Appendix 10

Completing the decision network. Twenty owners of large, forested properties (at least 20 ha in total area with at least 4 ha of forest) in Macon County, North Carolina, participated in a structured decision making (SDM) process consisting of two series of workshops with ten landowners each. In each series, landowners evaluated what they can do to their forest to maximize the achievement of their land use objectives. We built a Bayesian decision network to evaluate the expected utility of each decision option that could help landowners achieve their land use objectives. Described here are some procedures we used to analyze the Bayesian decision network.

For the water quality, exotic species abundance, and native species diversity nodes, Series 1 identified three levels in the attribute scale while Series 2 identified two levels. Experts were asked to provide probabilities for three levels, and we converted the probabilities to two levels by dividing the probability assigned to the second level in a three-level scale between the levels in a two-level scale. However, if the probability for the first or third level in a three-level scale was zero or one, we kept that probability and calculated the probability for the remaining level.

We calculated conditional probabilities for the native species diversity node by assigning probabilities for attribute levels when the forest was of less, equal, or more conservation value compared to an untouched forest for birds and herpetofauna. It is challenging to describe the response of taxa because different species have different niches. Total abundance of birds or herpetofauna is not adequate because it does not convey whether there are many individuals of a few generalist species or individuals from many species. Species richness indicates the total number of species but does not indicate information about the size of populations. Species evenness is not appropriate because there is no expectation about how similar population sizes should be among species. Therefore, we quantified the response of wildlife taxa to forests in terms of conservation value. In general, a conservation value index is a weighted sum of species' abundance (Götmark et al. 1986, Nuttle et al. 2003, Twedt 2005). The weight scales the abundance according to the species' conservation priority. We did not ask experts to complete any calculations, but rather to conceptualize their probabilities with regards to the forest's conservation value for birds or herpetofauna. We also assigned probabilities for attribute levels when the forest had lower, equal, or greater abundance of shade-intolerant trees compared to an untouched forest. Then, the probabilities for birds, herpetofauna, and shade-intolerant trees were averaged corresponding to each outcome combination. We first calculated probabilities for the four-level attribute scale for Series 1 and converted the probabilities for the two-level attribute for Series 2 by summing the Series 1 probabilities for the very high and moderately high levels and summing the Series 1 probabilities for the moderately low and very low levels.

At the time that landowners completed the conditional probability tables, we had not finalized the decision to include shelterwood harvest as a decision option. Landowners had said they were not interested in clearcutting, presumably because of aesthetics and a notion that clearcutting is bad for the environment, so we did not consider clearcutting and initially did not give much attention to shelterwood harvest. However, discussions with an expert at Forest Stewards and the consideration of shade-intolerant tree abundance led us to include shelterwood harvests in the decision options. Consequently, probabilities had not been completed for the effects of shelterwood harvests on rural landscapes in the Series 1 decision network. Therefore, we filled in probabilities that were consistent with the other probabilities in this node and asked landowners for revisions at the fourth workshop, but landowners did not request changes. Similarly, selling 1 ha was not included in the decision options when we asked the expert to provide conditional probabilities related to shade-tree abundance. We generated probabilities by multiplying the probabilities of each attribute level given personal use by 0.95, calculated the mean probabilities for each attribute level by averaging across the decision options that had unique probabilities provided by the expert, multiplied each mean probability by 0.05, and added the weighted mean probability for each attribute level and the corresponding weighted personal use probability.

An expert from the Land Trust for the Little Tennessee (LTLT) and an expert from Forest Stewards provided conditional probabilities for levels of net income given decision options. However, the LTLT may not have direct experience with the finances of timber harvests and Forest Stewards may not have specific information about conservation easement finances. Therefore, we talked to Forest Stewards about the costs and revenue associated with crown thinning, group selection, and shelterwood harvests and to the LTLT about the costs of conservation easements with and without timber harvest. We also discussed how property taxes would be affected by various decision options with Forest Stewards, the LTLT, and the Macon County tax assessor. For this analysis, we did not consider effects on income tax or estate tax because they are very landowner-specific, and this project focused on an evaluation of an average large, forested property in Macon County. After we compiled financial estimates from the experts (Appendix 9), we generated conditional probabilities for levels of net income given decision options and weighted them equally with the two sets of conditional probabilities from the LTLT and Forest Stewards. Based on the information provided by the LTLT and Forest Stewards, we also determined that a landowner would not be able to earn more than 33% of their income from the forest, making the node describing the proportion of income derived from the property deterministic.

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