



# The Five-Scale radiative transfer model

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## Introduction

A radiative transfer model simulates radiation transfer processes in certain media, such as vegetation and atmosphere. For vegetation, it computes the interaction between solar radiation and plants. Solar radiation reflected from the Earth's surfaces and measured by satellites depends strongly on the angles of the sun and the satellite in relation to the surface. This bi-directional behaviour is quantified using the Bi-directional Reflectance Distribution Function (BRDF). Five-Scale is thus used to simulate what optical remote sensing instruments are measuring when observing vegetation canopies. "Five-Scale" is a radiative transfer model that simulates the BRDF according to structural and biochemical properties of the vegetation.

## Why our model is named "Five-Scale"?

In Five-Scale, the solar radiation interaction with the foliage is considered at five different scales: within groups of trees, within individual crowns, within branches, within shoots, and within needles (leaves for deciduous).

## Applications

Five-Scale has been used to develop a vegetation index (namely the reduced simple ratio) that is less sensitive to different background than previously used indices and to assess the level of foliage clumping within a pixel using angular properties of the vegetation in the pixel.

## Further information

Five-Scale's code and a Microsoft Windows version are available on request from Sylvain G. Leblanc.

## References

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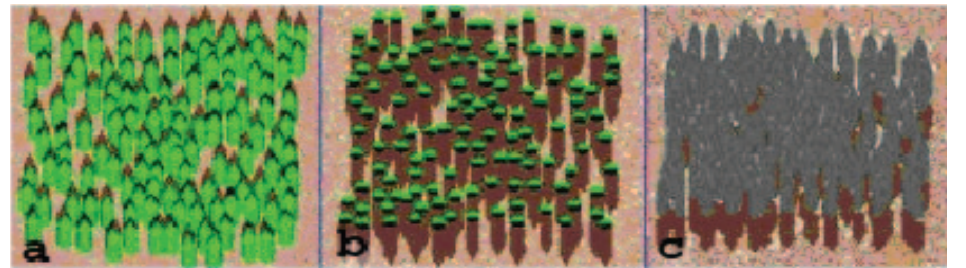
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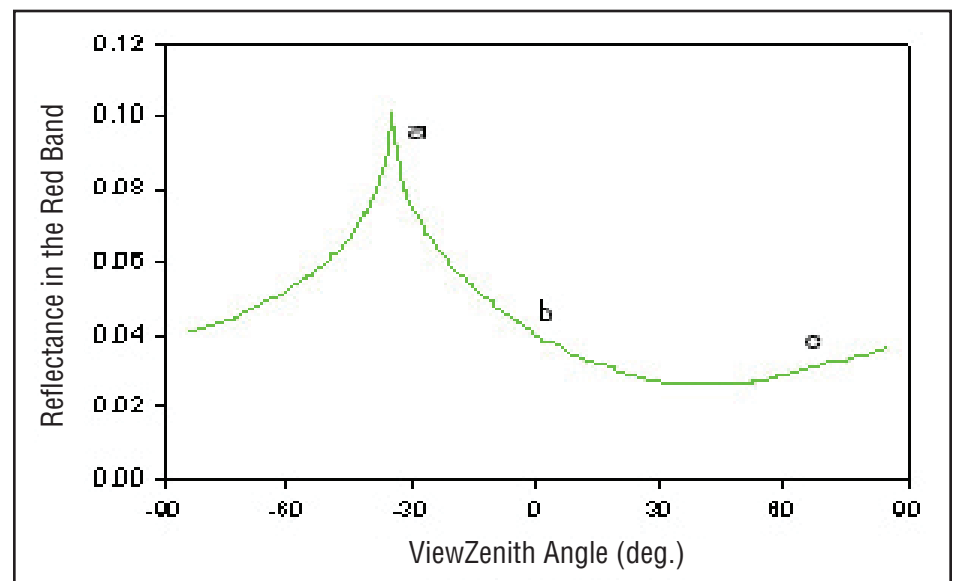
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BRDF rendering of a forest canopy composed of opaque cone and cylindrical objects viewed from 3 angles:

- (a) backward scattering, where the sun and the viewer are on the same side, hiding most of the shadows;
- (b) nadir view, where a maximum of the background can be seen; and
- (c) forward scattering where the sun and the viewer are on the opposite side.



"Five-Scale" simulated reflectance from a forest canopy at different view zenith angles on the plane parallel to the sun.