Progress Statement for the 2008 FHM Evaluation Monitoring and Analysis Funds
Request for continued funding of multi-year project for FY 2009.

TITLE: Interactions among gypsy moth, wildfire, forest health management, and climate change

LOCATION: New Jersey.

DURATION: 2 years FUNDING SOURCE: Fire EM: $48,000/yr, $96,000 total

PROJECT LEADER: John Hom, USDA Forest Service, Northern Global Change Program, Northern Research Station, 610-557-4097, jhom@fs.fed.us

COOPERATORS: Steve Van Tuyl and Kenneth Clark, USDA Forest Service, Northern Global Change Program, NRS; Rob Scheller, Conservation Biology Institute, Corvallis, OR

FHP SPONSOR/CONTACT: Jim Steinman, USFS Northern Area, 11 Campus Blvd., Newtown Square, PA  19073, 610-557-4158, jsteinman@fs.fed.us

PROJECT OBJECTIVES: The proposed study will address the following three questions: 1) how do current day interactions between gypsy moth defoliation and wildfire management in the New Jersey Pine Barrens (NJPB) affect ecosystem health? 2) Will these interactions be enhanced under climate change scenarios? 3) Are there alternative management strategies that could mitigate these interactions as the climate changes?

PROGRESS REPORT:

We have made progress on this project including the data acquisition, model parameterization and calibration, and on model development. We are on schedule and anticipate that we can complete the project in the two year time frame as originally proposed. Below are specific points of progress we have made over the last eight months since we were awarded the project (March 2008).

Data Acquisition

In June of 2008, we initiated a field campaign to help us understand the short and long-term effects of gypsy moth defoliation on health, mortality, and nutrient dynamics in NJPB forests. The field mortality survey and canopy foliar analysis were not part of the original proposal but added to this study to understand the process of forest decline with insect defoliation. We collected data on approximately 85 field plots that had been defoliated 1, 2, or 3 consecutive years and supplemented this data pool with data from approximately 75 plots collected in prior years at our research sites. Data collected on these plots includes tree mortality, crown dieback, and a set of measurements required to estimate carbon pools in these forest stands. We collected canopy foliage samples on a subset of these plots at the beginning of the defoliation season (June) and another sampling after a second flush of leaves emerged (during August-September) in order to determine changes in carbon and nitrogen concentrations with defoliation. The results of this field campaign will be used in the development of the insect defoliation extension of the LANDIS-II model (see below) as well as to act as a stand-alone product from this project.

Measurements from associated projects at our research sites in the NJPB have continued through 2008, including continuous carbon flux measurements, soil sampling, and biometric
estimates of carbon pools and fluxes – one of our indicators of forest health. These data sets add to the already large database of information that will be useful for understanding the effects of gypsy moth and fire disturbances on forest health. One of our research sites experienced severe defoliation in the summer of 2007. This disturbance event caused the site to take up substantially less carbon over previous, undisturbed years and may have a long term effect. These results suggest that defoliation events can have significant impacts on carbon sequestration – impacts that will be incorporated in to the final model framework.

We have compiled the necessary data sources that are used for parameterizing and calibrating the LANDIS-II model and evaluating model outputs. These databases include an extensive fire history database developed at Rutgers University using NJ Forest Fire Service records, and existing gypsy moth defoliation surveys from the USDA FS FHM program and the NJ Department of Environmental Protection. We have obtained the general circulation model data used in climate change scenarios by the Intergovernmental Panel on Climate Change (IPCC) for simulating climate change effects on forest health.

Model Parameterization, Calibration, and Development

The modeling component of this project using LANDIS-II makes use, primarily, of three model extensions or modules: the Dynamic Fire System (DFS) extension, the Biomass Succession extension, and an insect defoliation extension. Parameterization of the DFS and a version of the Biomass Succession extension are complete, having made use of new and existing data sources for the study area. Currently, calibration of the DFS extension is underway in order to ensure realistic simulations of fire growth and fire effects on tree communities and nutrient dynamics.

We have made substantial progress modifying current versions of the Biomass Succession and insect defoliation extensions for our simulations. Extension development is being coordinated so as to meet the objectives of our research.

Two extensions that modify the current biomass succession extension to better represent above and belowground carbon and nutrient dynamics are under consideration for our project. For both, soil and succession extensions dynamics have been refined and tested. Revisions include necessary changes to accommodate a new cohort library (below) and further refinements to their conceptual models and the necessary coding. A significant new function was added that allows direct defoliation and the movement of litter mass from the canopy to the forest floor. This defoliation function is required for the simulation of insect damage (with fractional loss of carbon due to insect respiration) as well as fire damage to *Pinus rigida* (pitch pine) which causes loss of foliage that is subsequently regained via epicormic resprouting.

In addition, we have reconfigured the insect extension to be more tightly integrated with the succession extensions. Insects can now modify the canopy via two mechanisms: reduction of growth (net primary productivity) and direct defoliation, as described above. Variable timing of outbreaks was also added to the insect extension.

A new cohort library was generated that separates aboveground wood and leaf biomass. The new library has allowed more precise estimates of leaf biomass and has enable both soils extensions to balance total N within 1% during simulations of 2000 years of succession.

Interim Product:
A poster and abstract was presented at the Annual Meeting of the Ecological Society of America which included the carbon dynamics of large scale gypsy moth defoliation at the Silas Little Experimental Forest flux tower site.


Projected Schedule for Remainder of Project Year 1

In October 13-15, 2008, all investigators and cooperators on the project will meet at the Silas Little Experimental Forest to coordinate model development and data sharing with special focus on development and data requirements of the insect defoliation extension. Development of the insect defoliation and biomass succession extensions will continue through the end of project year 1. We anticipate that we will complete calibration of the dynamic fire system extension for LANDIS-II and implement simulations of climate change effects on fire regimes and carbon cycling in the NJPB by approximately the end of the first year of the project.

Projected Schedule for Project Year 2

The second year of the project will be focused on incorporating insect defoliation and the new biomass succession extensions into the modeling framework. We anticipate that by the end of the second year simulations of both defoliation and fire effects on forest health (i.e. mortality) and nutrient dynamics under control and climate change scenarios will be completed as originally proposed. Results of the project will be submitted to peer reviewed scientific journals and presented to interested parties with the state of New Jersey, US Forest Service, the annual FHM meeting, and at scientific venues.

JUSTIFICATION OF FUNDING

2008 funding was used for 25% time of salary for Van Tuyl, and a contract for salary and travel for Scheller for model development. Overhead for NRS is 15% for total costs. The study was impacted by the Fire Borrowing, in which the net result was a loss of $8K of FY2008 EM funds. Despite the unanticipated loss of funds, we enhanced the study with the field survey for mortality and foliar nutrient analysis to get at process level understanding of defoliation and forest decline. Steve Van Tuyl has changed his duty station to the USDA NRCS Appleton, WI Regional Office on August 3, 2008. He will continue as a FS NRS term employee to work on this project.

REQUEST FOR CONTINUED FUNDING

2009 funding. As per the original EM proposal, we are requesting $48,000 for FY2009. These funds will also be used for 25% of salary for Van Tuyl, and a contract for salary and travel for Scheller. Overhead for NRS is 15% for total costs. We will continue to cost share the program management, and the carbon, soil and nutrient analysis. The original proposal document and detailed budget is attached as a separate document from this progress report.