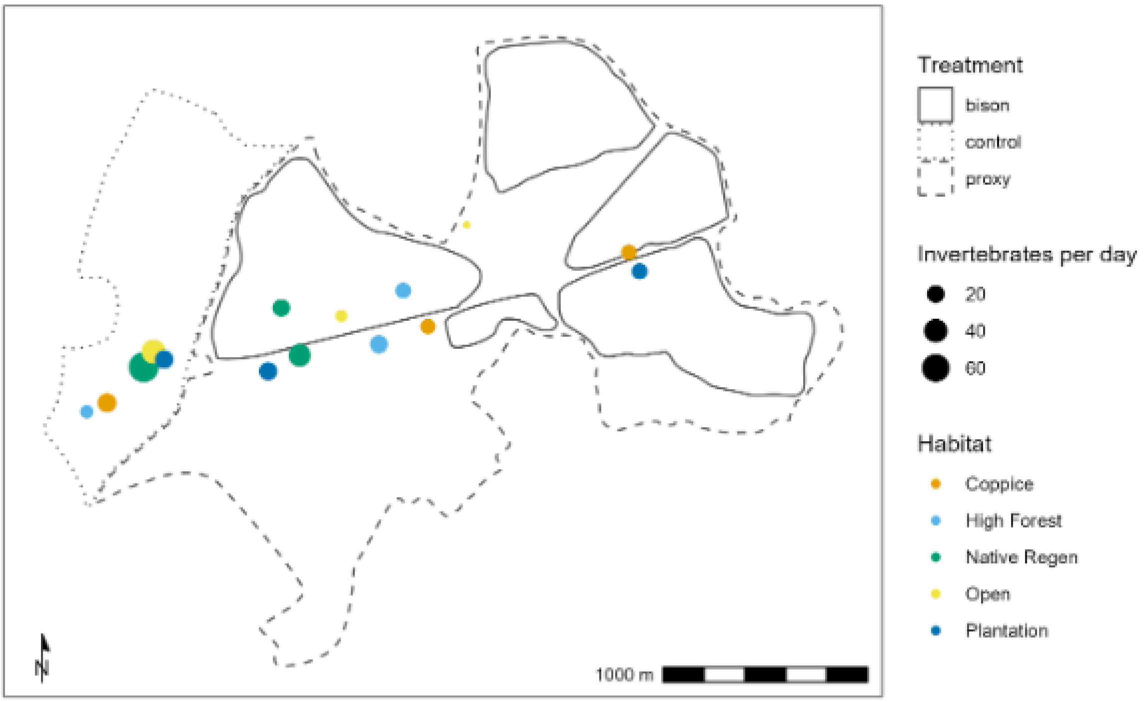


Figure 1 SLAM trap locations with the point size showing the invertebrate count per day and the colour showing the habitat type

We used a Linear Mixed-effects Regression (LMER) model to understand the effect of treatment type (Figure 2) on the number of invertebrates trapped per day, whilst controlling for the effects of collection date (Figure 3) and habitat type (Figure 4). Including collection date and habitat type as random effects, means the model includes a random intercept for traps within the same habitat type and a random intercept for each service date, and thus this grouped data structure is acknowledged in the model, increasing the accuracy of the results. The response variable, invertebrates trapped per day, was log-transformed prior to the analysis to reduce skewness and conform to normality. The results were back-transformed to aid interpretation.

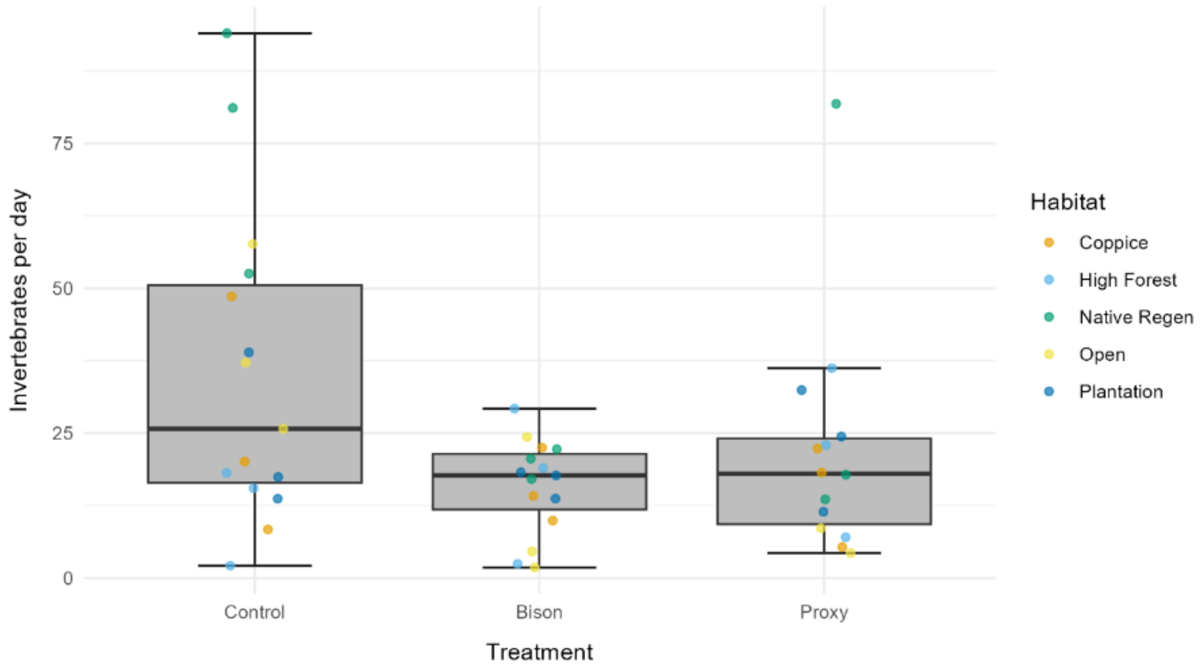


Figure 2 Boxplot with jittered data points showing the spread of the invertebrate count data by treatment type. The boxes indicate the interquartile range (central 50% of the data), either side of the median invertebrate count which is shown by the horizontal line inside the box. The vertical lines extend out by 1.5 times the interquartile range. The data points are plotted, coloured based on habitat type, and 'horizontally jittered' so they do not overlap to aid visualization.

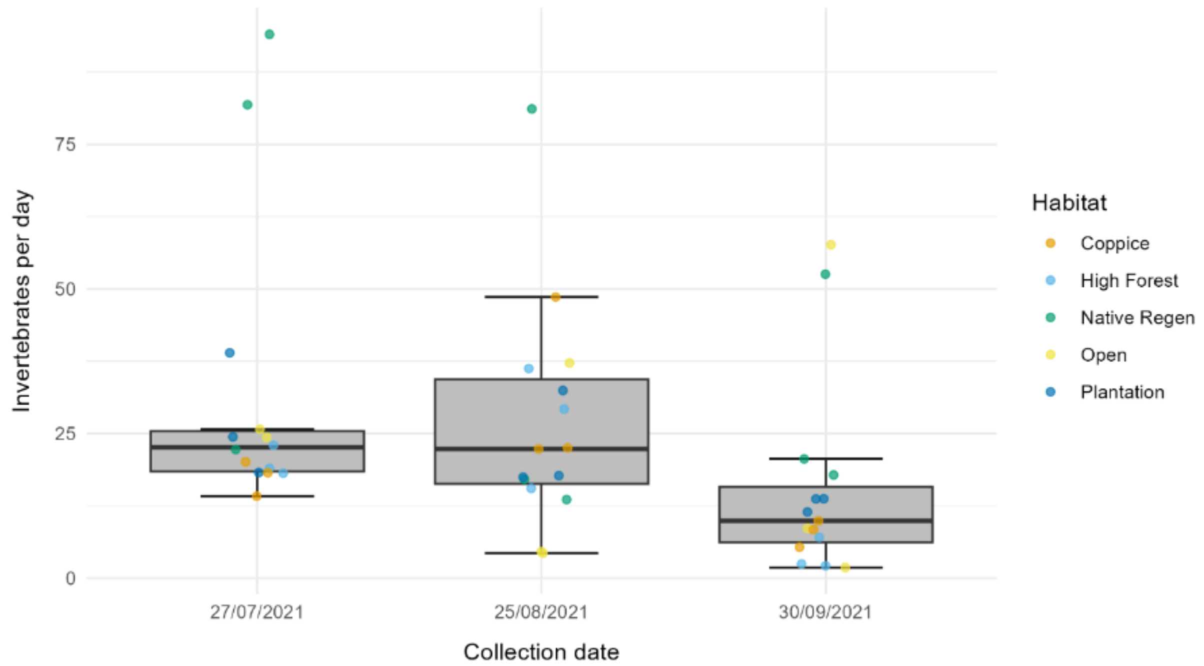


Figure 3 Boxplot with jittered data points showing the spread of the invertebrate count data by collection date. The boxes indicate the interquartile range (central 50% of the data), either side of the median invertebrate count which is shown by the horizontal line inside the box. The vertical lines extend out by 1.5 times the interquartile range. The data points are plotted, coloured based on habitat type, and 'horizontally jittered' so they do not overlap to aid visualization.

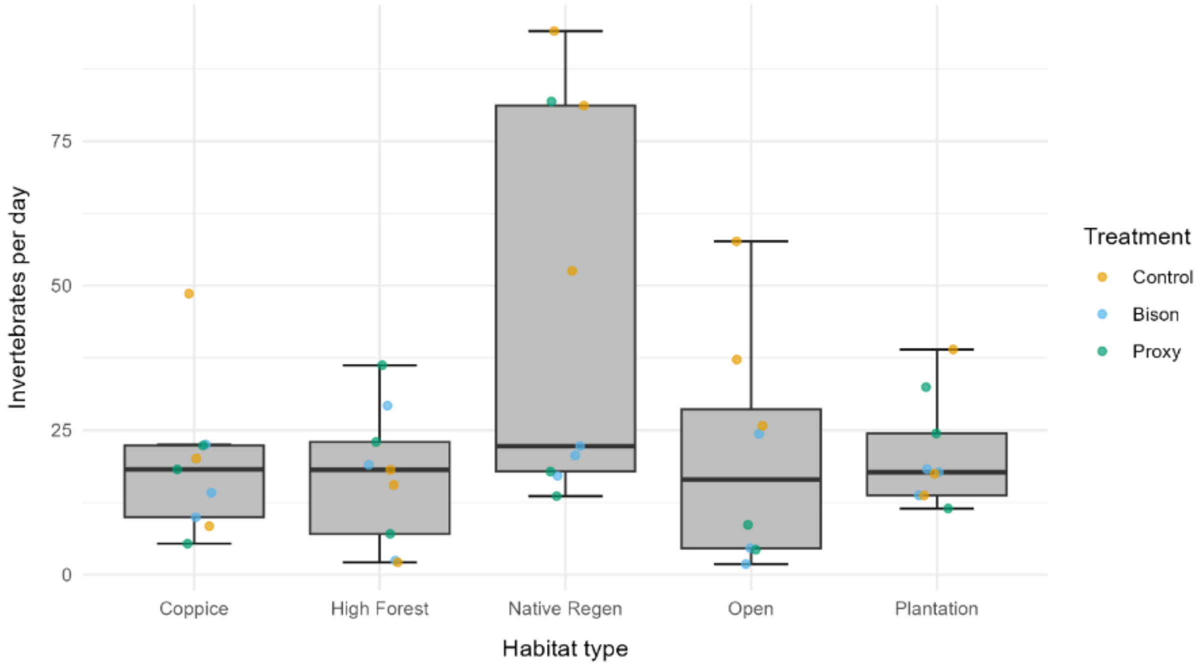


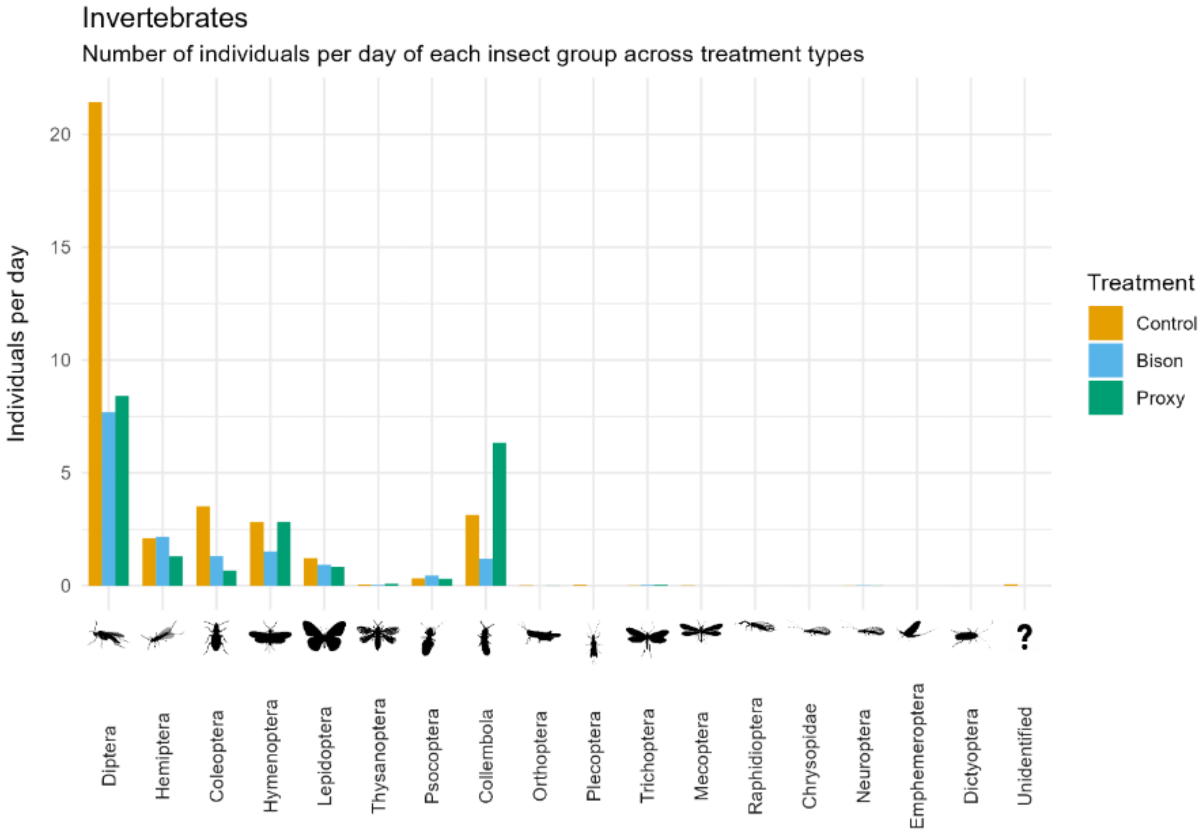
Figure 4 Boxplot with jittered data points showing the spread of the invertebrate count data by habitat type. The boxes indicate the interquartile range (central 50% of the data), either side of the median invertebrate count which is shown by the horizontal line inside the box. The vertical lines extend out by 1.5 times the interquartile range. The data points are plotted, coloured based on habitat type, and 'horizontally jittered' so they do not overlap to aid visualization.

The results show that approximately half as many invertebrates were sampled in the bison treatment compared to the control area, and this difference was statistically significant, see **Table 1**. A conditional R^2 value of 0.473 shows a moderate model fit.

Table 1 Results of the LMER model of invertebrate count as a function of treatment. The control treatment is the reference level.

	Invertebrates per day			
Predictors	*Estimates*	*CI*	*p*	*df*
(Intercept)	25.15	9.33 – 67.79	**0.001**	4.34
Treatment: Control	*Reference*			
Treatment: Bison	0.50	0.30 – 0.84	**0.011**	35.00
Treatment: Proxy	0.65	0.38 – 1.11	0.109	35.11
Random Effects				
σ^2	0.50			
$\tau_{00\ Habitat}$	0.13			
$\tau_{00\ Collection.date}$	0.23			
ICC	0.42			
$N_{Collection.date}$	3			
$N_{Habitat}$	5			
Observations	44			
Marginal R^2 / Conditional R^2	0.091 / 0.473			

The results show that the most common invertebrate group sampled in 2021 was Diptera with 17,241 specimens counted. Diptera were particularly highly abundant in the control area, making up for 9989 of the above. The control area was generally the treatment with the highest invertebrate numbers (16,153), followed by the livestock area (9,099) and the bison area (7,136). The control area saw a much higher coleoptera and a higher Hymenoptera count compared to the other two treatments whereas Hemiptera were most common in the bison area. There were high numbers of collembola found across all treatments with the highest number found in the livestock area. The least represented orders were Orthoptera with a total count of 12 and Mecoptera with a total number of 9 across all treatments as well as Raphidioptera with only one specimen in the bison area and Dictyoptera with only one specimen in the control area.



5 Assumptions and Limitations

The SLAM trap hanging in Open habitat in the proxy area was found on the floor on the first day of trap servicing (27 July 2021) which meant no data could be collected for the month of July. The same trap as well as an additional two traps bison – Native Regen and bison – Open) were also found on the floor on 18 August 2021 and replaced immediately which however meant that August data for these traps is limited as they only collected invertebrates for one week between 18 and 25 August 2021.

Seven sample pots ended up with a very large number of miniscule invertebrates. 8ml samples were taken from those pots and the number of invertebrate orders found in the samples was extrapolated to however much liquid was left in the bottle. This affected bison – Coppice (September), bison – High Forest (September), proxy – Coppice (July), proxy – Coppice (August), control – High Forest (August), control – Plantation (August) and control – Coppice (July).

6 Conclusion

It is very interesting to see that the invertebrate abundance is currently much higher in the control area than in both other treatments with the bison area having the lowest abundance score. These outcomes are mirrored in Graeme Lyons's standardised invertebrate survey and report. It is expected that the introduced grazers will create invertebrate friendly habitat in both the livestock and bison areas and that invertebrate abundance numbers area going to increase in both over time. Grazing by all animals present should increase topographical variation, plant diversity at all stages of development as well as structural variation of vegetation height which in turn will benefit invertebrates. At the same time the control area will benefit from a more conservative, human conservation management approach. The invertebrate abundance monitoring will continue on site on an annual basis comparing all treatments and whilst it is expected for the grazing impact to influence invertebrate abundance scores positively, it is likely to take a few years before these changes will be translated to this level and visible as a positive trajectory.