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Right Tree, Right Place, Right Reason: FC's Area Ecologists

Reducing the Impact of Tree Protection in Native Woodland

Innovative Woodland Creation in a Welsh Habitat Mosaic

Public Financial Support for Tree Planting in Scotland: A Critique

Afforestation and Tree-Planting

Surveying Birds in Open Habitats near Proposed Woodland Creation Schemes: What is the Effect of Having Fewer Visits?

Figure 1. Eurasian curlew (*Numenius arquata*). Photo credit: Natural England/Allan Drewitt.

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In relation to new woodland creation in England, the Forestry Commission (FC) may require breeding bird surveys of proposed sites to assess suitability for planting or natural colonisation. Previous protocols required six visits, but we wanted to test the impact of reducing the number of visits to save resources without substantial loss of information. To simulate the impact of reduced survey visits and specific timings as per new FC guidance, existing survey data from breeding bird reports at woodland creation sites in England from 2021 and 2022 were analysed, using as metrics (1) species richness and (2) territory density of two wader species of conservation concern – curlew and lapwing – which are particularly susceptible to impacts of afforestation. Our results suggest that the proposed change in survey methods from six to four visits would have a relatively minor impact on species richness relative to the reduction in survey effort, but the change in breeding territory densities would be more substantial, though would not usually have implications for decision-making.

Introduction

The Forestry Commission (FC) offers grants to landowners, land managers and public bodies (excluding Forestry England) wishing to create new woodland in England. The Woodland Creation Planning Grant and the England Woodland Creation Offer encourage and support woodland creation as part of the UK Government's Net Zero Strategy, for the benefit of biodiversity, and to enhance wider ecosystem services. Increased rates of afforestation are necessary for meeting environmental goals; however, this must be well-informed by effective surveying of proposed planting sites, to ensure the 'right tree in the right place'.

FC provides guidelines for assessment of site suitability for woodland creation with the requirement to survey one or more of habitats, peat and breeding birds. Additionally, FC, NE and Defra (2023) provide guidance to advise when a site may be important for wading birds (informed by territory density) and to assess suitability for woodland creation (see Coates *et al.* 2024, in this issue). FC's survey guidelines for the 2022 season (Forestry Commission 2021) were based upon those described by the Bird Survey and Assessment Steering Group (n.d.), which were developed for breeding bird surveys in lowland deciduous woodland. The six survey visits set out in this methodology were deemed sufficient to detect most birds in this dense and complex habitat; however, open-habitat proposed woodland creation sites will be less complex and detection of birds may be higher.

Following discussion with Natural England, British Trust for Ornithology, Royal Society for the Protection of Birds, and Bird Survey & Assessment Steering Group, FC changed the survey guidance for the 2023 season (Forestry Commission 2022) from six evenly spaced visits between late March and early July (with specific spacing not prescribed) to four survey visits with each respective survey within a specific date window (described below). Breeding bird survey of proposed woodland creation sites is very expensive in terms of both time and cost; therefore, a reduction in survey methods would save resources. FC commissioned our report in early 2023 to assess the likely impact of the reduced number of survey visits and review the potential impacts of the change on results and interpretation. This was done for both overall observed species richness (how many species are detected across all visits) and for estimated territory density of two important wader species: Eurasian curlew (*Numenius arquata*) and northern lapwing (*Vanellus vanellus*). We synthesised the findings to produce recommendations in terms of the likely impact of the change in survey approach adopted for 2023 and potential future survey considerations.

Methods

Twenty-seven breeding bird survey reports were analysed (Figure 2). Full methods and results can be found in Borthwick *et al.* (2024).

Species richness

Species richness refers to the number of different species present or detected at a site. We compared the species richness observed by surveyors over six visits from the 2021 and 2022 data with predicted values of species richness that would have been found if they had made only four visits (as per the new guidance). We also considered the

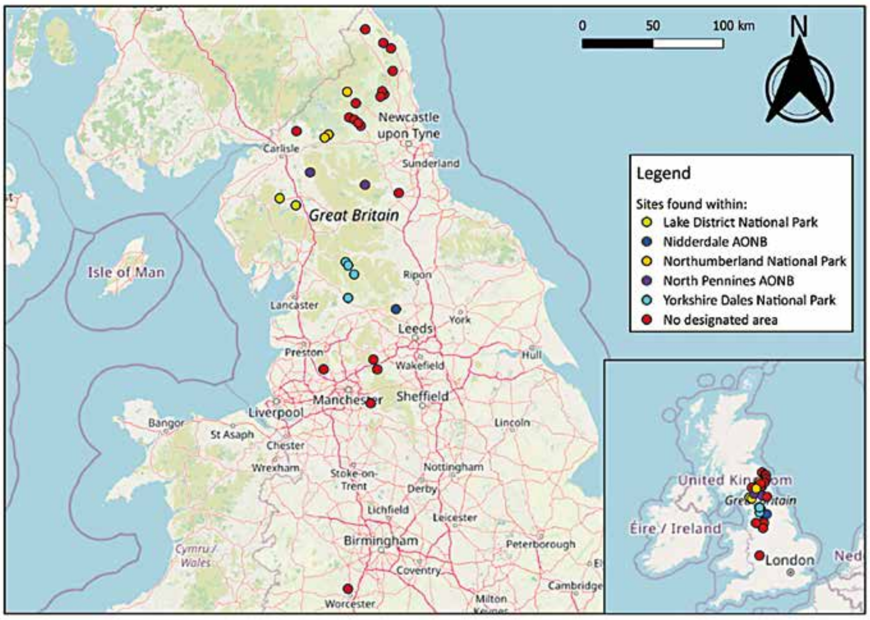

Figure 2. Distribution of proposed woodland creation sites in England from which breeding bird reports were analysed. Map created using QGIS Desktop 3.22.14; base map retrieved from OpenStreetMap (OpenStreetMap contributors, www.openstreetmap.org/copyright).

species richness detected if these four visits were (1) selected randomly from the six, or (2) where possible, fitted into the four-survey-window criteria of the 2023 guidelines (FC 2022).

For the latter, 12 reports were identified, each with six survey visits in total, where, by chance, at least four survey dates could be fitted to the new survey windows with at least one visit occurring in each of the four windows. In other words, a subset of these 12 reports' visits unknowingly followed the new guidance for 2023 surveys. Where multiple visits had occurred in one window, one of these visits was chosen at random to be included in the analysis. Where an evening visit and a morning/non-evening visit fell in the same window, the evening visit was excluded as the new FC survey guidance does not specifically require an evening visit. The selected visits falling within the new survey windows were termed the four 'targeted' visits for subsequent analysis, in contrast to the 'randomised' approach of any four visits. The distribution of visits from 2020 and 2021 extracted from reports with the four new required survey windows overlain are shown in Figure 3.

Observed species richness (S_{obs}) for each site was taken from the original six visits. Simulated species richness (S_{sim}) for each site was calculated (1) from the four targeted visits selected from within the new survey windows which directly simulated the modified survey approach, and (2) from randomised species accumulation curves representing the mean number of species detected across four visits from all possible four-visit permutations of the data. To examine the effect of reducing from six to four visits, for each site we divided the simulated species richness predicted to be found after

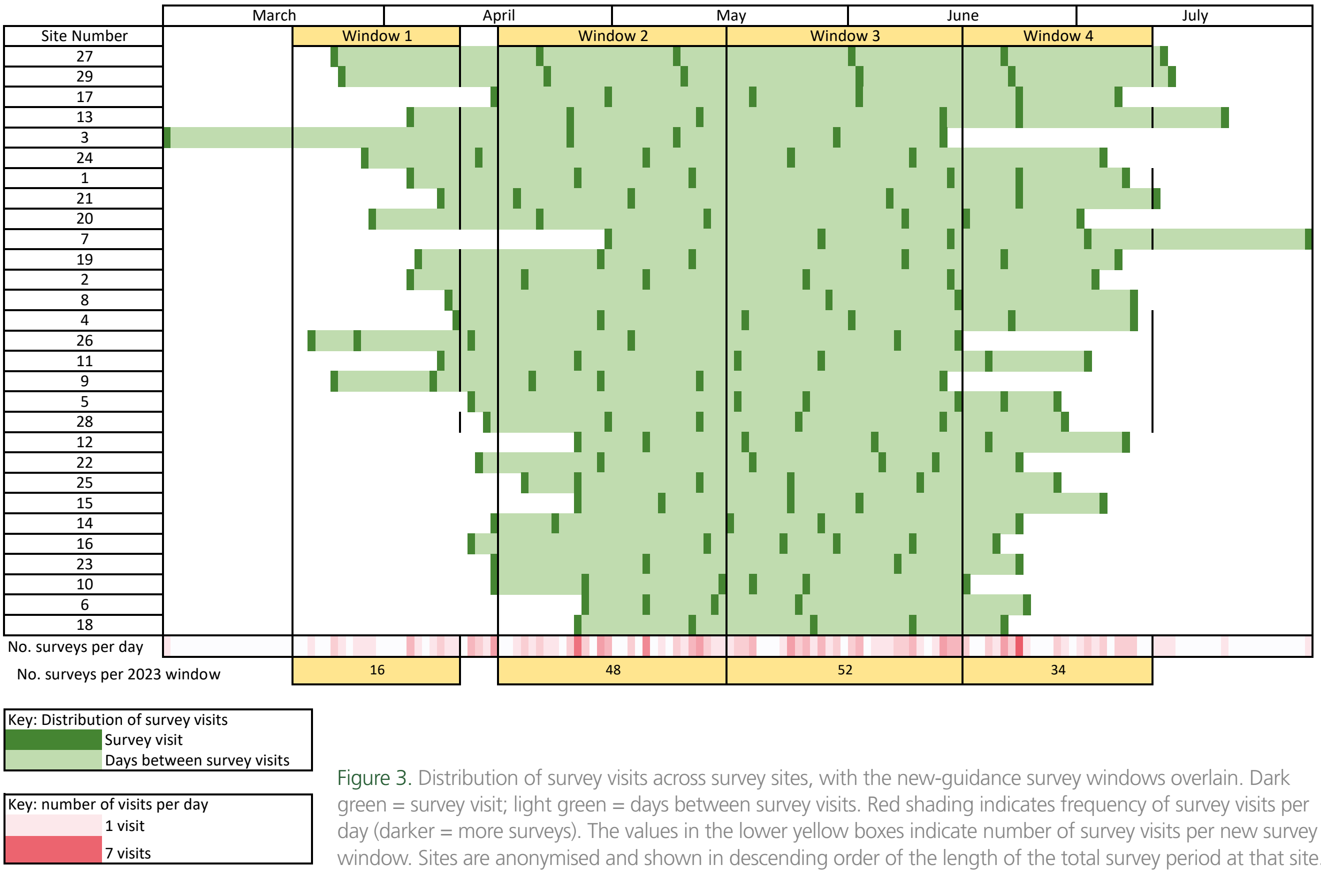

Figure 3. Distribution of survey visits across survey sites, with the new-guidance survey windows overlain. Dark green = survey visit; light green = days between survey visits. Red shading indicates frequency of survey visits per day (darker = more surveys). The values in the lower yellow boxes indicate number of survey visits per new survey window. Sites are anonymised and shown in descending order of the length of the total survey period at that site.

four visits (either randomised or targeted) by the observed species richness from six visits and expressed this as a percentage of species likely to still be detected following the reduced survey effort. For example, if S_{obs} from six visits was 20 and S_{sim} from the targeted four-visit approach was 17, then this percentage would be 17/20 = 85%. For the randomised approach, we also extracted simulated species richness for five, four, three, two and one visits for comparison.

Territory density

To assess the potential impact of reducing the number of visits from six to four, a comparison was made of territory density estimates derived from either a full set of six survey maps or a subset of four random survey maps. Similarly to the randomised approach with species richness, above, all possible permutations of four survey maps were extracted and territory densities were calculated from each permutation (15 permutations). Seven bird species were chosen as target species for this analysis, based on having sufficient data across multiple reports for a meaningful analysis, and prioritising species of conservation concern or likely to be particularly impacted by afforestation. From this set of sites and species, analysis was conducted for sites with at least one record of the species to be analysed in three or more survey visits. In this paper we report results only for Eurasian curlew and northern lapwing since they are IUCN red-listed (Stanbury 2021) wading bird species associated with upland habitats and sensitive to woodland creation. In addition, their estimated territory densities are specifically used to inform FC, NE and Defra (2023) guidance on when a site may be important for wading bird species to assess suitability for woodland creation. We also carried out this analysis for additional typical upland species as reported in Borthwick *et al.* (2024).

To count territories, an approach similar to the territory mapping technique as set out in the British Trust for Ornithology Common Birds Census Instructions was used (Marchant 1983). Briefly, territory mapping involves using information on number, sex, vocalisations and other breeding evidence from a succession of maps to estimate locations of independent breeding territories, and territory density is then estimated as the number of territories divided by the survey area (in km^2). Territory density analyses here apply only to the footprint of the proposed woodland creation and not a surrounding buffer zone which was surveyed using an alternative approach (details in Borthwick *et al*. 2024). As there were some minor variations in territory mapping methodology or reporting detail between surveyors/reports, we re-estimated territories for all map combinations and sites to ensure consistency across sites. We found that our density estimates were most similar to those of surveyors when we adopted a more conservative approach to territorial definition (comparison in Borthwick *et al*. 2024).

Estimating breeding territory densities for waders has direct implications in the decision-making process of assessing sites for woodland creation (FC, NE and Defra 2023). Densities of one territory/km^2 for curlew and two territories/km^2 for lapwing are used as thresholds for further discussions around site suitability in relation to breeding waders. Simulating the number of territories of curlew and lapwing detected after four visits (new survey guidelines) compared to six visits (old survey guidelines) would allow for identification of instances where the reduction of survey visits would have technical impacts on the requirement for further site assessment.

Results

Species richness

The simulated mean species richness (S_{sim}) after four visits was only marginally greater in targeted survey visits (36.8) than randomised visits (36.7). As a percentage of the species richness seen after six visits (S_{obs}) these represented 89% of species detected. Figure 4 shows the distribution of the proportions of total S_{obs} at each hypothetical number of survey visits. The simulations show that with fewer visits, fewer species are detected, but that this has an asymptote such that at four visits the proportion of species detected is still relatively high, falling more rapidly when decreased to three visits or fewer. The estimated proportion of species detected after four visits only varied within a 3% band whether we considered all species (Figure 4) or subsets of threatened species (red- and amber-, or just red-listed species).

“Open-habitat breeding bird surveys are a crucial tool in woodland creation assessment, enabling decisions about whether planting is likely to impact bird communities and individual species.”

Territory density

Results of the territory density analysis are presented in Figure 5. There were only two instances (both for curlew, at sites 4 and 17) where the mean number of territories detected from four visits fell below the FC, NE and Defra (2023) density thresholds when they had originally produced estimates above the thresholds after six visits. However, as each of these estimates were very close (0.09 territories/km^2) to the threshold figure of 1 territory/km^2 they would be further assessed as a precaution. Overall, a mean of 71% of curlew

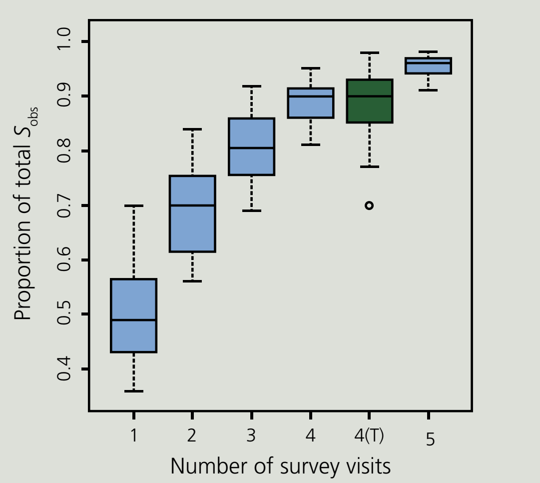

Figure 4. Predicted mean proportion of total species richness which would be detected at each number of survey visits, relative to the species richness after six actual visits. Blue box-and-whisker plots show the variation (median, interquartile range, min/max) across all 27 sites for between one and five randomly selected visits. The green box shows the same but for four targeted (T) visits that fall within the new survey windows recommended (Figure 3), from the subset of 12 sites where visits happened to fall within these windows.

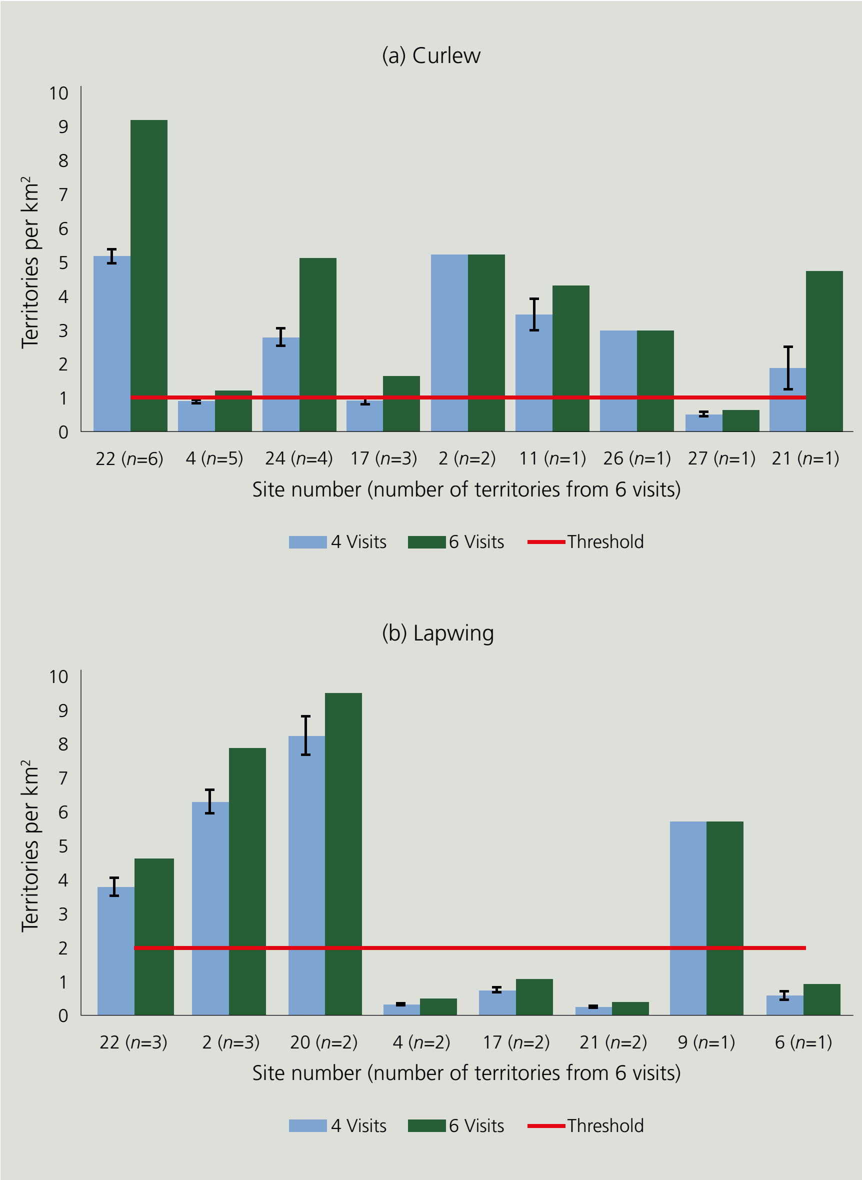

Figure 5. Estimated number of territories per km² for curlew and lapwing considering all six survey visits (green) and the mean of all combinations of four visits ± standard error (blue). Sites are arranged in descending order of the number of territories detected when considering all six visits (*n*). Territory density thresholds of one curlew territory per km² and two lapwing territories per km², as per guidance from DEFRA, FC and NE (2023), are indicated by a red line.

territories (range 40–100%) and 78% of lapwing territories (range 67–100%) were detected after four survey visits, relative to the total reported after six visits. In two instances for curlew and one instance for lapwing, the four-visit mean territory density estimate was the same for that seen after six visits.

Discussion

Open-habitat breeding bird surveys are a crucial tool in woodland creation assessment, enabling decisions about whether planting is likely to have impacts on bird communities and individual species. Like all surveys, they require a significant resource outlay and it is important to find the balance between data quality and resource efficiency. The fact that the randomised species accumulation curve (Figure 4) was beginning to flatten suggests that six visits were on average close to estimating true species richness. As might be expected, our analyses demonstrate that reducing the number of visits will likely reduce the species richness and/or territory densities detected. However, the predicted proportional reduction observed in species richness (11%) is substantially less than the reduction in survey effort achieved by reducing survey visits by a third (33%), suggesting four visits may represent an adequate trade-off between effort and efficacy. Simulations predicted that a further reduction to three or fewer visits would substantially reduce species richness estimates, however. These results broadly support a finding by Calladine *et al*. (2009), who simulated the effect of reducing the number of survey visits on population estimates of breeding birds in moorland habitats using a constant-effort-search method, finding that four survey visits were the minimum required to produce reliable estimates.

In contrast, the reduction from six to four visits (a 33% reduction) had a greater impact on territory density estimates, although still lower than the reduction in survey effort, with a mean of 26% fewer territories estimated for curlew and lapwing. A greater reduction in territory density than in species richness is perhaps to be expected, as territory estimation requires multiple records of the same species of bird over successive visits, whereas species richness only requires one record of a species in a single visit to be counted. The Common Bird Census (CBC) territory mapping method, which was superseded by the Breeding Bird Survey as the primary scheme for monitoring population trends among widespread breeding birds, required 10 survey visits (Marchant 1983). A weakness of the CBC approach was the burden of so many survey visits which reduced overall sample size and representation of sites (BTO n.d.). In contrast the two widely accepted methods of survey for upland breeding waders (O'Brien and Smith 1992; Brown and Shepherd 1993) require a minimum of three or two visits respectively. Thus, given four visits generally was not predicted to reduce densities of curlew and lapwing to the extent it would change the management implications of the data, it is likely that four visits will be sufficient to assess territory densities for these species, and it still represents more visits than two widely used breeding wader survey methods. Six wader species in the dataset had insufficient data for territory density analysis: IUCN green-listed (Stanbury 2021) European golden plover (*Pluvialis apricaria*), amber-listed Eurasian oystercatcher (*Haematopus ostralegus*), common snipe (*Gallinago*

Figure 6. Lapwing (*Vanellus vanellus*)

gallinago) and common redshank (*Tringa totanus*), and red-listed Eurasian woodcock (*Scolopax rusticola*) and Eurasian whimbrel (*Numenius phaeopus*). Further work would be needed to assess possible impact of fewer visits on territory density estimates for these species.

Despite analysis showing no significant difference in the proportion of species richness detected at four random or four targeted survey visits relative to six visits, the targeted visits (i.e. where the four surveys must each be spaced out within fixed survey windows) may bring additional benefits beyond the simple measure of species richness. It should result in greater consistency in the timing and spread of survey visits across the breeding season (which was highly variable between surveyors; Figure 3), making comparisons between sites more valid, as well as for future analysis using similar data. Targeted discussion was held between FC and consultants who had used the previous survey protocol and the revised protocol, and they indicated that the survey method was clearer and simpler and, as a result, it was not changed further. Our approach presents a potential framework for future analyses to consider a greater number of reports spanning more years, including those that will use the new FC survey guidelines.

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