Final Close-out information for
NASA-Ames Consortium Project NCC2-5222

"Use of Maple Seedling Canopy Reflectance Dataset for Validation of SART/LEAFMOD Radiative Transfer Model"

Barbara J. Bond (Oregon State University Collaborator)
David L. Peterson (NASA-Ames Research Center Collaborator)

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Four items are required for final close-out of this project:

1) A Summary of Research
2) Final Report of Inventions and Subcontracts
3) Final Federal Cash Transactions Report
4) Final Property Report

Items 1, 2 and 4 are included herein. A copy of this document will be forwarded to Mr. Robert Halvorsen at Oregon State University and his office will send three copies of SF 272, marked "FINAL" to:

NASA-Ames University Consortium
Mail Stop 241-1
NASA Ames Research Center
Moffet Field, CA 94035-1000

Summary of Research -- "Use of Maple Seedling Canopy Reflectance Dataset for Validation of SART/LEAFMOD Radiative Transfer Model" (NCC2-5222)

Barbara J. Bond (formerly known as Barbara J. Yoder)
David L. Peterson
Lee F. Johnson

This project was a collaborative effort by researchers at ARC, OSU and the University of Arizona. The goal was to use a dataset obtained from a previous study to "empirically validate a new canopy radiative-transfer model (SART) which incorporates a recently-developed leaf-level model (LEAFMOD)". The project was a sub-component of a larger NASA-funded project "Investigation of Canopy Biochemistry and Light Interception With a Coupled Leaf- and Canopy-Level Radiative Transfer Model: Application to Douglas-fir and Maple Seedling Datasets". Lee Johnson of NASA/ARC and Barry Ganapol of the University of Arizona were co-principal investigators for the larger project.

The specific tasks for NCC2-5222, as outlined in the Cooperative Agreement (signed 6/20/97) were:

Oregon State University: render maple seedling datasets, contribute to formulation and prioritization of research questions, and participate in development of joint publications

NASA/ARC: Derive specific biochemical absorptivities, develop and render Douglas-fir seedling dataset, develop and implement the coupled model, and work on model sensitivity analyses and verification.

These tasks were all completed in a timely manner. Dr. Bond met on two occasions at the ARC campus with the other collaborators to formulate questions and develop ideas. The maple and Douglas-fir datasets were employed successfully in testing the new model developed by Dr. Ganapol. In addition, Dr. Bond developed and shared a new dataset relating leaf thickness and specific leaf area of *Acer macrophyllum* -- this information was not included in the pre-existing dataset but was required by the new model.

The results of the collaborative effort are summarized in a paper by Barry D. Ganapol, Lee F. Johnson, Christine A. Hlavka, David L. Peterson and Barbara Bond, "LCM2: A Coupled Leaf/Canopy Radiative Transfer Model". The paper has been accepted for publication by *Remote Sensing of Environment*. Following is an abstract of this paper:

> Two radiative transfer models have been coupled to generate vegetation canopy reflectance as a function of leaf chemistry, leaf morphology (as represented by leaf scattering properties), leaf thickness, soil reflectance, and canopy architecture. A model of radiative transfer within a leaf, called LEAFMOD, treats the radiative transfer equation for a slab of optically uniform leaf material, providing an estimate of leaf hemispherical reflectance and transmittance as well as the radiance exiting the leaf surfaces. The canopy model then simulates radiative transfer within a mixture of leaves, with each having uniform optical properties as determined by LEAFMOD, assuming a bi-Lambertian leaf scattering phase function. The utility of the model, called LCM2 (Leaf/Canopy version 2), is demonstrated through predictions of radiometric measurements of canopy reflectance and sensitivity to leaf chlorophyll and moisture content.

With the acceptance of this paper for publication, the goal and tasks for this project have been met successfully.

FINAL REPORT OF INVENTIONS AND SUBCONTRACTS

There were no inventions or subcontracts associated with this project

FINAL PROPERTY INVENTORY

No equipment (i.e. items costing over $5,000) were purchased or furnished by the government as part of this project