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CONTROL ID: 1481852**TITLE:** Subcanopy Solar Radiation Model: an irradiation model for predicting light in heavily vegetated landscapes**PRESENTATION TYPE:** Assigned by Committee (Oral or Poster)**CURRENT SECTION/FOCUS GROUP:** Biogeosciences**CURRENT SESSION:** B054. Remote Characterization of Vegetation Structure, Function, and Condition**AUTHORS (FIRST NAME, LAST NAME):** Collin A Bode¹, Michael P. Limm^{2, 1}, Jacques C Finlay², Mary Power¹**INSTITUTIONS (ALL):** 1. Integrative Biology, University of California, Berkeley, Berkeley, CA, United States.
2. Ecology, Evolution, & Behavior, University of Minnesota, Saint Paul, MN, United States.**ABSTRACT BODY:** Solar radiation flux, irradiance, affects many biological (e.g. photosynthesis, germination, metabolism) and hydrological (e.g. snow melt, water cycling) processes. Models of these processes often require data at the watershed scale. GIS based solar models that predict irradiation at the watershed scale take topographic shading into account, but do not account for vegetative shading. Methods that quantify subcanopy irradiation do so only at a single point. Further, calibrating the subcanopy models require significant field effort and knowledge of individual species characteristics (leaf area index, mean leaf angle, clumping factor, etc.). Upscaling from point values to watersheds is a significant source of uncertainty.

We propose an approach to modeling irradiation that uses airborne LiDAR to estimate canopy openness as a Light Penetration Index (LPI). We coupled LPI with the GRASS GIS r.sun solar model to produce the Subcanopy Solar Radiation model (SSR). SSR accounts for both topographic shading and vegetative shading at the watershed scale. Output is 52 raster maps (one per week) of 24 hours of irradiation (watt-hours/m²).

We calibrated the r.sun model to a weather station at our field site and to field measurements of direct and diffuse solar radiation taken for 24 hours at the weather station site. We validate predictions of the SSR by comparing modeled output to field measurements and to a standard method for point estimation of subcanopy radiation, hemispherical photographs processed with Gap Light Analyzer 2.0 (GLA). Based on ANCOVA analysis, SSR and GLA models exhibit a similar linear relationship with field data, and the models predict similar total solar radiation flux across the range of canopy openness. With similar quality to a standard point method, but with greatly expanded spatial coverage, SSR should become a useful tool in watershed analysis.

INDEX TERMS: [0480] BIOGEOSCIENCES / Remote sensing, [0466] BIOGEOSCIENCES / Modeling, [0439] BIOGEOSCIENCES / Ecosystems, structure and dynamics, [0438] BIOGEOSCIENCES / Diel, seasonal, and annual cycles.

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