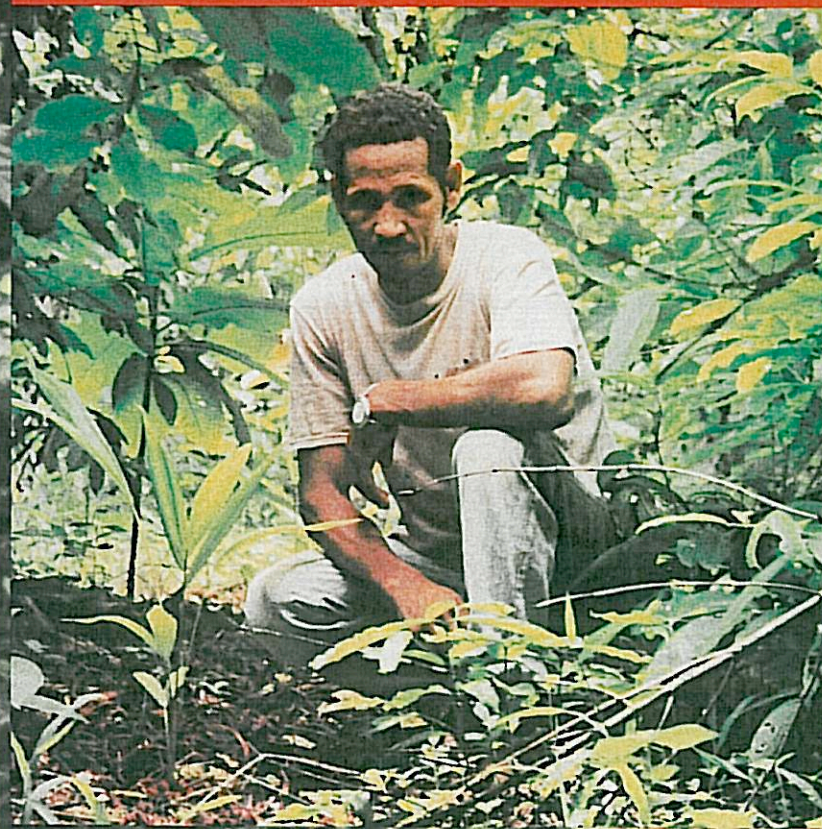


# PLANTING SEEDS OF CHANGE IN THE ASHES OF THE RAINFOREST

.....  
The Rondonia Agroforestry Pilot Project



Virginia Polytechnic Institute and State University  
College of Architecture and Urban Studies







**"The health of the planet depends upon the survival of tropical forests, the crucible of life on earth, which means we all depend upon the people who live in the rainforest."**

— **John O. Browder, Ph.D.**, Project Director, Rondonia Agroforestry Pilot Project, is a specialist in international development policy and environmental design and planning at Virginia Tech.

*H*umans are an integral part of Nature. We have inhabited and modified "natural" ecosystems for thousands of years in a dynamic co-evolutionary relationship of cultural adaptation and environmental change. In Amazonia small colonist farmers are blamed for much of the destruction of tropical forests. Yet, among a growing vanguard of colonists, a new "land ethic," a respect for the rainforest is emerging. This ethic is reflected by a growing number of colonist farmers who wish to plant trees with ground crops, an ancient indigenous practice they are reinventing called agroforestry.

This booklet describes an international effort — the Rondonia Agroforestry Pilot Project — to promote sustainable rainforest development.





## PLANTING SEEDS OF CHANGE IN THE ASHES OF THE RAINFOREST

### The Rondonia Agroforestry Pilot Project

WE ALL DEPEND UPON THE SURVIVAL OF TROPICAL FORESTS. These majestic woodlands of the tropics supply essential pharmaceutical compounds used in one-quarter of all prescription drugs, sequester atmospheric greenhouse gases, moderate global atmospheric temperatures and precipitation regimes, supply most of the world's demand for diverse hardwoods, and provide habitat to as many as one-half of the world's species. Rainforest destruction everywhere in the tropics is a growing international concern but nowhere is the devastation greater than in the Brazilian Amazon, where between 20 and 30 percent of total global tropical forest loss occurs each year. And nowhere in the Amazon is deforestation occurring more quickly than in the colonization projects of the western Brazilian state of Rondonia, described by ecologist Norman Myers as "one of the world's five worst deforestation hotspots."

How to conserve the Amazon's tropical forests, while meeting the pressing economic needs of its mainly poor colonist population, is indisputably among the most complex and critical challenges of our time. While so much public attention has recently focused on the forces of tropical forest destruction, this booklet describes a project that is making progress in conserving and rebuilding rainforests. The Rondonia Agroforestry Pilot Project (RAPP) is dedicated to three goals: curbing tropical deforestation, rebuilding degraded forest environments, and developing alternative sources of income for poor farmers. The project encourages farmers who practice commercial shifting cultivation to rehabilitate degraded pastures and croplands into new "natural" environments: commercial agroforests.

We thank the Teresa and H. John Heinz Charitable Trust for its generous grant that initiated the Rondonia Agroforestry Pilot Project in 1992.

## The People of Rondonia

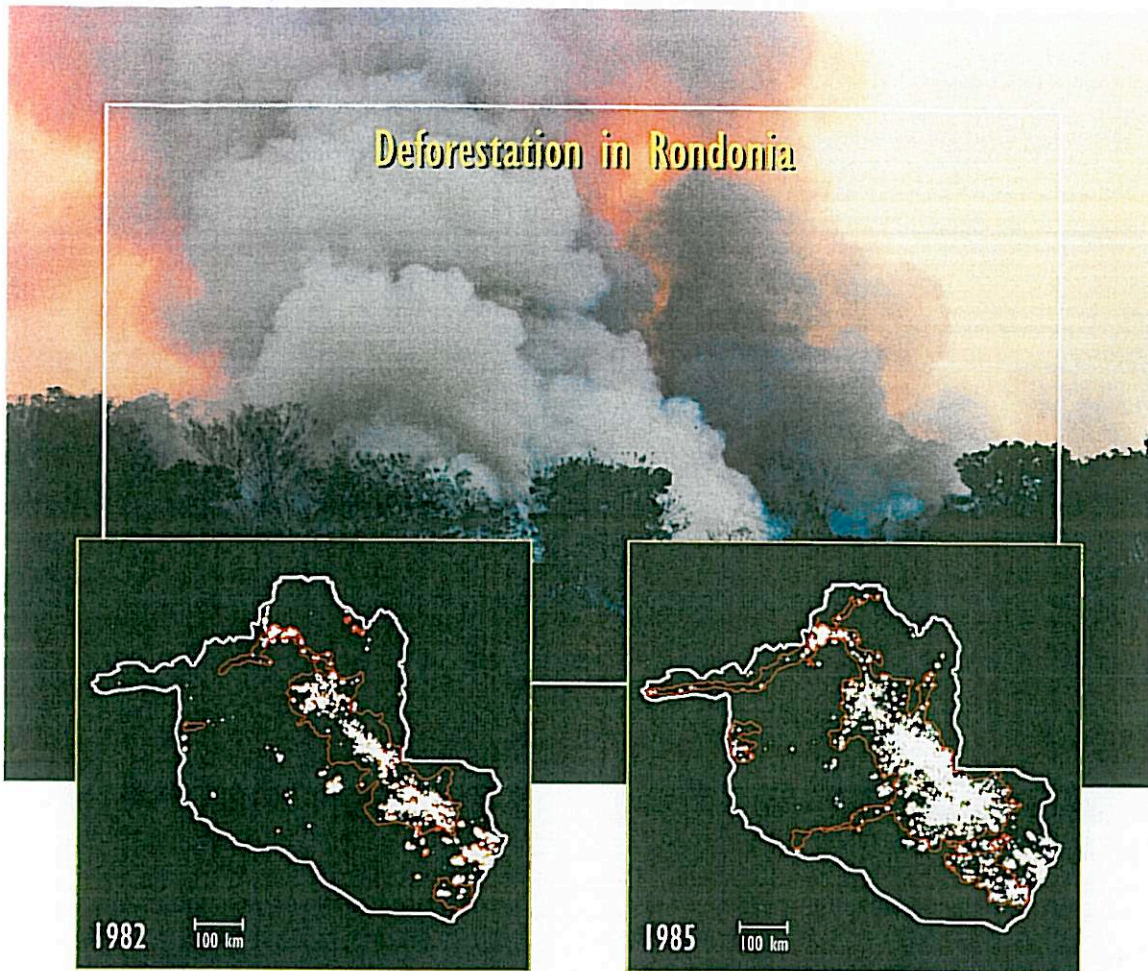
The contemporary people of Rondonia are colonists, the products of a larger historical project in Brazilian national development. Anxious to become a world economic power, Brazil's military regime in the mid-1960s promoted a Green Revolution strategy based largely on citrus and soybean production for export. The resulting transformation of Brazil's agricultural heartland succeeded in elevating Brazil's share of world markets for frozen orange juice and soybeans, but it also displaced millions of rural workers and land owners whose traditional mixed farming systems stood in the way of agricultural modernization. Wary of unleashing a tidal wave of impoverished rural migrants into the already choking slums of metropolitan São Paulo and Rio de Janeiro, the Brazilian national government chose instead to open up and give away the tropical forestlands of Rondonia to agrarian resettlement. Initial government efforts to regulate the rapid settlement of Rondonia into 6 planned colonization areas were overwhelmed from the start, as thousands of landless farm workers poured into the territory at a rate that topped 2,000 families per month. From 1971 to 1985, the population of Rondonia grew at a breathtaking rate of 16 percent per year, from 111,000 to 1,028,500, in what the *Washington Post* called the "greatest land rush since the settling of the American West" (July 24, 1988).

In 1981, the World Bank funded the Northwest Region Development Program (POLONOROESTE) to "help bring order to the large, spontaneous migratory flow to Rondonia and [to promote] sustainable farming systems based mainly on tree crops" (World Bank 1987). Despite noble intentions, the World Bank temporarily suspended loan disbursements for the program in response to growing public concerns about its adverse impacts on tropical forests and indigenous peoples. Satellite images support estimates that more than one-fifth of Rondonia's natural forests were cleared and burned by colonists between 1970 and 1995.

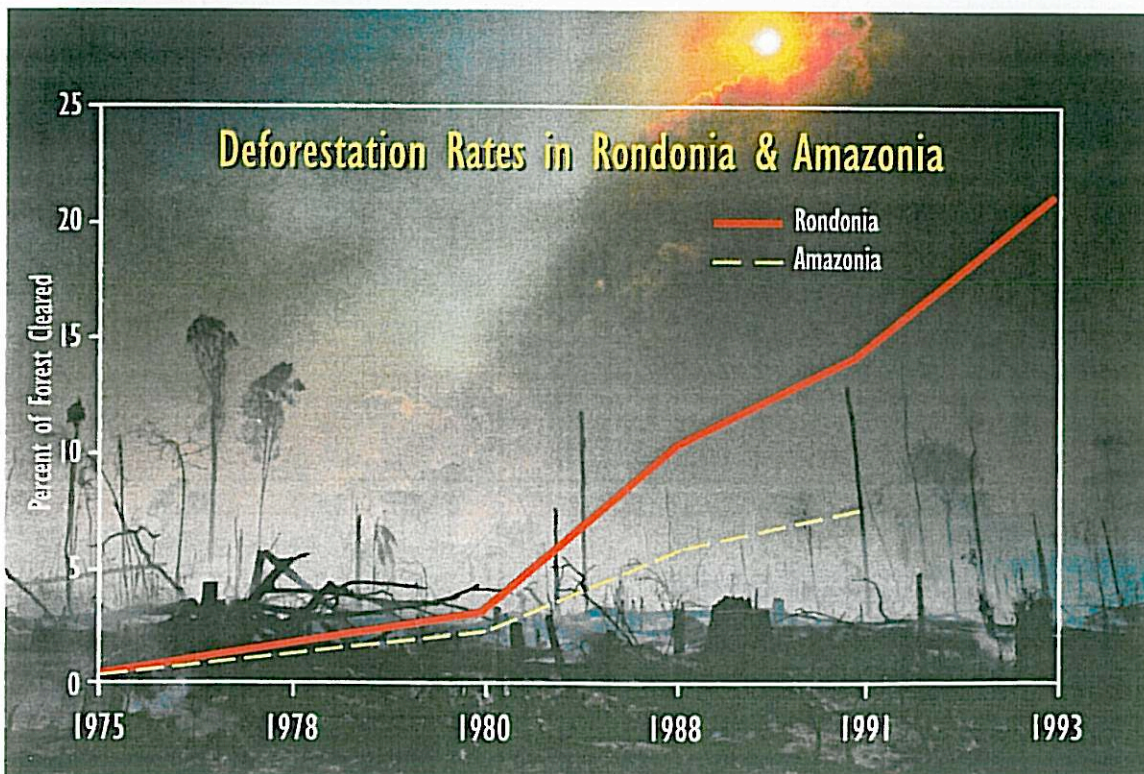
Although often vilified as slash and burn destroyers of the rain forest, many of the original colonists now, twenty years later, have developed a surprisingly sensitive appreciation of tropical forests and a desire to find ecologically sound land use practices enabling them to earn a livelihood and conserve the forests they own. Our 1992 survey of 240 farmers found that more than one-half wished to integrate tree planting into their farming systems if impediments to their doing so were eliminated. Among the impediments revealed were: (1) lack of knowledge of useful tree species; (2) lack of knowledge about how to manage tropical forests and maintain agroforest plots; (3) concerns about the effects of tree planting on other household activities and household member workloads; and (4) lack of knowledge about markets for tree crops.

The Rondonia Agroforestry Pilot Project is a long-term initiative to work with colonist farmers to overcome these obstacles to sustainable tropical forest land development in Rondonia. We must recognize that Rondonia's new "forest people" can no longer be treated as a homogeneous population, considered the enemies of tropical forest conservation; many are indeed eager allies in this cause.





Satellite image composite of active fires in Rondonia, 1982 and 1985, indicate rapid increase in deforestation.



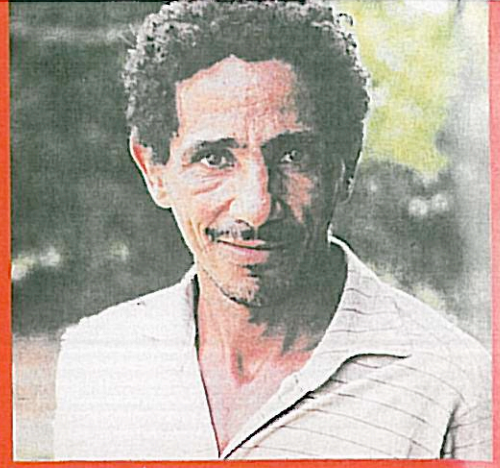




**“The forest is something incredible. When it is very hot, I go inside the forest and it is very refreshing. If I had alternatives, I wouldn’t clear forest anymore. My intention is to keep areas in forest.”**

— Sebastião Maximiliano, Alto Paraiso, Rondonia, 1994

Turning his failing monoculture into a small, more diverse agroforest: Sebastião squats next to young pupunha palm planted inside his mature coffee grove.



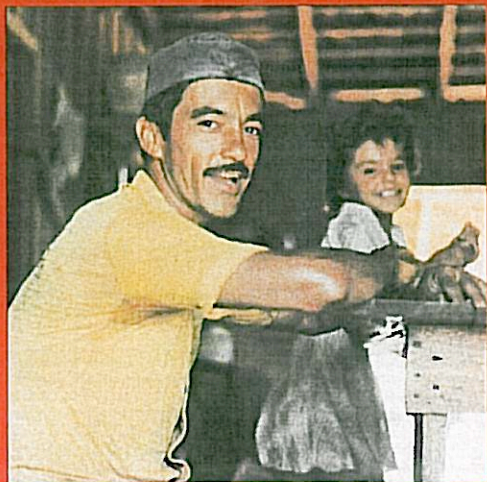
**“I feel better in the deepness of the forest. There, I can listen to the animals. When we clear the land, the area becomes warmer.”**

— Francisco Maximiliano, Alto Paraiso, Rondonia, 1994

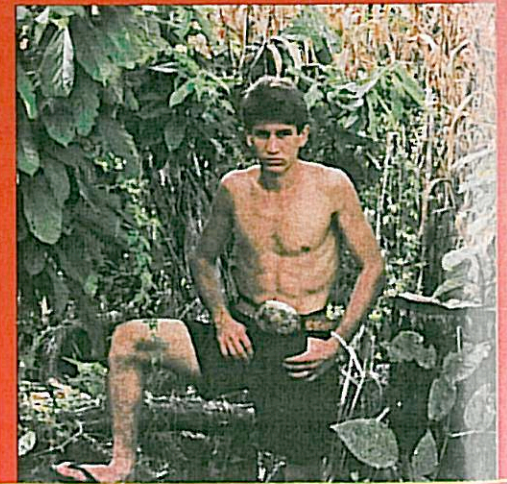
Diversifying the family’s coffee grove with four agroforest species posed new challenges for Francisco. Cutting back the coffee to forge new growth allowed excessive sunlight to damage the introduced shade-loving agroforest species. Francisco recognized the problem and adjusted his coffee grove management strategy to accommodate the new species.

***“The forest is a source of hope.”***

Antonio Abilio, a rural workers union leader and Catholic activist, planted the most complex agroforest plot in the Rondonia Agroforest Pilot Project containing 460 individual plants of 18 species. An experimentalist at heart, Antonio sees the planting of trees and the reconstruction of tropical forests as part of a broader social movement in Brazil that will free rural workers in Amazonia from economic and political exploitation.



Wilson Pereira’s oldest son, José Braz, shown here standing next to a two-year old cupuaçu bush, manages the one-hectare agroforestry plot containing five timber species in addition to cupuaçu and pupunha palms. From his weekly walks through the plot to pull weeds and clear strangling vines, José literally knows the location and physical condition of each of the 460 plants constituting the Pereira agroforest plot.







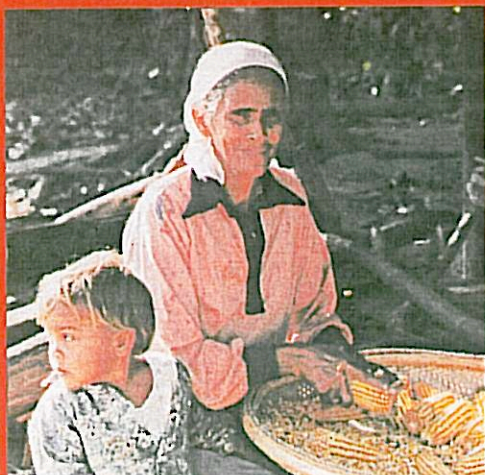
**“We always will need trees. We cannot clear the land if we cannot take care of it. It is always good to have forest.”**

— *Maria Lurdes Schiffler, Alto Paraiso, 1994*

Maria Lurdes Schiffler (left) raised her three sons and daughter as a divorced single mother in Rondonia's frontier. All of her children still live with her on the family farm in Alto Paraiso tending their coffee and agroforest plot, considered one of the most successful in the Rondonia Agroforestry Pilot Project.

— **Wilson Jose Pereira, colonist**

While working to put food on the table, female colonists in Rondonia, such as Maria Alarindo da Silva, share a growing awareness of the natural forest's bounty. Several colonists in the Rondonia Agroforestry Pilot Project can identify up to 200 non-timber natural forest products including diverse remedies for snakebites, skin rashes, malaria, and a myriad of other disorders.

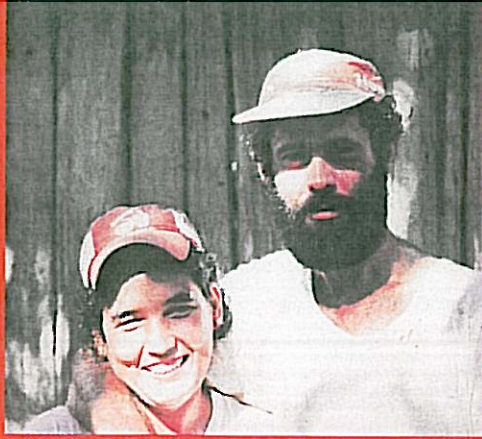


## Women, Agroforestry and Forest Conservation

Rondonia is largely a “women’s frontier.” Women and children labor in two workplaces: the home and the orchard. Agroforest plots are considered by many households to be orchard extensions. One of the important research activities of the Rondonia Agroforestry Project is to determine the impacts of the introduction of agroforestry on women’s and children’s workloads. A careful examination of household labor allocation by gender and age revealed that while men, women, and children often participate in planting the agroforest seedlings, subsequent agroforest plot maintenance typically falls upon hired workers and male youths.

Another interesting research finding concerns the role that women play in male attitudinal changes toward natural forest conservation. Women typically gather fruits and nuts from orchards, enjoy the shade and fresh water streams from forest patches, and frequently express distress about the dangers that male household members confront in cutting down forests. Not surprisingly, many of the women in the RAPP are critical of their husband’s forest clearing activities. Many of the adult males in our project explicitly credit their female spouses with helping them overcome either their initial fear of the forest or their view of it as a worthless obstacle to farm development. The Rondonia Agroforestry Pilot Project is uniquely poised to pursue these important gender issues of tropical forest conservation as an integral part of its second 3-year phase.





## THE STORIES OF

**“We should have started planting trees a long time ago. If we had planted trees in the beginning, we would have money from that right now!”**

— João Feijer, with Marli Feijer, Ouro Preto do Oeste, Rondonia, 1994.

### João and Marli Feijer



João Feijer next to two-year old mahogany tree in front of palm.

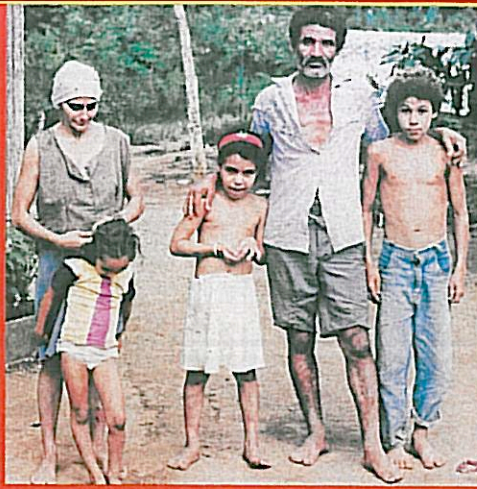
João and Marli Feijer were among the first wave of settlers to Rondonia in the early 1970s, economic refugees of Brazil's agricultural modernization. Like the other colonist farmers in the Rondonia Agroforestry Pilot Project, João's and Marli's families suffered repeatedly from malaria and excruciating poverty during their first years in the frontier. Both families worked temporarily as sharecroppers before staking claims to their own farms in Rondonia. After starting his own family, João began planting annual crops to ensure household subsistence, admitting that his view of the forest (initially seen as an obstacle) had changed because of Marli's interest in non-timber forest products, especially Brazil nuts.

In 1993, the Feijer family joined the RAPP. Reclaiming an abandoned, weed-infested manioc field, João and Marli, working side-by-side, planted their experimental agroforest plot with 500 seedlings of 10 different commercial species supplied by the project. These included pupunha and açai palms, cupuaçu, and five valuable hardwoods (teak, andiroba, freijó, Brazilian cherry, and mahogany), which in only 18 months had grown to 4-6 meters tall and 12-15 centimeters in diameter.

Today Marli is active in a women's self-help group created by the Catholic Church and she is director of the rural workers labor union in her area, promoting agroforestry strategies among other mostly male farmers. João believes that the future of his farm depends on the success of his agroforestry plot. Acknowledging that they may never see the income from the harvest of the tropical hardwoods they planted in 1993 in their agroforest plot, the Feijers realize that their children's future is more secure with the tree-planting strategy promoted by the Rondonia Agroforestry Pilot Project.



## TWO FAMILIES



“Here in Rondonia, the forest contains many resources. A person doesn’t need to cut forest. Instead, one can use the forest resources in order to survive.”

— Clodoaldo Carvalho, with Inês Carvalho and three of their children, Alto Paraiso, Rondonia, 1995.

### Clodoaldo and Inês Carvalho



Beehives in wood boxes used to produce honey enhance the productivity of young secondary forests where several project agroforests are planted.

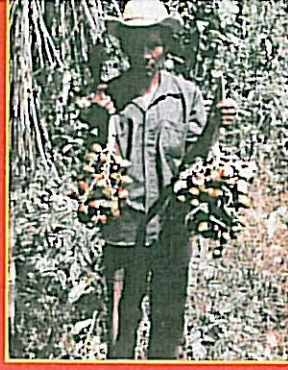
Clodoaldo and Inês Carvalho migrated to Alto Paraiso, Rondonia in 1976 when the living conditions on the frontier were very harsh. Without roads, the Carvalhos regularly walked up to 30 kilometers to buy supplies and sell their produce in the nearest town. Much of their rice and bean harvests were lost in the first 2 years due to inadequate marketing. Dysentery, snake bites, and malaria took their toll as well, and the Carvalhos were nearly forced to sell their farm to pay medical expenses in their second year.

Clodoaldo and Inês joined the RAPP in 1994, and together planted 300 seedlings of cupuaçu, pupunha palm, mahogany, and araçá-boi fruits supplied by the project in a degraded coffee field. In addition, with RAPP assistance the Carvalhos expanded their beekeeping activities and, by 1994, sold 150 kilograms of honey, earning an additional \$1,200, and nearly doubling their net income for the year.

Today, Clodoaldo and Inês support a household of nine family members. Through the local coffee producers association (Associação dos Cafeicultores de Alto Paraiso), Clodoaldo has become an outspoken local advocate for agroforestry development, urging his association to promote the cooperative marketing of cupuaçu and pupunha. Like other farmers participating in the Rondonia Agroforestry Pilot Project, the Carvalhos would rather plant trees than destroy forests to survive.

These profiles show that some of Rondonia’s colonists are able to manage their land in ways that are adaptive, ecologically sensitive, and economically profitable.





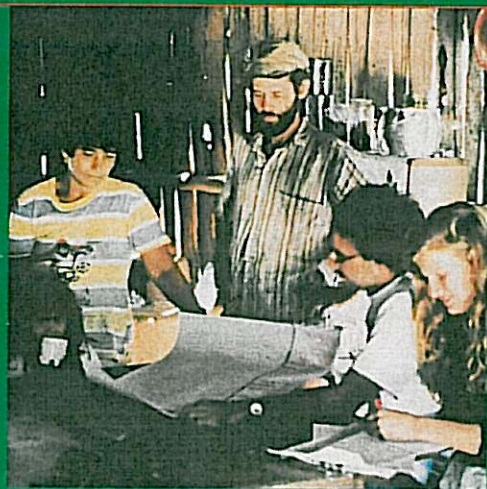
## The Rondonia Agroforestry Pilot Project

Phase I: 1993 - 1996

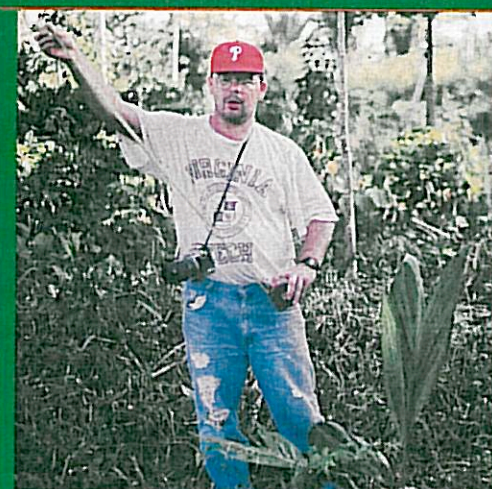
The Rondonia Agroforestry Pilot Project is a development, demonstration, and a research project rolled into one. The RAPP seeks to integrate income generation with tropical forest conservation among the rural poor by achieving the following three objectives:

1. To demonstrate that small-scale farmers who successfully establish agroforest plots will earn higher incomes than other farmers
2. To demonstrate that farmers who do earn higher incomes from planting trees and managing agroforests on degraded fields will clear less primary forest than other farmers
3. To provide useful information on agroforestry development to policy makers, corporate investors, and planners of other forest conservation projects in the tropics.

Based on the findings of our 1992 farm survey, 50 farmers in Nova União and Alto Paraiso municipios were invited to participate in the Rondonia Agroforestry Pilot Project. Another 190 farms surveyed serve as a "control group" by which to identify and evaluate project impacts. Recognizing the importance of local farmer's organizations – e.g. cooperatives, rural workers unions, etc. – in enabling participatory development, most of the farmers invited to be project participants are active members of such local non-



A RAPP research team (seated) interviews a Rondonian family participating in the project's gender study.



Assistant Project Director Marcos Pedlowski prepares to measure pupunha palm tree.





**Pupunha palm seedlings grown at RAPP nursery.**

governmental organizations. Participating farmers selected the seedlings that they planted from a diverse menu of species that attempts to balance economically valuable tree crops with ecologically restorative species. Tree crops with strong local consumer markets currently supplied by distant producers outside Rondonia were emphasized on the menu. The agroforestry pilot plots are located on degraded crop fields (not in areas of undisturbed forest). Each plot contains between 3 and 18 species and represents an agroforest system that typically involves three income generating components:

1. Short-term (1 + years): Bee-keeping for honey and wax, inter-cropping of temporary food and cash crops with young fruit and timber tree species
2. Mid-term (4 - 10 years): Commercial fruit, palm, nut trees, and shrub species that improve soil quality, block wind, and provide shade and other ecologically useful functions
3. Long-term (10 + years): Industrial softwoods and long-growing commercial hardwoods, like mahogany, Brazilian cedar, cherry, teak, among others.

Seedlings were produced on a project-funded nursery located inside Rondonia and supplied to participating farmers free of charge, thereby overcoming the key financial barrier to innovation that most of Rondonia's farmers face. In return, farmers invested their own labor to plant and maintain the seedlings in accordance with a mutually agreed to plot design and maintenance plans.

To enable project evaluation, five baseline and on-going research activities involving participating households were completed:

1. Soil chemistry analysis of each agroforest plot prior to planting
2. Detailed gender study of household division of labor on each farm
3. Land-use analysis of each farm using ground surveys and satellite images
4. Socio-economic survey of each farm household
5. Semi-annual and annual plot maintenance visits to measure seedling growth and resolve plot management problems

RAPP research activities are closely linked to both answering practical questions in the field and addressing broader policy concerns about the direction of private investment and development assistance. The process of natural forest regeneration can be harnessed by agroforest farmers to produce additional income. While replanting ecologically compatible cash species, agroforest farmers restore degraded lands and produce economic benefits for themselves and future generations.

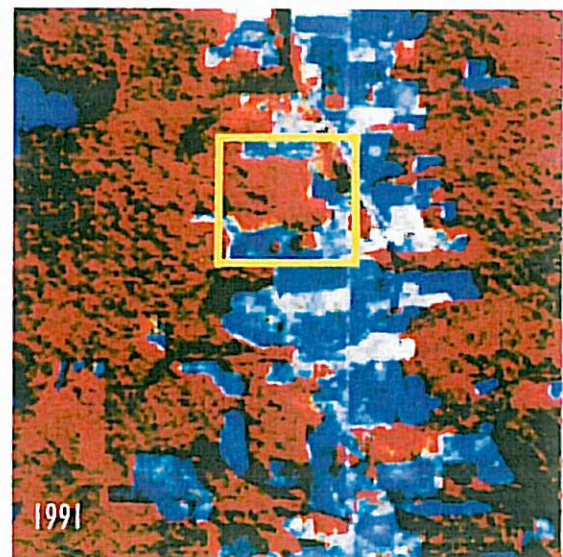
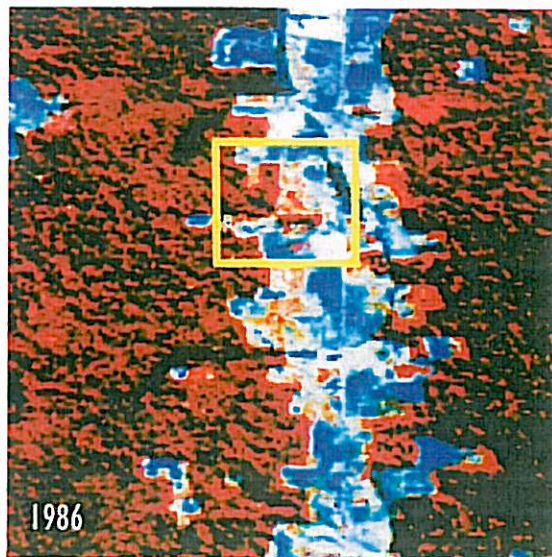




## Initial Project Results

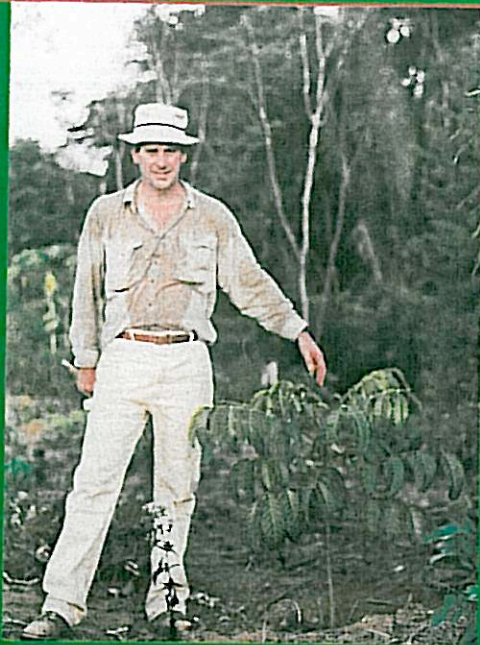
Preliminary results from Phase I of the Rondonia Agroforestry Pilot Project have been very encouraging. More than 80 percent of the original 50 farmers who joined the Project were still maintaining their agroforest plots after three years, a significant achievement by international development standards. Several have increased the area of their plots using their own financial resources. Seedling survival rates, although widely ranging, generally were high by experimental on-farm standards (70 percent and higher for most of the key species). Hardwood seedling growth rates, while varied overall, were stunning on many farms; stem diameters tripled in the first 12 months.

While we are encouraged by the initial results, the success of the RAPP is not a foregone conclusion. And while over 27,000 trees were planted on 50 farms between 1993 and 1995, critical new work remains to be done in the project's second phase to insure that the project achieves its goals.

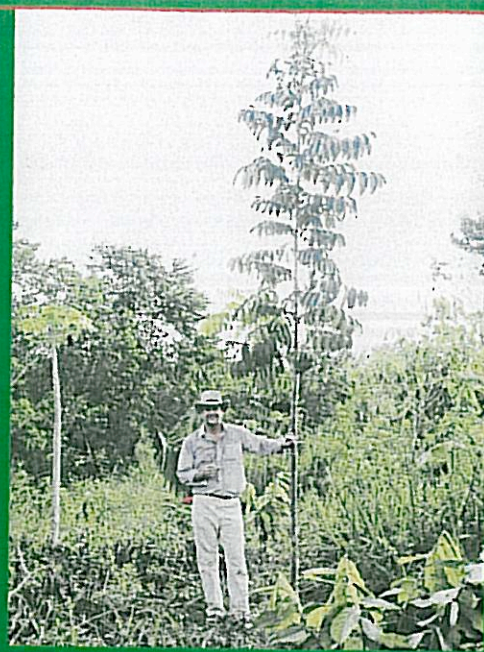


SPOT satellite images of natural tropical forest regeneration over a five-year period enable detailed landscape analysis of individual RAPP farms. The deforested area within the yellow-line square in 1986 becomes visually indistinguishable from undisturbed forest area surrounding it by 1991, illustrating the regenerative powers that farmers can manipulate on some degraded clearings. Agroforest plot growth rapidly provides important vegetation cover as illustrated in the two photos on the opposite page.

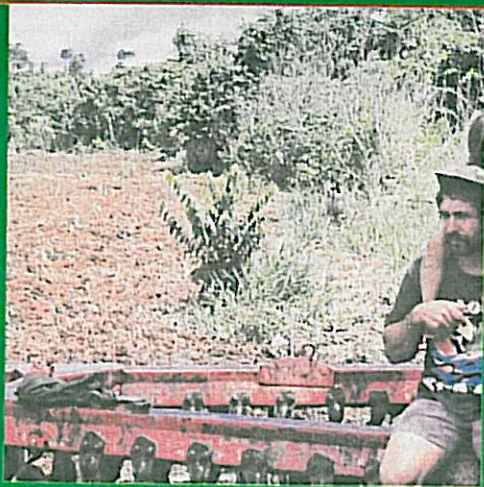
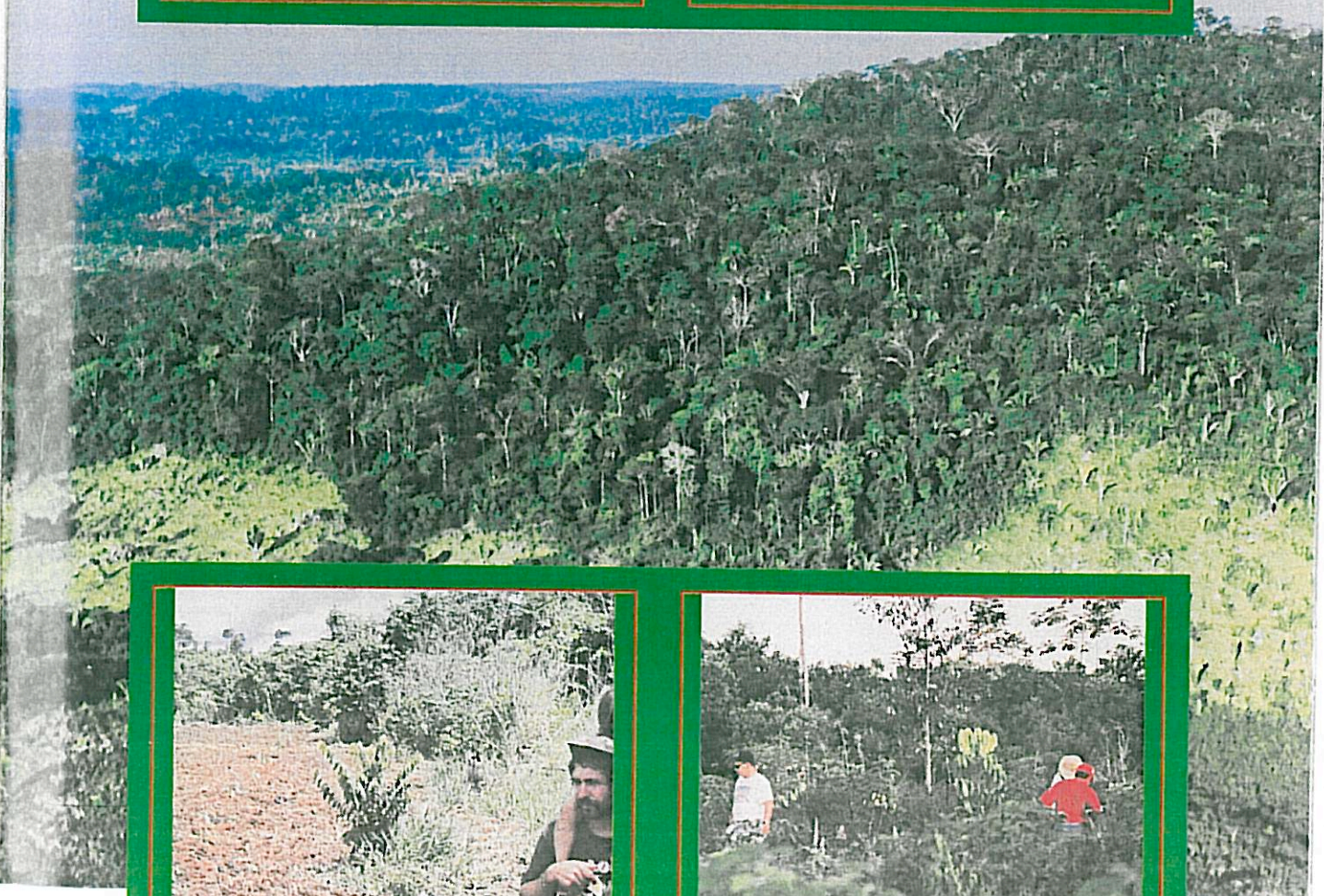




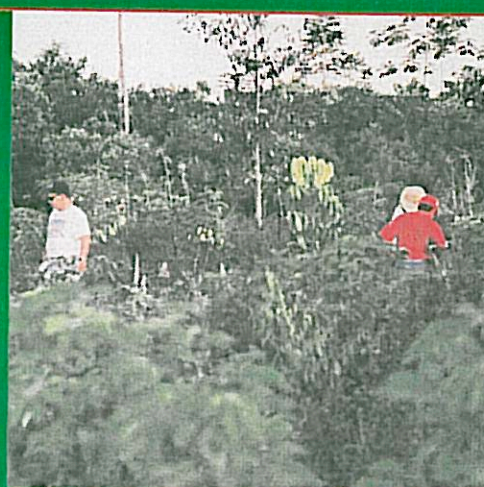
Project Director John Browder next to 6-month old mahogany seedling on Schiffler farm in 1993.



John Browder next to the same mahogany seedling, now 18-months old, on Schiffler farm in 1994.



Barren tractor-graded agroforestry plot site on farm of Tarcisio Fazoli at time of planting.



Same agroforestry plot 18 months later. Ground is completely covered with cultivated species.





## The Rondonia Agroforestry Pilot Project

### Phase II: 1996 - 1999

The second phase of the project entails three new components. First, there are immediate marketing questions. As young trees begin to bear fruit (and already some 5 year-old citrus, cupuaçu, and palms are beginning to produce), efforts to commercialize the project's outputs will be launched. While project goals seek, as the first priority, local markets, we recognize the eventual need to expand into regional, national, and possibly international markets. This will require additional market research.

Second, there are ecological questions to be answered over the long-term that will affect recommended planting guidelines. During the first 2-3 years most plant/plant and plant/soil interactions are insignificant and imperceptible. In the second 3-year phase the project will closely monitor these emergent interaction effects to ascertain the compatibility of different species combinations within specific soil classes. This will enable project scientists to offer clear guidelines for future agroforestry development projects.

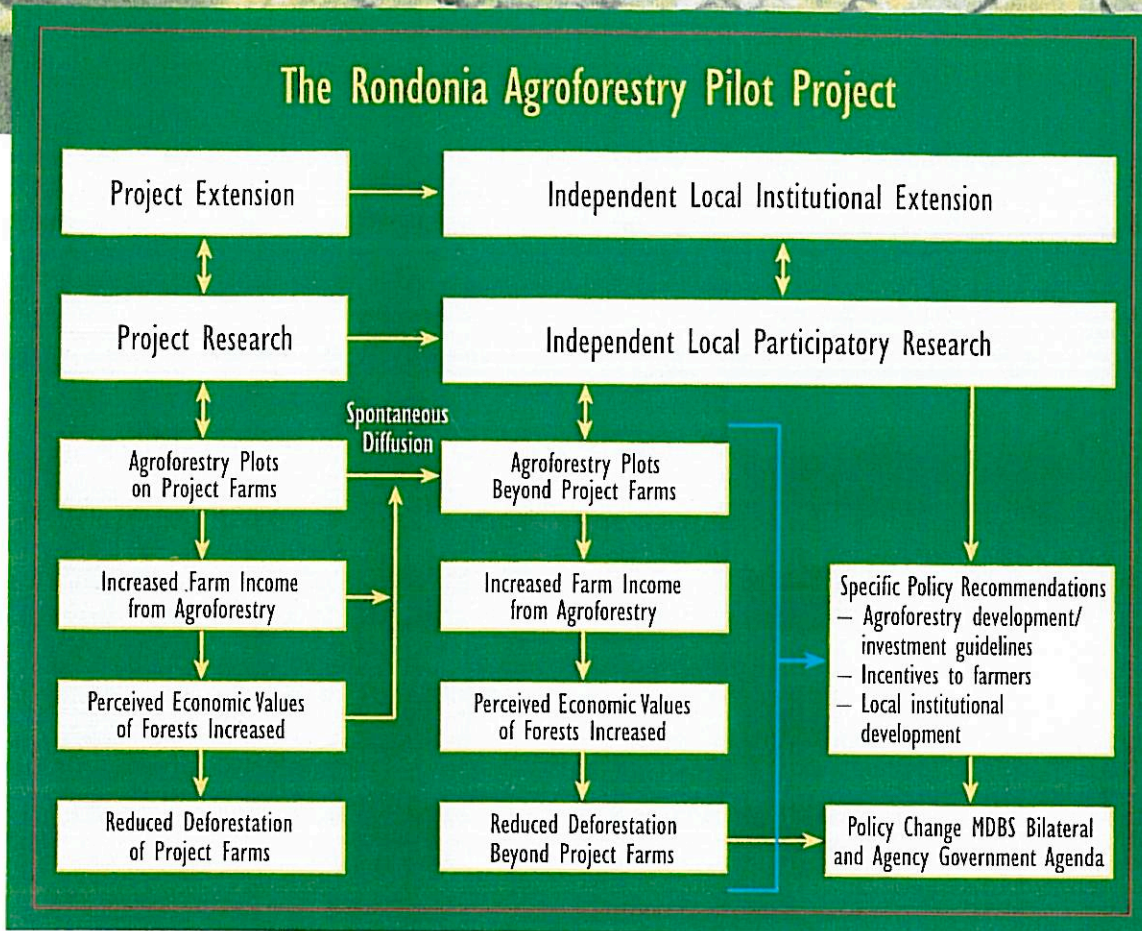
Third, critical sociological issues remain. Over time, household demographics change. Teenagers, a vital source of unremunerated family labor in the first years of the project, grow up and typically leave "empty nests" behind in Rondonia, as they do everywhere. We need to know how changing household demographics affect agroforestry plot maintenance (and land use practices generally) among Rondonia's aging colonist population over time. Another question is how the agroforestry plot, once it reaches a productive stage (and requires additional labor for crop harvesting), affects the workloads of men and women and children differently. The introduction of a new labor-intensive (or labor saving) activity could have important implications for farm income, household diet, and public health. Although building upon existing and ongoing project monitoring and data gathering activities, these sociological issues are of central concern to the project's second phase.

For policy-makers the key question is how the RAPP contributes to existing knowledge to make practical innovations in rainforest-saving technologies. Simple panaceas do not exist. Saving tropical forests requires working closely with diverse forest people who engage in numerous land uses and economic activities. RAPP is helping many colonists learn sustainable ways of making a living by replanting the rainforest with ecologically beneficial income-generating trees.

The Rondonia Agroforestry Pilot Project hopes to demonstrate that simple, small-scale agroforestry practices will increase farmer income beginning in the short-term, and increasing in the mid-term, while reducing pressures on bio-diverse rainforests in the long-term, and helping farmers rebuild their forests. This is what we call "sustainable rainforest development."



## The Rondonia Agroforestry Pilot Project



### Extended Project Impacts

The impacts of the Rondonia Agroforestry Pilot Project extend beyond the project itself to provide useful guidelines for agroforestry development elsewhere in the tropics. The project's participating institutions are prepared to expand the project to hundreds of additional farms under appropriate conditions. The project, although directly focused on 50 small farmers, is already having intended "spillover effects" as neighboring farmers begin to spontaneously adopt agroforestry practices independently of the project. We believe that farmers adopting income-enhancing agroforestry practices will develop a greater appreciation for natural forests remaining on their properties and that the spontaneous neighborhood diffusion of agroforestry practices should lead to reduced deforestation beyond the project farms. Why? Because natural forest patches are biological reserves that help to restore useful vegetation and nutrients to neighboring degraded areas where project agroforestry plots are located. Contrary to popular misconceptions, Rondonia's farmers are not uniformly inclined to destroy forest. Most, we predict, would not clear forests if other income alternatives, like agroforestry, were available.

The project's ongoing research component will document the outcomes of the project however they turn out. If our predictions are correct, then the information produced by the research accompanying project activities will provide clear policy and investment recommendations on appropriate agroforestry development, incentives to farmers to adopt agroforestry systems, and strategies for galvanizing local institutional development to make agroforestry development self-sustaining after the project ends.



*"I have great faith in a seed.  
Convince me that you have a seed there,  
and I am prepared to expect wonders."*

Henry David Thoreau

The Rondonia Agroforestry Pilot Project gratefully acknowledges:

The Teresa and H. John Heinz Charitable Trust

Instituto de Pre-Historia, Agricultura e Ecologia

Virginia Polytechnic Institute and State University

The College of Architecture and Urban Studies

The Department of Urban Affairs and Planning

The Environmental Design and Planning Program

University Office of International Programs

Office of International Research and Development

Office of the Vice Provost for Research

For further information about the Rondonia Agroforestry Pilot Project, please contact:

John O. Browder

Department of Urban Affairs and Planning

Virginia Polytechnic Institute and State University

Blacksburg, VA 24061-0113

(540) 231-6217 / Fax (540) 231-3367

e-mail: [browder@vt.edu](mailto:browder@vt.edu)

1996



Printed on recycled paper