Active Timber Management

by Outsourcing Stumpage Price Uncertainty with the American Put Option

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Abstract

Timber production is an inherently risky business. Stumpage price fluctuates all the time, creating price uncertainty for forestland owners and managers. In this paper, we address this challenge by outsourcing it with an American put option to determine the reservation prices at different ages. These reservation prices enable forestland owners to determine whether the stumpage price is high enough to justify an immediate timber harvest. The harvest value based on the American put option approach and the harvest age are then incorporated into the generalized Faustmann formula to determine the corresponding land expectation values.

To calculate the reservation prices of a 55-year long American put option, starting at stand age 15 and ending at stand age 70, the following parameters were employed. The average stumpage price of $169.19 /MBF was used as both the current and strike prices with a standard deviation of $65.73 /MBF. Volume equation Q(t) =exp(12.09-52.9/t) represents the stand volume in thousand board feet for southern pine in US South. The real interest rate equals 4%. The simulation results showed that outsourcing stumpage price uncertainty with the American put option resulted in an average land expectation value of $2633/A. This result is 37% higher than that of the $1921/A under certainty assumption. But the average harvest age of 46 years is nearly 50% longer than the 31 years under certainty assumption. Moreover, the result with the American put option approach is $250/A less than that with the Brazee and Mendelsohn reservation price approach. To further enhance the outcome of the American put option approach, partial coverage of the stand volume at age 70 was explored. A partial put option coverage of 60% of such volume resulted in an average land expectation value of $2881/A with average harvest age of 35.51 years, essentially the same as the $2883/A with an average harvest age of 35.45 years under the Brazee and Mendelsohn method. More importantly, the curvilinear relation between partial put option coverage and the average land expectation value creates intriguing opportunities to balance uncertainty tolerance and the average land expectation value. For example, an uncertainty seeking 30% partial coverage will produce a result that is slightly better than that of a 100% coverage ($2647/A vs. $2633/A). Yet, the average harvest age of the former of 26.85 years stands at less than 58% of the 46.15 years of the latter. Consequently, forestland owners are no longer passive stumpage price takers. Instead, by balancing uncertainty and return with partial American put option coverage, they become active timber managers and stumpage price setters.