Is Lacunarity a valuable measure of plant canopy structure?

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Introduction

In the UK, a greater emphasis is being placed on increasing the biodiversity of agricultural land. There is a particular emphasis on increasing functional biodiversity for biological control. The structure of a plant canopy is crucial in determining the micro-environment within a habitat and hence the biodiversity that that habitat will support. Our aim in this work is to develop a method for comparing canopies to allow assessment of the impact of canopy structure on biodiversity.

Novel use of Lacunarity measures

3-Dimensional Lacunarity analysis is a recently developed scale-dependent measure from the 2-Dimensional gliding box approach that provides a useful indication of spatial arrangement or texture of plant structures in a given canopy volume using voxels. Lacunarity effectively describes the 'gaps' in a volume (Chmiela and Slota 2006; Cheng, 1997; Plotnick and Gardner, 1993, 1996; Allain and Cloitre, 1991).

To measure the lacunarity of a canopy, we create a virtual canopy from digitised plant data . We then voxelise the canopy using Euclidean co-ordinates of x, y, and z within a virtual volume of 1000000units^3. Occupied voxels are given an index of 1 for and un-occupied voxels 0. For our purposes, Lacunarity is calculated in a 2-dimensional X-Z plane for each Y pixel. A gliding box algorithm (Cheng, 1999; Plotnick, et al. 1993; Plotnick and Gardner, 1996) is used to calculate the lacunarity for the plane. This creates a spectrum of lacunarity values through the canopy.

The spectrums generated can then be used to compare canopies and related to biodiversity measures to determine the influence of canopy architecture on biodiversity. Through this approach we hope to be able to determine the canopy structure with the greatest biodiversity benefits for agricultural land.

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