Supplementary Information
Modelling disease spread in real landscapes: Squirrelpox spread in Southern Scotland as a case study.
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Calculation of the disease transmission coefficient

The disease transmission coefficient, β,was set so that the seroprevalence of grey squirrels matched that observed from trapping data in Southern Scotland. Trapping data provided by Saving Scotland's Red Squirrels (SSRS) recorded grey seroprevalence and trap locations. The trap location could be used in conjunction with the forest inventory records (assuming a core range radius of 150 m) to determine the forest composition covered by the trapping regime. Following Tompkins et al. (2003) the seroprevalence was matched to the endemic equilibrium densities for grey squirrels in the deterministic model (Equation 1 in the main paper) by assuming that

$$\text{seroprevalence} = \frac{R_G}{H_G} \Rightarrow \beta = \frac{\gamma(b+\gamma)}{K_G(\gamma - \text{seroprevalence}(b+\gamma))} \tag{S1}$$

The relationship between seroprevalence and carrying capacity saturates as the carrying capacity increases (and therefore similar levels of seroprevalence correspond to very different squirrel densities when seroprevalence is high). For this reason we restricted the trapping data to sites which gave accurate trap positions and in which seroprevalence was below 75% (note, this does not restrict the seroprevalence in model). Results are shown in Table S2 and disease transmission was chosen as β=0.55 as being in the predicted range.

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Table S2: Trapping data for sites in Southern Scotland provide records of seroprevalence and trap location. This can be used to estimate carrying capacity and disease transmission (using Equation S1).

Location	**Carrying Capacity,** K_G	**Seroprevalence, %**	**Estimate of** β
Wauchope 1	49	47	0.54
Wauchope 2	60	63	0.63
Arton Castle	60	60	0.58

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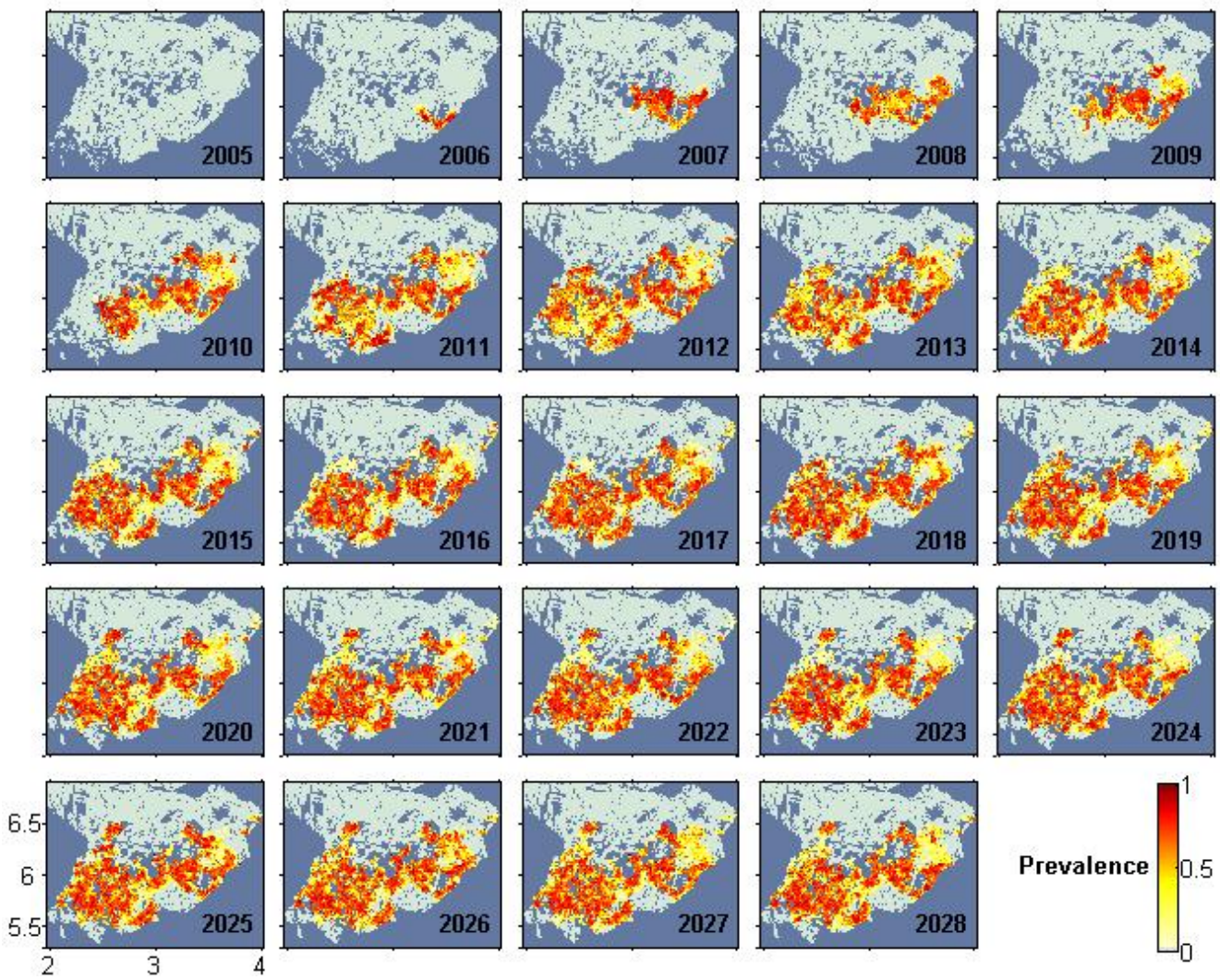

Figure S3: The spread of squirrelpox from its initial introduction in 2005 in a single model simulation. The maps show the prevalence of seropositive greys (R_G/H_G). Squirrelpox spread is initially rapid throughout Southern Scotland but the extent of squirrelpox remains relatively fixed from 2013 onwards. This happens in 50% of the model simulations. Easting and Northing values (/10^5) are shown on the bottom left panel.

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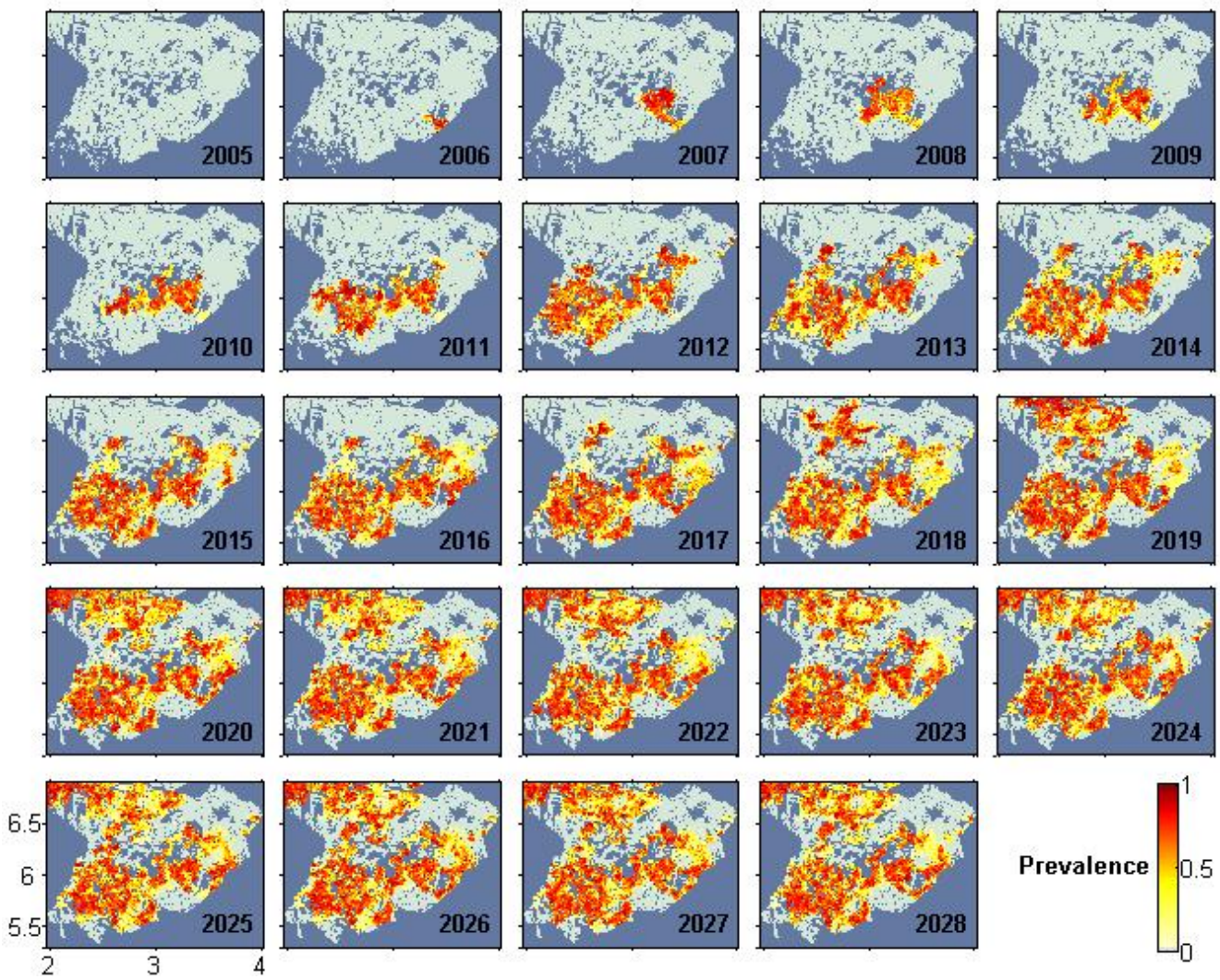

Figure S4: The spread of squirrelpox from its initial introduction in 2005 in a single model simulation. The maps show the prevalence of seropositive greys (R_G/H_G). Squirrelpox expands into Central Scotland through a dispersal route in north east Ayrshire which can be seen as the expansion in the region of seropositive greys in 2017. Easting and Northing values ($/10^5$) are shown on the bottom left panel.

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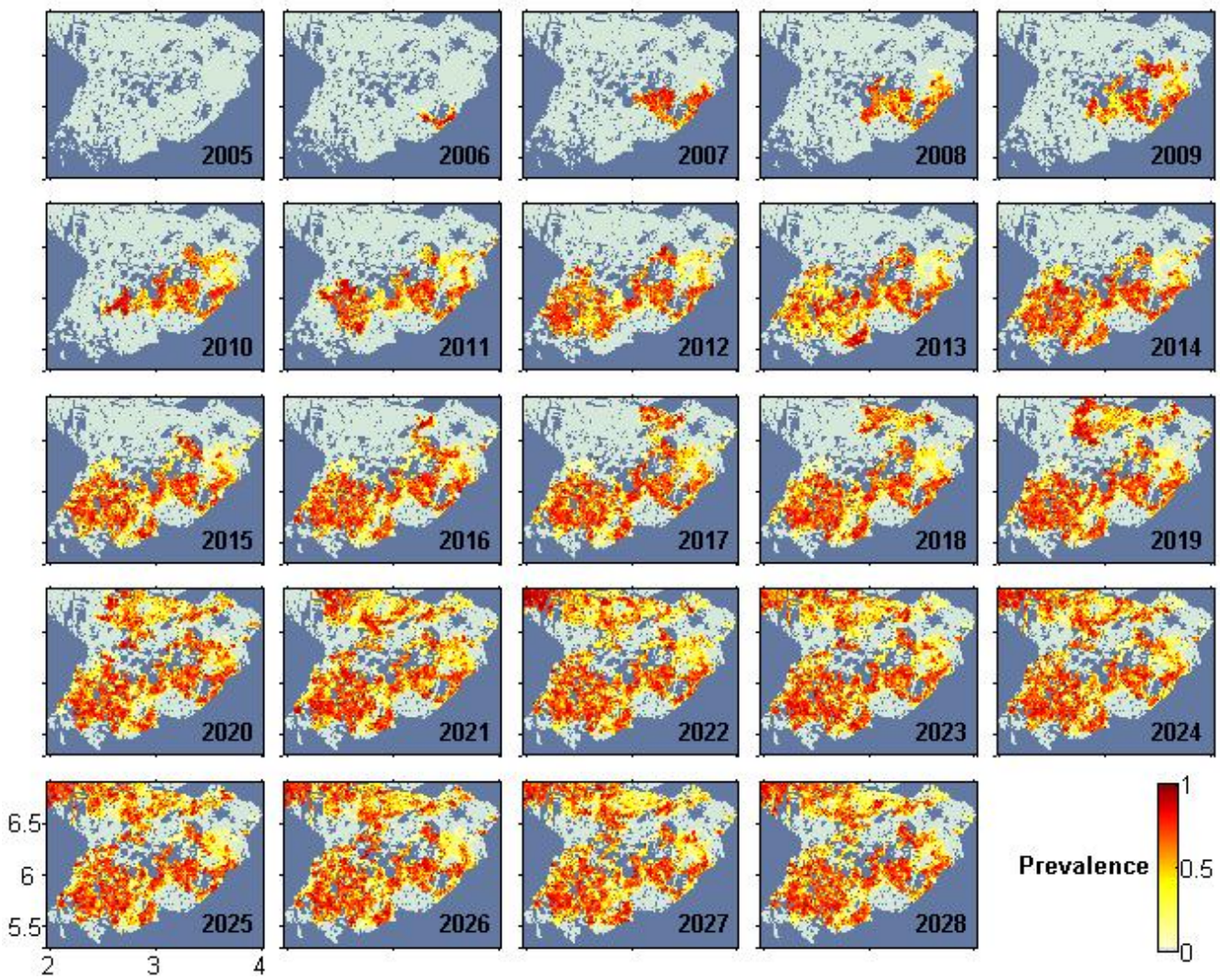

Figure S5: The spread of squirrelpox from its initial introduction in 2005 in a single model simulation. The maps show the prevalence of seropositive greys (R_G/H_G). Squirrelpox expands into Central Scotland through a dispersal route in the northern Scottish Borders which can be seen as the expansion in the region of seropositive greys in 2015 and 2016. Easting and Northing values ($/10^5$) are shown on the bottom left panel.

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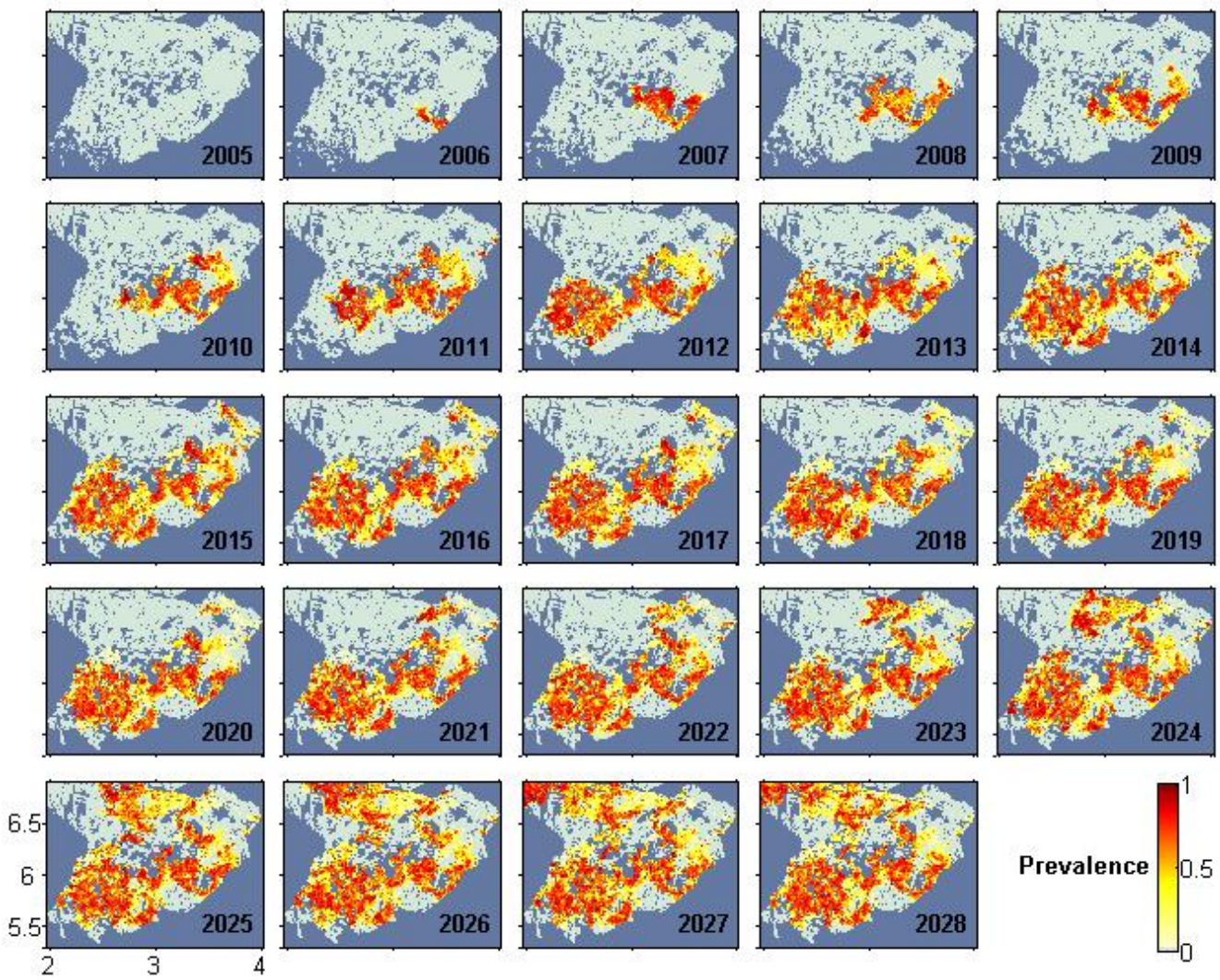

Figure S6: The spread of squirrelpox from its initial introduction in 2005 in a single model simulation. The maps show the prevalence of seropositive greys (R_G/H_G). Squirrelpox expands into Central Scotland through a dispersal route in the Scottish Borders and East Lothian which can be seen as the expansion in the region of seropositive greys in 2015 and 2016. Easting and Northing values ($/10^5$) are shown on the bottom left panel.

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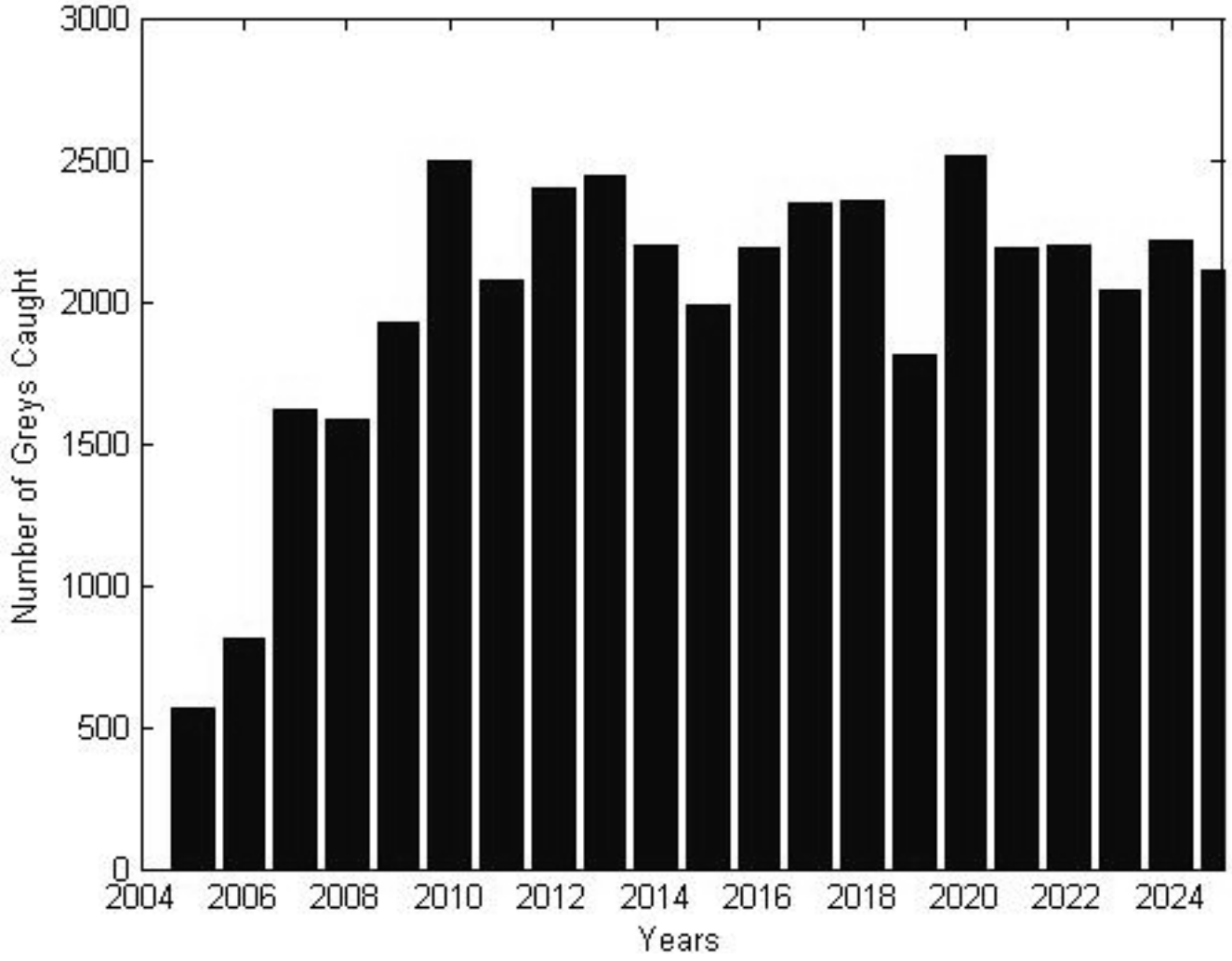

Figure S7: The total number of grey squirrels removed each year in the model (for a typical model realisation).

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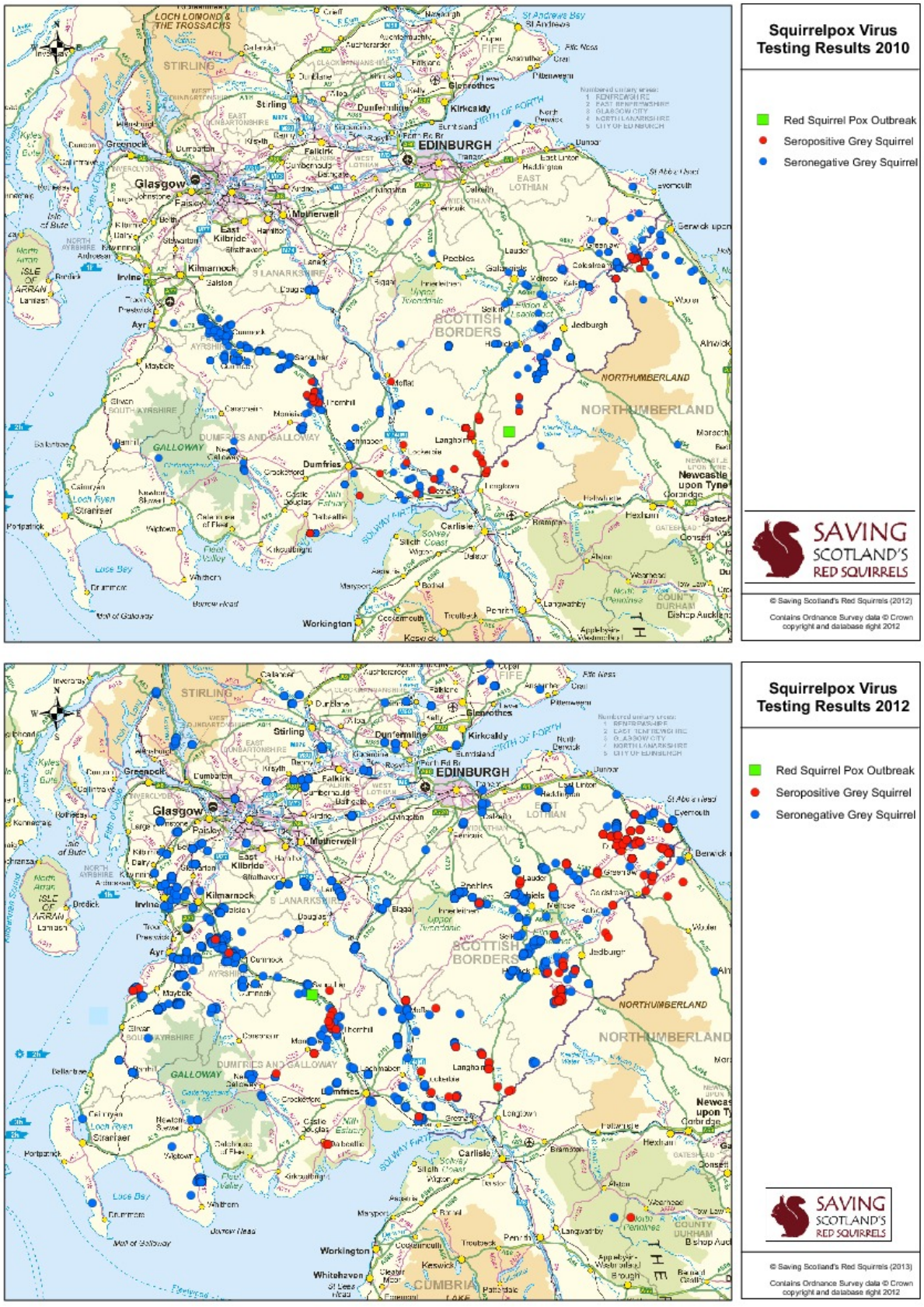

Figure S8: The recorded incidence of squirrelpox in the south of Scotland in 2010 and 2012 (provided by SSRS).

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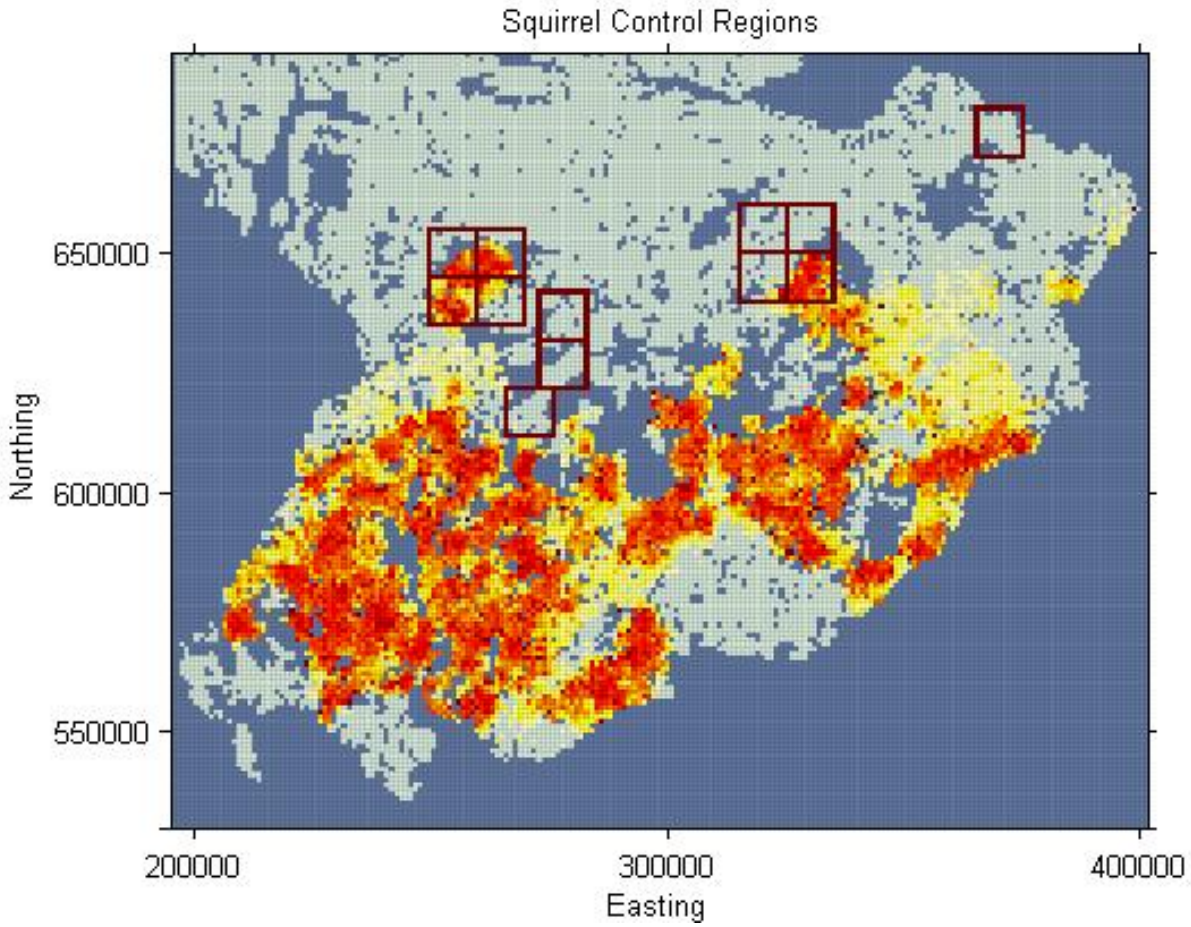

Figure S9: The highlighted regions indicate 10×10 km grid squares in which the targeted control procedures was applied to prevent SQPV spread along key corridors connecting Southern and Central Scotland. The control procedure is similar to that outlined previously but in each 10 km grid square 20% of the habitable region is controlled and it is assumed that control removed 80% of greys squirrels (compared to 40% in the original control procedure). The model was tested for several combinations of targeted control: 80% intensity, 20% coverage (shown in Fig. 5 of the main paper); 80% intensity, 40% coverage; 40% intensity, 20% coverage and 40% intensity; 40% coverage. Both combinations with 80% intensity prevented squirrelpox spread to Central Scotland whereas both combinations with 40% intensity did not prevent its spread.

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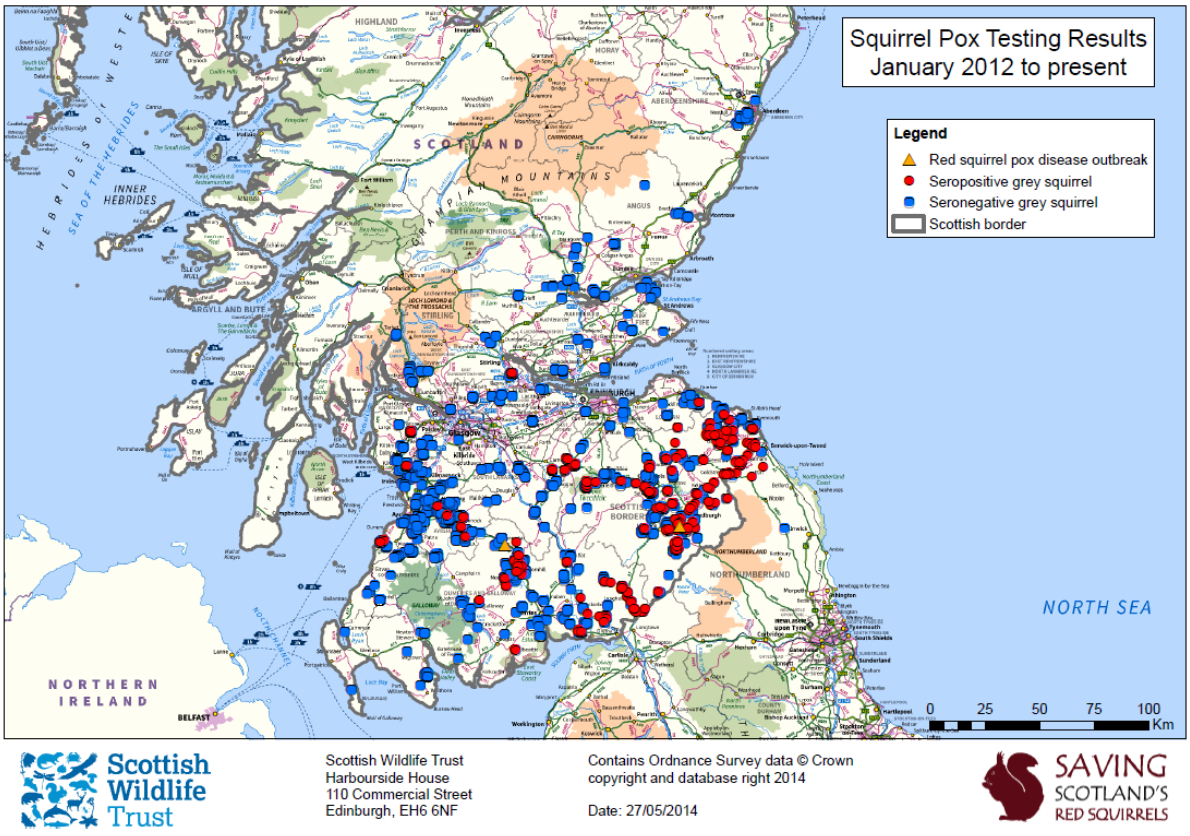

Figure S10: The recorded incidence of squirrelpox in the south of Scotland from 2012 to 2014 (provided by SSRS).