

## **USDA Forest Service International Programs**

### **USAID Report October 2003**

#### **Brazil Program Overview**

The Brazil Program consists of several components that are independently managed but closely coordinated to provide the greatest possible payoff to Brazilian and United States forest managers and forest users. The Sustainable Forest Management Project provides baseline biological and socioeconomic information underlying the development of advanced forest management strategies, providing assistance with institution building and analysis for silviculture, environmental conservation, and ecotourism. It is closely linked with Ministry of the Environment's National Forest Program, Brazilian Natural Resource Agency's Directory of Forests, Brazilian Space Agency (INPE) and the Large-Scale Atmosphere/Biosphere project. Silvicultural development has concentrated on the multiple advantages of low-impact harvesting. The Forest Management Project has been focused on the Tapajós National Forest, but also includes development and training at Cauaxi in conjunction with the Fundacao Floresta Tropical.

The Fire and Environmental Change Project is a coordinated series of research and development activities addressing questions of biomass burning, global change, and fire-danger rating in Brazilian ecosystems. The project contributes remote sensing for fire detection and mapping, and compiles inventories of fire activity and air pollution through cooperation by the Pacific Southwest Research Station and NASA with IBAMA and other Brazilian institutions. A fire-hazard rating system, used to anticipate flammability and fire effects in tropical ecosystems, is being developed by the Pacific Northwest Research Station in collaboration with the Brazilian Space Institute and others.

This progress report, covering the six-month period of March 2003 through October 2003, is one in a series of outputs describing the mission, scope, activities, and accomplishments of the USDA Forest Service/USAID Program in Brazil. Additional information can be obtained from the Latin America Program Coordinator or the Forest Service's International Programs website at: [www.fs.fed.us/global/globe/l\\_amer/brazil/welcome.htm](http://www.fs.fed.us/global/globe/l_amer/brazil/welcome.htm)

#### **Fire and Environmental Change in Tropical Ecosystems Program Highlights**

- In June 2003, a report synthesizing the thirteen years of collaboration between the USDA Forest Service and the Brazilian Government was completed. The report presents the policy, technical and collaborative results from thirteen years of collaboration on fire science and management.
- The Fire and Environmental Change Program of the USDA Forest Service, Pacific Northwest Research Station and Pacific Southwest Research Station, continued a successful and active cooperative program with Brazilian counterparts. Collaborative projects continue with the Brazilian Agency for the Environment (IBAMA), University of Brasilia, INPE's combustion laboratory, the University of the State of Sao Paulo, and the University of Washington.
- A fire-measuring instrument called the FireMapper 2.0 is currently undergoing testing; its delivery to IBAMA in early 2004 will greatly increase Brazil's capability to enforce regulation of

wildland and agricultural burning and will expand their tools for monitoring selective harvesting and deforestation.

- Fire and Environmental Change in Tropical Ecosystems Project “trained the trainers” on the use of the aerial camera system previously provided to IBAMA and strengthened IBAMA's capacity as shown by their recent successful application for a grant to validate fire detection data from the NASA MODIS satellite-based imager.
- Plans continue for the new photo series volume to estimate fuels in the Cerrado. In addition, planning continues for flammability and vegetation change trials funded by NASA-LBA and IPAM in an area that transitions from Cerrado to primary and secondary forests.
- Data analysis from experimental burns from 1997 to 2001 is being completed to consolidate the results in reports and publications. Data from observations on an operational fire at the Fazenda Ouro Verde, Alta Floresta, state of Mato Grosso. Several papers have been accepted for publication in international journals. Posters and papers were presented at the Third International Wildland Fire Conference in Sydney, Australia, and prepared for presentation at conferences upcoming in Brazil and Orlando, Florida.
- A proposal for full instrumentation for analysis of combustion gases was approved by FAPESP. It is being implemented at INPE's combustion laboratory with a field campaign on smoke analysis in flaming and smoldering combustion scheduled for 2003, 2004 and 2005. Laboratory tests will provide improved combustion rates and better smoke emission factors from Amazon forest burning. It will also enhance the capacity to assess carbon fluxes and paths during burning in the Amazon forest.
- A proposal to estimate residual charcoal production was prepared and submitted for funding to FAPESP. FERA and INPE will add sampling protocols for residual charcoal to the biomass consumption studies in 2003 to 2005. This work will provide for the first time estimates on the biomass that is converted to charcoal, which may represent one to several percent of the pre-burn biomass loading or two to thirty percent of estimated biomass consumption. A Mechanical Engineering graduate student from UNESP will work on this topic with support from the FERA team.
- A UNESP student, associated to the FERA project, defended her dissertation. Her work on flaming and smoldering combustion of tropical biomass will provide the scientific basis for improving estimates of smoke emissions from Amazonian fires. Her doctoral work has been partially supported financially and intellectually by FERA.
- An agreement was established between INPE and the Universidade Estadual de Mato Grosso, Campus Alta Floresta, for cooperation in the September 2003 field campaign. The field-work will be used for internships of forestry students and graduate work of the faculty. The 2003 field campaign included the participation of the local IBAMA firefighters.

### **Fire and Environmental Change in Tropical Ecosystems Program Activities**

The working group is providing technical assistance to the Government of Brazil on issues of fire and environmental change through a multi-year cooperation with the Brazilian Federal Institute of the Environment and Renewable Natural Resources, IBAMA. Activities during the second half of fiscal year 2003 involved

- Continuation of a project to develop and transfer to IBAMA technology for airborne fire remote sensing and monitoring; and

- Continued simulations for IBAMA with a regional-scale spectral climate model, which has been customized for fire management with Internet-accessible forecasts for South America.

### **Transfer of remote-sensing technology**

The Forest Service Pacific Southwest Research Station has worked with IBAMA since 1992 in the development of remote-sensing technology and its application to monitoring of wildland and agricultural burning and natural resources. This has included eight aircraft campaigns employing Brazilian or U.S. aircraft, the last of which deployed a new thermal-imaging radiometer, the FireMapper, for the first time over wildland fires. Beginning in 2002, this project has contributed to the development of a FireMapper 2.0 thermal-imaging system that will supplement ForestMapper digital aerial cameras transferred previously to IBAMA. FireMapper is an advanced remote-sensing instrument designed specifically for fire measurements and monitoring.

During this reporting period, project partners have completed the assembly of both mechanical and electronic components for the prototype FireMapper 2.0, written software for instrument control and in-flight calibration, and calibrated the instrument with a high-temperature target. The instrument is providing high-quality thermal imagery and will be entered into flight-testing prior to delivery to IBAMA during early 2004. Upon delivery to IBAMA, the FireMapper 2.0 will provide unique capability in Brazil for airborne monitoring of wildland and agricultural fires and enforcement of Brazilian law and policies for burning. A short course was also prepared for IBAMA on use and maintenance of the ForestMapper system, and two trainers were trained (two males, with diplomas).

### **Fire Assessment**

The cooperation has been helping IBAMA to assess the extent and impact of widespread burning in central Brazil, especially through a series of aircraft remote sensing campaigns, smoke measurement, and mapping from Landsat data of historic burned areas. During this reporting period, final editing was done on a landmark publication, "Remote measurement of wildfire energy and carbon flux", that was previously accepted for publication by the scientific journal, Ecological Applications. Planning was begun for a joint mission to monitor fires with the FireMapper 2.0 in the State of Roraima during early 2004, and past experience with the Cooperation's airborne campaigns contributed to the success by IBAMA in obtaining scientific support from NASA for validation of fire detection data from the Moderate Resolution Imaging Spectrometer (MODIS). Synthesis of project results from the prescribed fire experiments at the IBGE ecological reserve was furthered by work under a cooperative agreement between PSW and the Universidade de Brasília.

### **Fire and Environmental Change Program Activities**

The Fire and Environmental Research Applications Team (FERA) of the Pacific Northwest Research Station, USDA Forest Service, continued an active and successful cooperative program with Brazilian counterparts. Collaborative projects continue with IBAMA, University of Brasilia (UnB), the Brazilian Space Agency (INPE) combustion laboratory, the University of the State of Sao Paulo (UNESP), and the University of Washington. It has recently expanded to include the Universidade Estadual de Mato Grosso, and more extensive support of local IBAMA and firefighters is part of the program success. In 2003, FERA began to integrate the fire projects in South America. Bolivians, Brazilians and FERA members participated in the Amazon forest fires.

### **Photo Series to Assess Flammability in the Cerrado**

In order to address wildfire issues, the USDA Forest Service has been working with several partners in Brazil for the past ten years on the Fire and Environmental Change in Tropical

Ecosystems program. Specifically, the US-Brazil team has focused on developing a component of this large-scale research—the Stereo Photo Series for Quantifying Cerrado Fuels in Central Brazil. A tool for assessing biomass loading and flammability in the Cerrado, or the Brazilian Savanna, the photo series can also be used as a quick and cheap way to evaluate different fuel and vegetation conditions.

One of FERA's objectives in Brazil is to support the development of technical and science capacity of Brazilian institutions engage in wildfire research. Support, financially and intellectually, of graduate students at the University of Brasilia has been a main component of the Fire Program. FERA's program has been successful in this regard. During these years, several master students have worked in the program and graduated. In 2003, a student from UnB was awarded a doctoral degree in ecology from the University of Brasilia. She conducted her doctor doctoral dissertation work on fire ecology in association with the work that the FERA team conducts in the Brazilian Cerrado. Her novel approach on fire effects in the Cerrado ecosystems provides very valuable information to understand the role of fires in the dynamics of the Cerrado and better manage these ecosystems.

The publication of the Cerrado Photo Series Vol. 1 has been a success story of the FERA fire program. Fire managers, land managers, scientists, libraries, even a city zoo have requested copies of it. Distribution in Brazil continues being done by the University of Brasilia. Copies have been requested from Europe, South Africa, Europe, China, Australia, and the United States, among others. Plans continue for the new photo series volume. Potential sites for additional photo series have been identified and prioritized.

### **Combustion and Carbon Emissions from Tropical Biomass**

FERA continues a successful collaboration between IBAMA, INPE's combustion laboratory, the University of the State of Sao Paulo (UNESP), and the University of Washington, in Alta Floresta, Mato Grosso, Brazil. Four new INPE, UNICAMP, and UNESP scientists and new UNESP graduate student have joined the group to study gas emissions, combustion characteristics, immediate effects of fire on water quality, release of mercury from tropical biomass burning, and effects on human health. A faculty and student group from the Biology and Forestry Departments at University of the State of Mato Grosso joined the group to support the field campaign in Alta Floresta. The project has been expanded by INPE and UNESP to include a smoke emissions and chemistry component in 2004 and 2005. The team received requests from Brazilian graduate students to conduct their doctoral studies working with the research group in Alta Floresta.

FERA continued to support development of technical and science capacity of Brazilian institutions to study wildfires and biomass burning in the Brazilian Amazon forest. FERA team members believe that this component of the cooperation has the potential to be one of the most important outputs of the fire program. Some of the graduate students move on to managerial, teaching, or scientific positions where they will have the largest and long-lasting effect in Brazil. To date, three master and two doctoral students have completed their degrees from the work in the Amazon forest, some others are still working on their programs. FERA intends to continue intellectual support of graduate students, in addition participating in the training of fire and land managers. During this reporting period, a graduate student was awarded a doctoral degree in combustion engineering from UNESP. She conducted her doctoral dissertation research in association with the work sponsored by FERA in the Amazon forest and in INPE's combustion laboratory. Her work from laboratory testing and field burning in Alta Floresta is a significant contribution the understanding of smoldering combustion of tropical biomass. It will be a keystone to improve substantially the smoke emission estimates from biomass burning.

Data analysis from experimental burns between 1997 and 2003 is being completed to consolidate the results in reports and publications. Data for 2002 includes observations on an operational fire at the Fazenda Ouro Verde, Alta Floresta, State of Mato Grosso. Several papers have been accepted for publication in international journals. Posters and papers were presented at the Third

International Wildland Fire Conference in Sydney, Australia, and prepared for presentation at conferences upcoming in Brazil and Orlando, Florida. In addition to presentation of data in several forums, a technology transfer package will be prepared in the near future to fulfill with the obligations imposed by CNPq to international scientific cooperation.

One experimental biomass burning was conducted in 2003 to investigate consumption and emissions in flaming and smoldering combustion and residual charcoal production. The plot was located at the Fazenda Ouro Verde, near Alta Floresta. A proposal to estimate residual charcoal production was approved by FAPESP for the 2003 fire test. This research conducted in field burning is unique in the international fire science community. FERA and INPE began testing sampling protocols for residual charcoal to the biomass consumption studies in 2003 and will continue in 2004 and 2005. This work will provide, for the first time, estimates on the biomass that is converted to charcoal, which may represent a significant amount of the pre-burn biomass loading. The charcoal produced in the biomass burning will basically remain inert; it will not be released to the atmosphere and will not decompose. A mechanical engineering graduate student from UNESP is working on this topic with support from the FERA team. Charcoal produced from the biomass burning varied from 70 kg/ha to 4.7 Mg/ha.

Forest flammability was monitored in the understory of a primary forest near the Fazenda Ouro Verde. The fire was evaluated in two accidental fires that escaped from pasture fires. Understory fires were monitored for two days. These two fires burning for several days and burned a significant number of hectares. Plots have been established to monitor tree mortality from the understory fires. A significant result of this data collection effort is that will allow assessment of the characteristics of the fires that happen during the driest time of the year, when burning is still restricted by IBAMA but accidental fires remain a real threat to the primary forest. The observations from these two fires are also a validation of previous experimental results from burning a one-year-old slash in 1999. Observations during the 2003 field campaign revealed that some of the accidental fires involved areas that had been cleared the year before, 2002. The slash from those areas had not burned adequately because they were ignited during the rainy season when IBAMA authorized the fires in the state of Mato Grosso. The biomass reduction from these fires is likely to reach approximately 60%, as was measured from the 1999 experiments. However, a more complete biomass burn may have, on one hand, a more desirable result by opening growing space for agriculture or range vegetation. On the other hand, more smoke is released from these fires and the effect on soil and the environment have not being assessed and may have a negative impact that may last longer than burning fresh slash.

In 2003, FERA began to integrate the international cooperative projects in Brazil and Bolivia. The purpose is to exchange expertise that has been developed during these years of international collaboration by FERA personnel and collaborators in those two countries. During the field campaign in Alta Floresta, Mato Grosso, a researcher from IBIF/BOLFOR, Bolivia, participated in the experimental fires. He learned the techniques and methodologies used by the FERA and collaborators in the Amazon forest. He will implement them in the prescribed fire research that he is conducting in October in Santa Cruz, Bolivia. One of FERA collaborators from Brazil will assist him in the fieldwork and instrumentation during the fire experiments in Bolivia. Plans are under way to formalize exchange and collaboration between Bolivians and Brazilians to the fire experiments in the Brazilian Amazon and the Bolivian Chiquitania forest.

A proposal for full instrumentation to analyze combustion gases was approved by FAPESP. It is being implemented at INPE's combustion laboratory with a field campaign on smoke analysis in flaming and smoldering combustion scheduled for 2003, 2004, and 2005. Laboratory tests will provide improved measurements of combustion rates and better smoke emission factors for Amazon forest burning. It will also enhance the capacity to assess carbon fluxes and paths during burning in the Amazon forest. Negotiations are underway to conduct a large field campaign in smoke emissions in 2004 and 2005. The work will include an air campaign in collaboration with scientists from the University of Montana, University of Sao Paulo, the USFS Missoula Fire

Laboratory, and others. Personnel from local IBAMA, local bombeiros, PROARCO will be invited to participate.

An agreement was established between INPE/UNESP and the State University of Mato Grosso, Campus Alta Floresta, for cooperation in the September 2003 field campaign. The fieldwork is being used for internships of forestry students and graduate work of the faculty. Training of forestry students and faculty from the UNEMAT Campus Alta Floresta, is conducted in the experimental burns on topics such as forest inventory, timber harvesting, use of GPS, dendrology, effects of deforestation, and wildfires. Training of these undergraduate students occurs as part of research operations. The 2003 field campaign also included the participation of the local IBAMA and bombeiros. A compromise that the research team established with the local university and authorities is to present a seminar by the scientists who participate in the research in Alta Floresta. Accordingly, a seminar on forest fires, biomass burning and fire management was conducted in Alta Floresta, Mato Grosso on September 8. INPE, UNESP, UW and IBIF/BOLFOR personnel delivered eight presentations. Attendees included university faculty and students, NGOs, bombeiros, IBAMA, local authorities and general public. Over 60 people from the local community attended the seminar.

### **Sustainable Forest Management Program Highlights**

- In October 2003, two researchers from IMAZON were invited by the CITES Secretariat to present the background technical document on sustainable management of Mahogany to the, and to participate in working meetings as technical advisors representing the CITES Secretariat. The broad objective of this meeting was to develop actions on the implementation of Appendix II.
- The Mahogany Project continued to support reduced-impact logging began during 2002 in Acre, with silvicultural treatments for establishing mahogany regeneration. This year's activities were concentrated in 500 hectares of primary forest. Lessons learned this year have assisted this year's activities at larger scales.
- Research on mahogany life history continued in southeast Pará at three field sites where studies have been conducted since 1995-1996. This year's activities included a recensus of diameter increment growth by over 500 trees >10 cm diameter, assessment of fruiting effort by all reproductively mature trees, and assessment of survivorship and growth by natural regeneration and seedlings in experimental out plantings between 1996-1998.
- An analysis of the effects of logging on coarse woody debris production under both conventional and reduced impact management in the FLONA Tapajos and the Fazenda Cauaxi areas was completed and submitted to *Global Change Biology* as part of an LBA special issue.
- Researchers analyzed the long-term sustainability of logging using 2 different models and data that they gathered from the FLONA Tapajos and Cauaxi. The results of these models indicate that under Reduced Impact Logging management with an expanded list of commercial species in the future, logging could be sustained for about 200 years at about 30 m<sup>3</sup> ha<sup>-1</sup> on 30 year rotations. This work has been accepted for publication in a book *Working Forests in the Tropics* to be published by Columbia University press.

## **Sustainable Forest Management Activities**

### **Big-leaf mahogany in the Brazilian Amazon: its life history and management in natural and artificial systems**

The Mahogany Project in Brazil now has research and management objectives in two geographical regions within Amazonia: southeast Pará, where studies of mahogany's growth and regeneration ecology have been on-going since 1995, and the western Amazonian state of Acre, where both basic and applied research were initiated in October 2001. In Acre, management recommendations derived from field research in Pará for mahogany's sustained-yield production from natural forests are being tested as part of a pilot management project implemented within a private land-holding of approximately 8000 hectares located near Sena Madureira.

Field activities since April 2003 at three southeast Pará sites focused on recensusing diameter increment and fruit production by nearly 500 adult and sub-adult trees monitored annually since 1996. As well, natural and artificial regeneration at the study's principal research site, Marajoara, was recensused for survivorship and growth.

At the Acre site, inventory and preparation for the 2003 logging season continued until early July. Twenty high-value timber species were logged from approximately 375 hectares at the Sena Madureira management site. After tree selection and accounting for permanent preservation areas along a seasonal streambanks and on especially steep slopes, an estimated 8 m<sup>3</sup>/ha were extracted. Mahogany was not logged within this area due to unresolved legal status at the end of September. New federal legislation indicating management practices for mahogany was issued in late August, requiring adjustments in the current management plan for the area. Field verification by the Brazilian environmental regulatory agency, Ibama, is pending.

Meanwhile monitoring of mahogany enrichment plantings in logging gaps in 2002 continued at the Acre site. As well, silvi cultural studies continued of three other high-value species (cerejeira – *Torresia acreana*, cumaru ferro – *Dipteryx ferrea*, and bálsamo – *Myroxylon balsamum*), focusing on seedling regeneration and reproductive ecology.

Through its affiliation with the Instituto do Homem e Meio Ambiente da Amazônia (Imazon), the Mahogany Project's contributions to Mahogany Working Group meetings convened by the Ministry of the Environment (MMA) during spring 2003 culminated in a final report which formed the basis for new legislation defining management practices for mahogany in the Brazilian Amazon. In September, Imazon contributed a technical background document on sustainable management of mahogany to the 2nd CITES Mahogany Working Group, which met in Belém from October 6 – 8 with Imazon's participation.

### **Effects of Timber Harvesting on the FLONA Tapajos**

*Overall Project Description* - This project has 2 goals: (1) To evaluate the effect of selective timber harvest at the Tapajos National Forest on a wide range of ecosystem functions, and (2) To evaluate the economic efficiency and effects on harvest system sustainability for alternative methods of land management. Research activities can be grouped into 6 themes. Divisions among these themes are somewhat arbitrary and function primarily to illustrate the range of activities that the USFS and IBAMA will pursue as part of the Tapajos Project. Harvest is ongoing at the FLONA Tapajos. In 1999 only 100 ha were harvested, in 2000 nearly 1000 ha were harvested, in 2001 and 2002 approximately 600 ha were harvested in each year. An additional 900 ha is planned for timber harvest from July through December 2003. With current progress, the entire concession of 3200 ha will be logged by the end of the calendar year 2003.

*Harvesting Systems* - Researchers from Brazilian and U.S. universities recently harvested (Quadra 2, Block 1) and adjoining undisturbed control area in 2000. They took samples to measure the effects of harvesting on soil properties. This area was previously surveyed in 1996 in preparation for this study. Several students from Auburn University and FCAP participated. Data analysis continues.

During January 2003, a Brazilian student recently enrolled in the Natural Resources MS program of the University of New Hampshire and U.S. researcher continued measurements of logging residues (coarse woody debris) generated by the harvest activity in four 100 ha logged blocks and two control areas. They made re-measurements to quantify ongoing branch-fall and tree mortality following logging. Logged blocks are compared to controls.

An analysis of the effects of logging on coarse woody debris production under both conventional and reduced impact management in the FLONA Tapajos and the Fazenda Cauaxi areas was completed and submitted to *Global Change Biology* as part of an LBA special issue. That paper led by the principle researcher has been accepted for publication. In addition researchers analyzed the long-term sustainability of logging using 2 different models and data that they gathered from the FLONA Tapajos and Cauaxi. The results of these models indicate that under Reduced Impact Logging management with an expanded list of commercial species in the future, logging could be sustained for about 200 years at about  $30 \text{ m}^3 \text{ ha}^{-1}$  on 30 year rotations. This work has been accepted for publication in a book *Working Forests in the Tropics* to be published by Columbia University press.

*Biophysics* - Eddy covariance studies of carbon dioxide and water vapor flux are continuing at the tower sites. Logging took place around the tower at km 83 from August 2001 through January 2002. A control site is has been operational at km 67 since April 2001. Researchers from the University of California, Irvine and University of Sao Paulo have acquired nearly years of continuous data at the logged site. Other researchers from Harvard University have acquired more than 2 year's worth of data at the control site at km 67. The data is publicly available (<http://beija-flor.ornl.gov/lba/>). Automated chambers and time domain reflectometry probes have been operated to measure soil respiration and soil moisture at the control site since April 2001. Based on work prior to the harvest, researchers have produced 3 papers for the LBA special issue of *Ecological Applications* to be published this year. The results of this analysis are under review for publication by *Science*.

*Biogeochemistry* – Researchers continue to monitor nutrient and trace gas effects of harvesting. A second survey was completed on sandy-clay soil. Preliminary indications are that timber harvesting increases nitrous oxide and methane emissions measurably. However, when these emissions are extrapolated to a wider area, the effects of harvesting on trace gases (expressed as a Global Warming Potential) are far smaller than the effects from the carbon loss. These results will be presented in a paper led by the primary investigator.

*Remote Sensing of Logging* – Methods are being developed to detect logging and to estimate canopy damage using remote sensing analysis. Work to date has focused on readily available Landsat multispectral imagery. Analysis of Landsat images compared detailed field observations at the Fazenda Cauaxi shows that simple band comparisons and textural analysis are insufficient for estimation of logging damage although textural analysis may be useful for location of logging activity. More recent work by the same team shows that a linear mixing model of Landsat bands can be used to estimate canopy damage. This paper in press in *Ecological Applications* opens new possibilities for logging detection and analysis using readily available satellite data. Conversion of the algorithms developed by this research team into applications usable by government agencies, business enterprises, and non-governmental organizations would represent a major new practical tool for monitoring of logging in tropical forests. A practical tool could be developed with a limited amount of new funding needed to support a programmer as well as professionals who could help translate the research approach into a practical product.

To further this work, researchers are analyzing data from the Hyperion spectrometer on the NASA EO-1 satellite. Preliminary results indicate that hyperspectral remote sensing will present an even more powerful means to measure damage caused by selective logging.

## In Press

Asner, G.P., Keller, M. Pereira Jr., R., Zweede, J.C. and Silva, J.N. In Press. Canopy Damage and Recovery Following Selective Logging in an Amazon Forest: Integrating Field and Satellite Studies. *Ecological Applications*

Keller, M., M. Palace, G.P. Asner, R. Pereira Jr., and J.N.M. da Silva. Coarse Woody Debris in Undisturbed and Logged Forests in the Eastern Brazilian Amazon *Global Change Biology*

Keller, M., G. P. Asner, J.M.N. Silva, and M. Palace. Sustainability of Selective Logging of Upland Forests in the Brazilian Amazon: Carbon Budgets and Remote Sensing as Tools for Evaluation of Logging Effects. in Eds: D.J. Zarin, J. Alavalapati, F.E. Putz, M. Schmink *Working Forests in the American Tropics: Conservation Through Sustainable Management?* Publisher, Colombia University Press. New York.

Grogan, J., M.S. Ashton, J. Galvão. 2003. Big-leaf mahogany (*Swietenia macrophylla*) seedling survival and growth across a topographic gradient in southeast Pará, Brazil. *Forest Ecology and Management*.

Grogan, J., J. Galvão, L. Simões, A. Veríssimo. 2003. Regeneration of big-leaf mahogany in closed and logged forests of southeastern Pará, Brazil. In: A. Lugo, J.C. Figueroa Colón, M. Alayón (Eds.), *Big-Leaf Mahogany: Genetics, Ecology, and Management*. Springer-Verlag: New York, NY, USA, pp. 193-208.

Grogan, J. 2002. Some simple management guidelines could help the sustainable management of bigleaf mahogany in the neotropics. *Tropical Forest Update*, ITTO Newsletter 12(4): 22-23.

## Success Stories

1. In June 2003, a report synthesizing the thirteen years of collaboration between the USDA Forest Service and the Brazilian Government was completed. An independent consultant was contracted to conduct interviews of Brazilian and US partners involved in the Fire and Environmental Change Program. The report presents the fire context in Brazil; the policy issues that the program has tried to answer; the program approach; and main program results. The report will be displayed on USDA Forest Service – International Program's website and distributed to partners.
2. The Fire and Environmental Change Program of the USDA Forest Service, Pacific Northwest Research Station and Pacific Southwest Research Station, continued a successful and active cooperative program with Brazilian counterparts. Collaborative projects continue with the Brazilian Agency for the Environment (IBAMA), University of Brasilia, INPE's combustion laboratory, the University of the State of Sao Paulo, and the University of Washington.

Through the collaboration and partnership a Stereo Photo Series for quantifying cerrado fuels in central Brazil was published. These are a series of photographs with accompanying vegetation data designed to help users appraise fuel and vegetation conditions. The first photo series workshops aimed at training protected area managers and firefighters have been a success. Demand for the workshops and the photo series publication has increased from several agencies and NGOs. The agenda for the workshops include (1) a description of the photo series, (2) an introduction to fire behavior and fire effects in the cerrado with several fire behavior and fire effects exercises, (3) classroom exercises on how to use the photo series, and (4) field exercises for the students to practice using the photo series.

Plans continue for the new photo series volume. In addition, planning continues for flammability and vegetation change trials funded by NASA-LBA and IPAM in an area, which transitions from cerrado to primary and secondary forests.

3. The Mahogany Project in Brazil now has research and management objectives in two geographical regions within Amazonia: southeast Pará, where studies of mahogany's growth and regeneration ecology have been on-going since 1995, and the western Amazonian state of Acre, where both basic and applied research were initiated in October 2001.

Through its affiliation with the Instituto do Homem e Meio Ambiente da Amazônia (Imazon), the Mahogany Project is making a direct contribution to forest policy in the Brazilian Amazon through various public fora and publications. Imazon researchers have contributed to Mahogany Working Group meetings convened by the Ministry of the Environment (MMA) during February and March to resolve issues associated with the current moratorium on mahogany's harvest, transport, and commercialization within Brazil. Researchers affiliated with the Mahogany project have contributed to the natural forest management Sub-Working Group.

In October 2003, two researchers from IMAZON and affiliated with the Mahogany working group were invited by the CITES Secretariat to present the background technical document on sustainable management of Mahogany as well as participate in working meetings as technical advisors representing the CITES Secretariat. The broad objective of this meeting was to develop actions on the implementation of Appendix II.

### Staffing

#### USDA FOREST SERVICE, PACIFIC SOUTHWEST RESEARCH STATION(PSW)

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Dr. James Grogan

Other Collaborators

Jason Neff - provides expertise to describe behavior of organic matter at the FLONA Tapajo  
Alan Townsend and Greg Asner (University of Colorado) and Mercedes Bustamente (University of Brasilia) provide expertise in the analysis of satellite imagery and soil and vegetation samples from the vicinity of the FLONA Tapajos.