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SUPPLEMENTARY MATERIALS

Effects of Fire and Commercial Thinning on Future Habitat of the Northern Spotted Owl

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SAMPLE CALCULATION USING THE STATE AND TRANSITION MODEL (EQUATION 1)

To illustrate the calculations we performed using equation 1, we present an example using data from the Klamath region, calculating the change in late successional forest over one time step (1 year) with thinning. The starting (t=0) proportion of late successional forest in the landscape is 76.6%, while mid-successional and early successional forests occupy 14.4 and 9.0 percent of the landscape, respectively. The transition probabilities we used in our calculation are defined in Table 1, while forest regrowth and high severity fire rates are given in Table **2**. Fig. (**1**) shows all the non-zero transitions.

$$\begin{bmatrix} \phi_t^{EE}\ \phi_t^{ME}\ \phi_t^{TE}\ \phi_t^{LE} \\ \phi_t^{EM}\ \phi_t^{MM}\ \phi_t^{TM}\ \phi_t^{LM} \\ \phi_t^{ET}\ \phi_t^{MT}\ \phi_t^{TT}\ \phi_t^{LT} \\ \phi_t^{EL}\ \phi_t^{ML}\ \phi_t^{TL}\ \phi_t^{LL} \end{bmatrix} \begin{bmatrix} P_t^E \\ P_t^M \\ P_t^T \\ P_t^L \end{bmatrix} = \begin{bmatrix} P_{t+1}^E \\ P_{t+1}^M \\ P_{t+1}^T \\ P_{t+1}^L \end{bmatrix} \tag{1}$$

From equation 1 we write out the formula for calculating the change from year t=0 to year t=1.

$$P_{t+1}^{L} = P_{t=0}^{E}(\psi_t^{EL}) + P_{t=0}^{M}(\psi_t^{ML}) + P_{t=0}^{T}(\psi_t^{TL}) + P_{t=0}^{L}(\psi_t^{LL})$$

Using the starting amount of late successional forest in the Klamath study region (76.58%) and the transition probabilities from Table **1**, we can make the following calculation:

P_{t+1}^{L} = 9.0(0) + 14.4(1/32) + 0(0) + 76.58(1-(1/362 – 0.000073) – 0.01135) = 75.95%

Therefore, late successional forests decrease in this scenario by 0.6 percent. This is the average annual change over the time period in which the thinning is occurring. The loss of forest from thinning (0.01135) abates after 20 years when the thinned area amounts to 21 percent of the original late successional forest amount. We then model a scenario where the thinning treatments are maintained, or they reverse themselves at the same rate such that no effects of thinning are apparent after 40 years (treat and recover scenario). The term $P_{t+0}^{L}\ (\psi_t^{TL})$ captures the return of late-successional forest from thinned forest.

The calculations of the changes in amounts of the other forest types (early and mid-successional, and thinned) are comparable to this example. Each calculation accounts for all the transitions shown in Fig. (**1**). As illustrated by this calculation, all the reduction in a forest type that occurs due to its transitioning to another type is captured by subtraction of all of these transitions. In the example presented here, the value 1/362 that is subtracted represents the proportion of late-successional forest burned at high-severity when no thinning occurs, and the number subtracted from this (0.000073) is the reduction in high-severity fire resulting from thinning. This reduction will gradually increase every year for 20 years, at which time 50% less high severity fire would be occurring in unthinned areas compared to a no-thinning scenario. In addition, we assumed no high-severity fire at all would occur in the thinned areas, which comprise 22 percent of the landscape in our model scenario by year 20.

The no treatment scenario is simplified in that all the terms related to thinning are absent. The term representing transition from mid- to late-successional forest (P_t^{MT} (1/32)) exceeds the term representing transition from late- to early successional forest (P_t^{L} (1/362), so late successional forest increases. The increase in late-successional forest from time t = 0 to t=1 with no thinning, for comparison with the calculation provided above, is from 76.58% to 76.96%.