**Optimal Moso Bamboo Forest Management: A Dynamic Model**

**Presenter:** Tong Wu; Cornell University  
**Presenter Email:** tw494@cornell.edu  
**Authors:** Tong Wu, Cornell University; Cynthia Lin Lawell, Cornell University; Jiancheng Zhao, Zhejiang, Academy of Forestry; Zhangjun Fei, Boyce Thompson Institute and Cornell University; David R. Just, Cornell University; Qiang Wei, Nanjing Forestry University

Moso bamboo is the single most important bamboo species in China, accounting for 74% of China’s bamboo forest area, and the third most important source of timber in China. Optimal Moso bamboo management is a complex dynamic problem. Moso bamboo forest management involves both selective bamboo stem harvesting and bamboo shoot thinning. The harvesting of bamboo stems entails cutting down the bamboo. Bamboo shoot thinning involves the selective harvesting of bamboo shoots, which provides more space for bamboo shoots left in the ground to grow and more space for future bamboo stem growth, as well as bamboo shoots, a product with a high market price. Both bamboo stems and bamboo shoots are products that are sold on the market.

In this paper, we solve for the optimal bamboo stem harvest and bamboo shoot thinning policy using a numerical dynamic model that nests an inner finite-horizon within-year daily dynamic programming problem within an outer finite-horizon between-year annual dynamic programming problem. We use a Chapman-Richards growth function as our model for bamboo biomass accumulation.

The results of our numerical dynamic model suggest that since the number of bamboo shoots at the beginning of each year depend on the number of bamboo stem remaining at the beginning of each year and on whether the previous year was a high-precipitation year, and since bamboo stem continue to grow each year while bamboo shoots only grow within a year, it is generally optimal not to harvest any bamboo stem until the first day of the last year, and to harvest all the bamboo shoots at the end of each year.

After analyzing optimal Moso bamboo management numerically, we then develop and estimate a dynamic structural econometric model of Moso bamboo management and apply our model to a detailed daily panel data set we have collected and constructed on bamboo shoot and bamboo stem harvests on multiple bamboo plots in multiple townships in Zhejiang province in China. We will use our model and results to design sustainable, effective, and politically feasible forest management policies that maximize net benefits to society.