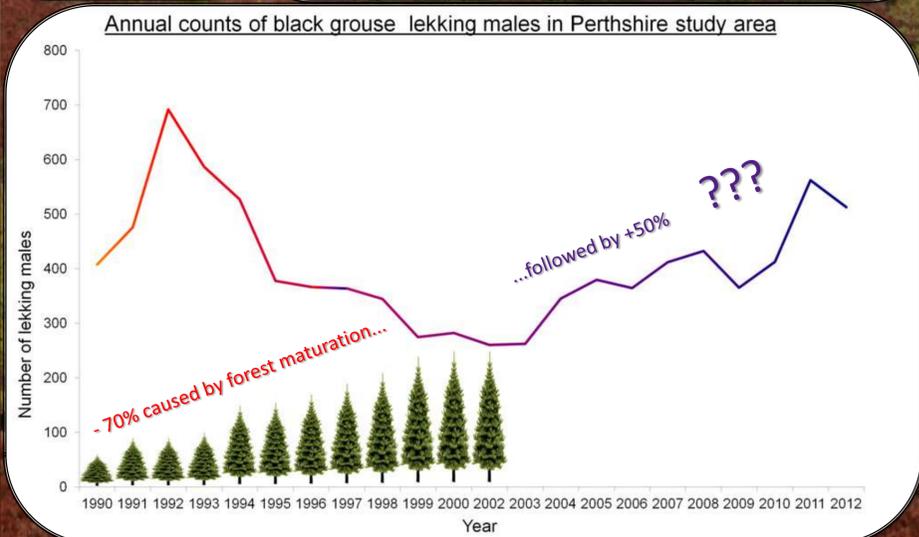
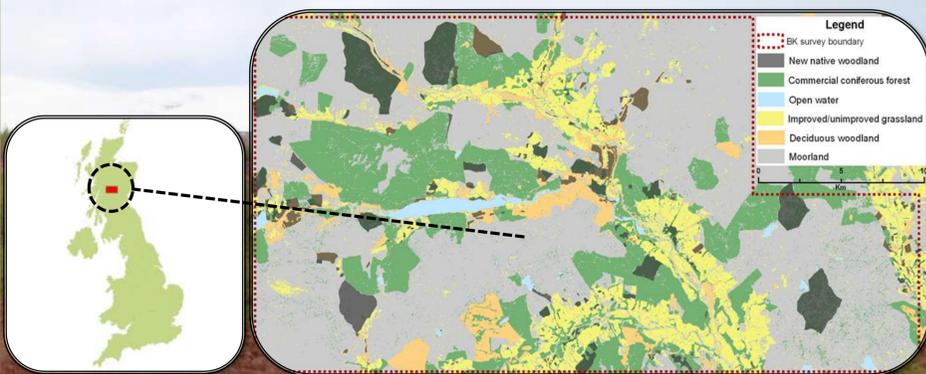


Associations between new native woodland creation and population change in Scottish black grouse *Tetrao tetrix*

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Background: A population of black grouse in Perthshire, Scotland, declined by an estimated 70% between 1990 and 2002. Maturation and canopy closure of commercial forest explained 58–78% of the variation in population change (Pearce-Higgins *et al.* 2007). This population has subsequently begun to increase again, however correlates of this increase have not been examined. One reason may be the creation of new native woodland (NNW) within the area, which provides open forest cover and field layer regeneration through the exclusion of grazers.

Method: Within the 700km² study area, we investigated whether black grouse lek occurrence, lek size and population change from 2002 to 2012 were related to the area or amount of edge of different habitats (see map) within three radii of leks; 500m, 1500m and 3000m (see right for the ecological explanation of these buffers). We followed a similar methodology to Pearce-Higgins *et al.* 2007, but distinguished NNW plots from other habitats (see map above). A detailed field layer survey was also conducted in summer 2012, to evaluate field layer differences between NNWs and surrounding moorland.

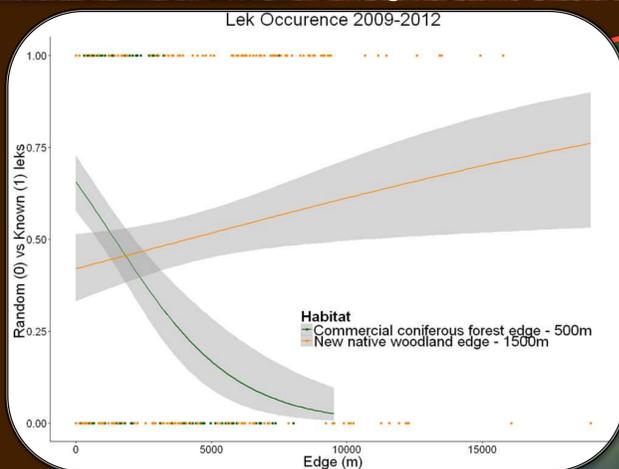


Figure 1: Locations of known leks from 2009 to 2012 (1) were compared to an equal number of randomly located points (0). Known leks were at sites with significantly more NNW and less commercial forest edge.

Buffer 3000m
where all females of the lek occur

Buffer 1500m
where most nest occur and broods raised

Buffer 500m
is the immediate lek proximity

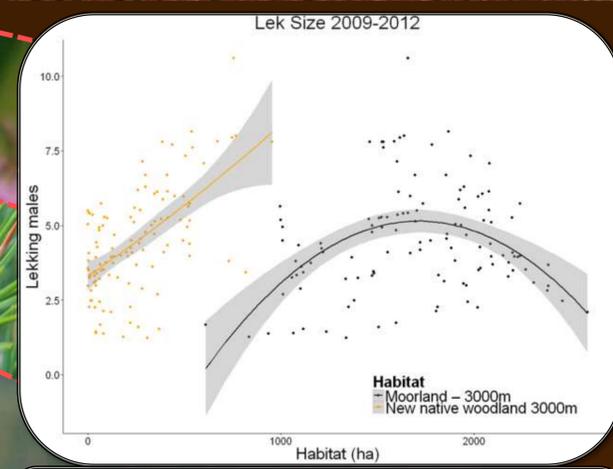


Figure 2: Despite NNW occupying a small proportion of the landscape, larger leks were associated with extended areas of NNW. Lekking males also gradually increased in number in relation to moorland area - but only to 1800ha - after which they declined (quadratic relationship).

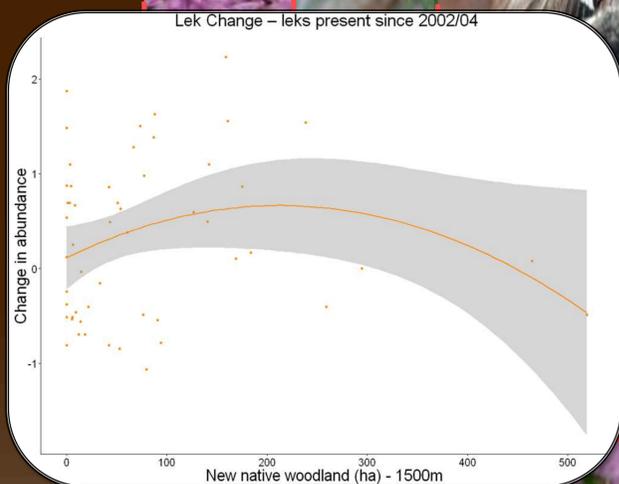


Figure 3: Changes in BK numbers (log-ratio) for leks constantly present since 2002/04 were weakly correlated (quadratic relationship) with NNW area. Values above zero represent an increase in number of lekking males from 2002/04 to 2010/12, while values below zero represent a decline.

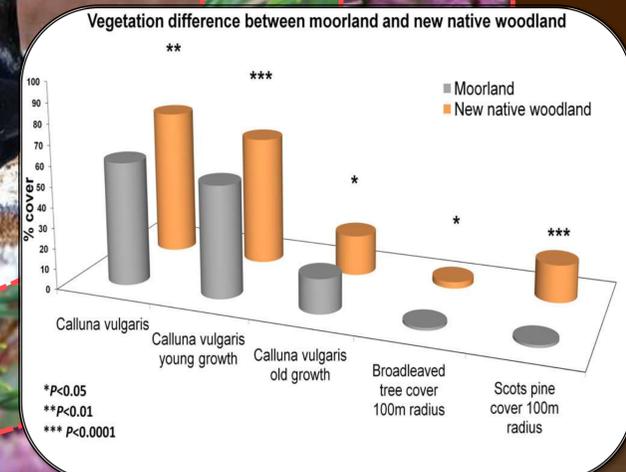


Figure 4: Significant differences in field layer cover and composition were found when comparing vegetation at sampling points within NNWs plots to those in the surrounding moorland.

Results & Discussion: Despite focussing only in a period of positive black grouse population growth, we found a strong negative relationship between commercial conifer forest on lek occurrence ($P=0.0017$; see **Figure 1**) and lek size ($P=0.0086$). NNW plots covered only 5.5% of the survey site, however a positive correlation was found with lek size ($P=0.02$; see **Figure 2**) and lek location ($P=0.02$; see **Figure 1**), while temporal changes in grouse abundance were weakly related to NNWs area (quadratic relationship; $P=0.04$; see **Figure 3**). Within NNW plots, typically fenced to exclude grazers, vegetation structure and abundance was significantly different from the surrounding moorland, with greater heather cover and native tree density (see **Figure 4**). NNW plots might provide black grouse with foraging, nesting and refuge resources through increased field layer and tree cover. We should therefore seek to identify the optimum management actions within such plots for black grouse and the wider bird community.