
Assessing structural complexity of temperate agroforestry systems using soundscape analysis

Christopher Bobryk*¹, Christine Rega², Sougata Bardhan³, Almo Farina⁴, Hong He⁵, and Shibu Jose⁶

¹Department of Forestry, University of Missouri – 203 Anheuser Busch Natural Resources Building, Columbia, MO 65211, United States

²Department of Fisheries and Wildlife, University of Missouri – 302 Anheuser Busch Natural Resources Building, Columbia, MO 65211, United States

³The Center for Agroforestry, University of Missouri – 203 Anheuser Busch Natural Resources Building, Columbia, MO 65211, United States

⁴University of Urbino – Campus Scientifico 61029 Urbino, Italy, Italy

⁵Department of Forestry, University of Missouri – 203 Anheuser Busch Natural Resources Building, Columbia, MO 65211, United States

⁶The Center for Agroforestry, University of Missouri – 203 Anheuser Busch Natural Resources Building, Columbia, MO 65211, United States

Abstract

The homogenization of the landscape is threatening to weaken ecosystem function by minimizing structural complexity. This is evident in agricultural systems where intensification has created major disparities in ecosystem functions by reducing variations in structure across landscapes. Agroforestry is an integrated, land-use option that supports ecosystem properties coupled with socioeconomic benefit by incorporating trees and grasses with traditional agricultural crops. The developing field of soundscape analysis is a practical tool for describing complex phenomena and presents an effective approach for assessing and monitoring ecological functions across integrated land-use systems. A small-scale study was conducted using low-cost recorders (LCR) within varying agroforestry systems to test the utility of the acoustic complexity index (ACI) as an indicator for ecosystem structure along 4 land-use types (mixed hardwood forest, alley-cropping, silvopasture, and monoculture). Preliminary results indicated a relationship between ACI as a function of gradients in complexity ($R\text{-sqr.} = 0.38$) and soundscape composition ($R\text{-sqr.} = 0.58$). This study is a first step in understanding how soundscape analysis may be used as an assessment tool for indicating ecosystem dynamics within integrated agroforestry systems.

Keywords: Agroforestry, Acoustic Complexity Index, Low cost recorder, Sustainable agriculture

*Speaker