

Smallholder Farmers, Agrodiversity, and Climate Change

Miguel Pinedo-Vasquez

CSD course

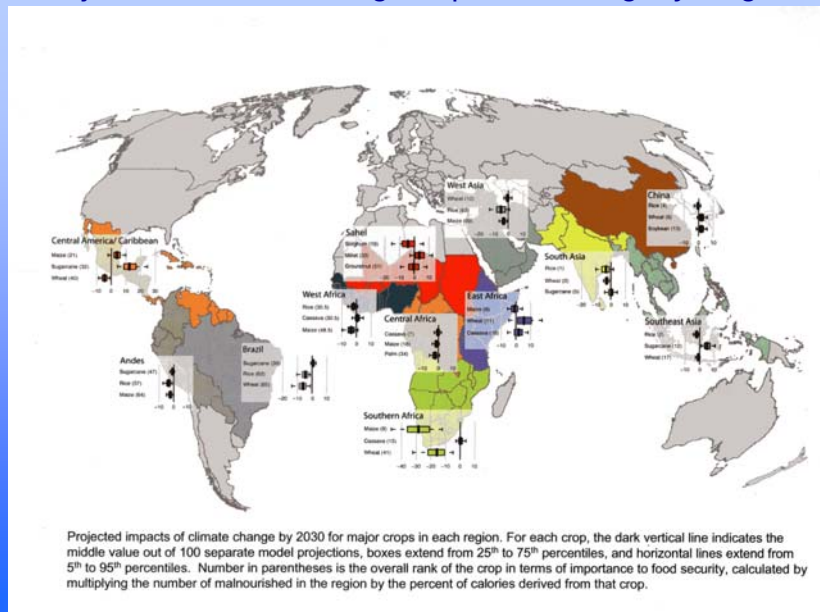
May 16, 2008



Three issues to be discussed:

- The effects that climate change is apt to have on smallholder farmers
- The tools that smallholder farmers have to deal with climate change
- The effects that programs to mitigate and/or adapt to climate change might have on smallholders

Projected Climate Change Impact Ranking, by Region



Lobell et al *in press*

Atmospheric changes that are affecting smallholder farmers include:

- Increase in temperatures
- Changes in rainfall amounts and patterns
- Increase in climate variability
- Increase in the severity of extreme events
- Changes in levels of CO₂ and ozone in the air

Why do we care about smallholder farmers?

- They are more than 525 million
- They are the poorest of the world's poor
- They are the victims of the expansion of industrial agriculture
- They are living in marginal lands and environments that are prone to floods, drought, storms and other environmental disasters

Smallholder farmers are more susceptible to climate changes due to:

- Poverty
- Political powerlessness
- Cultural marginalization
- Farm marginal lands: often sloping, unirrigated
- Farm lands that are prone to floods, droughts, and other natural disasters

In most countries smallholder farmers:

- Have poor access to communication
- Have very limit access to agricultueal services, including agricultural credit
- Have no access to any form of insurance or disaster-relief benefits
- Are at a disadvantage in competition over markets

In most countries smallholder farmers:

- Cannot make a living by farming
- Are migrating to urban centers
- Are increasingly being displaced and forced to migrate

In most countries smallholder farmers are already victims of climate change

- Massive erosion
- Landslides
- Loss of crops by extreme rainfall events
- Loss of crops and livestock due to outbreaks of pests and diseases
- Bush fires

But smallholder farmers are not invariably at a disadvantage:

- Many have considerable resources with which they manage the increased risks that climate change brings
- These resources are biological, technological, social, as well as political in nature
- Many have developed a great diversity of tools and strategies to cope with many acute and simultaneous changes
- Solutions are often found in the intersection of all resource types, tools and strategies

Among the most important resources small farmers have is the diverse and constantly evolving agrobiodiversity that they own, manage, and use.

Agrobiodiversity

- The many varieties of staples, cash crops and other plants and animals that smallholders commonly combine in their gardens, fields and agroforests have long helped them to adapt to a broad range of natural, economic and social changes
- This diversity and the processes of adaptation of these agrobiodiversity resources offer flexibility and resilience that larger and more specialized farmers often do not have, and can confer an advantage on the small farmer in times of stress.

- Not only do small farmers manage and harvest many species and landraces of crops, they commonly rely on an even larger assemblage of undomesticated, or semi-domesticated plants and animals for their livelihoods
- Traditions of risk management or risk avoidance through agrobiodiversity are found among smallholder farmers around the world
- Will these traditions and the richness of landraces and plant knowledge be adequate to cope with the often extreme and novel changes associate with climate change?

- There are surely some limitations to the kind, degree, and speed of change that can be accommodated
- Changes in rainfall, humidity, temperature and seasonality as well as other parameters may exceed the capacity of some farmers with even a great agrobiodiversity to adapt successfully
- But smallholder agrobiodiversity resources are undoubtedly among the very valuable resources that humankind has for the changing future
- There is a “memory” of risks and trials built into these crops and agriculture systems

Agrodiversity

- Useful diversity is not confined to agricultural biodiversity, but also encompasses the great flexibility and variety of production and management technologies that many smallholder systems are built upon that is known as ***agrodiversity***

Agrodiversity is a complex concept that integrates:

- biological diversity at various levels
- diversity of agricultural technologies or management
- bio-physical diversity
- diversity in the organization of agriculture

Agrodiversity integrates
biological, physical, cultural,
social, spatial and other factors

Each of these factors is in turn
complex and each is changing in
the short and long terms.

Agrodiversity is a “moving
target”

Agrodiversity

- Smallholders notoriously adapt their field and crop management at every stage to changing conditions
- Technological adaptation “in the course of action” is characteristic of these systems.

- Small farmers commonly employ many kinds of production simultaneously based on broad-based environmental and agronomic knowledge, again hedging bets and spreading risk
- Annual crop production is performed alongside agroforestry, forest management, animal husbandry, fishing, hunting, and increasingly wage labor, often off-farm
- In the small-farming household such diversity of production, production sites and practices serves many purposes other than risk avoidance, but in an increasingly risky world, these complex patterns have the potential to protect small farmers from catastrophe and guarantee some degree of food security.

- The diversity of production patterns among farming households within a community bestows yet another form of security.
- Within a village one commonly finds great variety among households in production strategies; smallholder conformity and homogeneity are merely myths.
- The diversity among small farmers may help farmers survive and adapt because of the social institutions and links that operate within and among households and promote resource sharing and other forms of reciprocity.

What is “organizational diversity”?

- Tenure: land, tree, water resource tenure
- Size, age and gender make-up of household
- Labor availability and labor arrangements: labor-sharing, gender-specific labor
- Market access, transport, credit, access to extension
- Off-farm employment
- History of farm use; plans for the future
- Food security
- Class, rank in village

What is “organizational diversity”? (cont.)

- Length of residence in area
- Acceptance or aversion to risk
- Kinds of knowledge
- Preferences, aesthetic considerations

Social networks:

- Social networks of various kinds -- kin-based and not -- are important mechanisms for adaptation to present and coming change
- An ever- greater body of research shows that such links operate on scales ranging from within communities to across borders and oceans to protect smallholders from the devastation that can result from major climatic and economic shocks

Migration as a resource:

- The ability and willingness to migrate internally and internationally, permanently and temporarily has long been a mechanism of adaptation and coping by smallholders
- The role of remittances and other economic linkages is difficult to overestimate.

Informality as a resource:

- Other social mechanisms include many virtually invisible or “informal” types of land and resource access and tenure, credit and marketing.
- Some of these involve illegal or extra-legal actions and figure among a large repertoire of “weapons of the weak” that now can also be seen as weapons in the fight to survive climate change.

How smallholders are managing risks

- Smallholder tools and resources combine biological, social, cultural, and political forms of diversity, integration, and networking to manage risk, to generate new products and solutions, and generally to help manage change.
- Many of these mechanisms are very site and situation-specific, making their use in other places, times, and societies, and their general replicability problematic at best.
- The importance and usefulness of these tools may be found largely in the sources of adaptation they reveal, and approaches they point to for enhancing rather than diminishing resilience, rather than in any specific “package” of solutions to the increased risk that global climate change will surely bring.

Mitigation and adaptation programs

- global and local reactions to climate change are breeding countless projects and programs that seek to respond both to calls to mitigate the changes and to adapt to them as they occur
- Among these responses are calls for more effective conservation of forests and various forms of carbon payments (including REDD), a diversity of programs for greening of wastelands and other degraded areas, intensified calls for the elimination of the use of fire in agriculture and animal husbandry, and a plethora of projects for the planting and increased use of biofuels.
- Each of these may offer some attractive advantages to smallholders and aids to their ability to adapt, as well as some severe problems for rural households.

Mitigation and adaptation

- Much depends on how well the special needs and abilities of smallholders are taken into account and how site- and situation-specific project designs will actually be.
- The multi-scale diversity and flexibility of smallholder resource uses that we have pointed as the most important resources of the farming household, are also important and possibly near-insurmountable drawbacks for the successful design of these programs.

Mitigation and adaptation

- Few governments, international NGOs, or intergovernmental programs are structured to really work with the diverse world of smallholders to tailor programs to their needs and abilities, especially while ever-increasingly urgent calls for immediate solutions to climate change problems are being heard worldwide.
- But these seemingly impossible tasks must at least be attempted lest the rush to resolve problems quickly and adapt uniformly destroy some of humankind's most important resources and tools for sustainable and just forms of adaptation and successful change

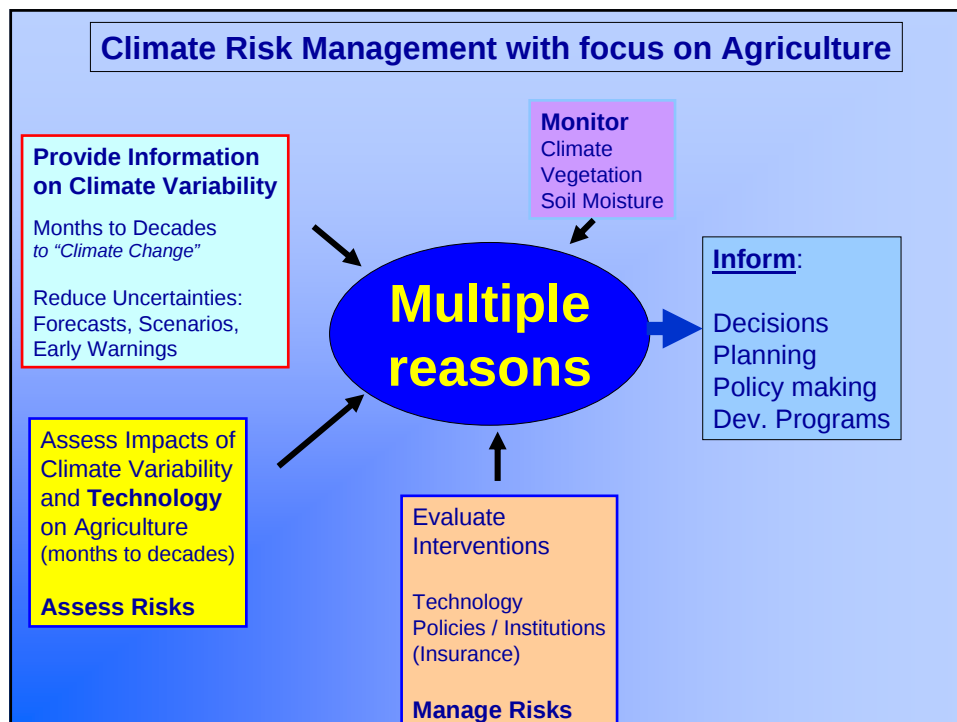
Conclusions

- We would like to point out that the PLEC program was and is still based on just such an approach of identifying mechanisms and their practitioners and then promoting them within a specified local, appropriate zone
- In smallholder societies, crop diversity is not an accident of history or geography, but a product of management and stewardship of particular cultures and communities, and even of individuals.
- Providing information on rain fall and other weather related factors can help small farmers to deal with the effects of climate change

Scientists working with Farmers: Approach to Climate Risk Management

(from months, through Decades, to Climate Change)

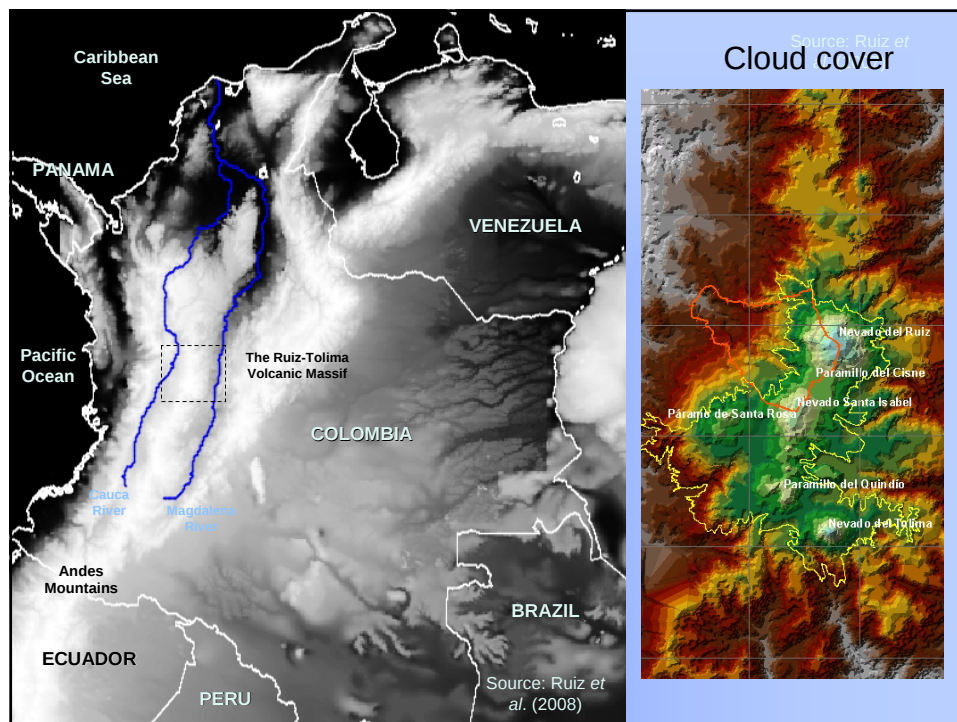
1. Identify vulnerabilities to climate variability and change
(which systems, components within systems)
2. Reduce uncertainties
(learn from the past, monitor the present, provide relevant info on the future)
3. Identify technologies that reduce vulnerability
(e.g., water holding capacity, diversification, drought resistance)
4. Identify policies and institutional arrangements that reduce vulnerability and/or transfer risks (e.g. Insurance)

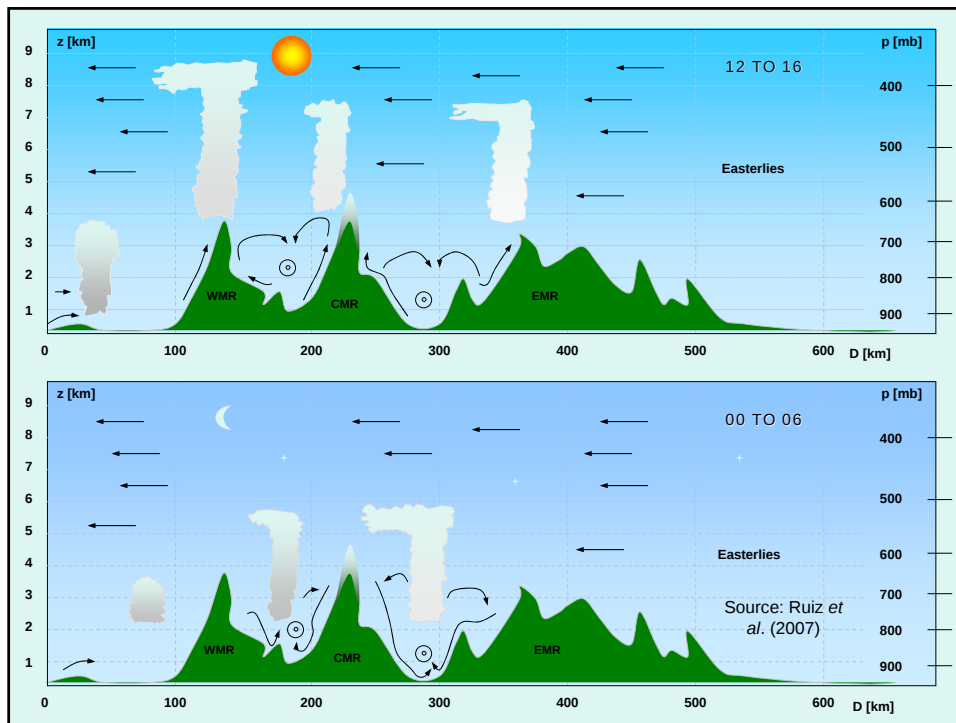


Informing smallholders

- Forecast intervention facing water scarcity and variability
- Forecast intervention facing rainfall variability
- Test effectiveness of potentially scalable forecast intervention
- Feasibility, particularly in terms of communication needs to be taken to the field

GLACIER RETREAT CASE STUDY IN COLOMBIA

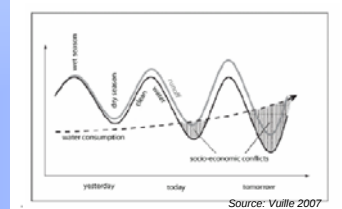




Social Impact of Glacier Retreat: Case Studies with neighboring populations

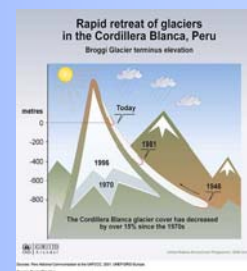
Andean Scenarios of risk:

- Water availability
- Floods and landslides
- Land problems and opportunities
- Other potential scenarios of conflict

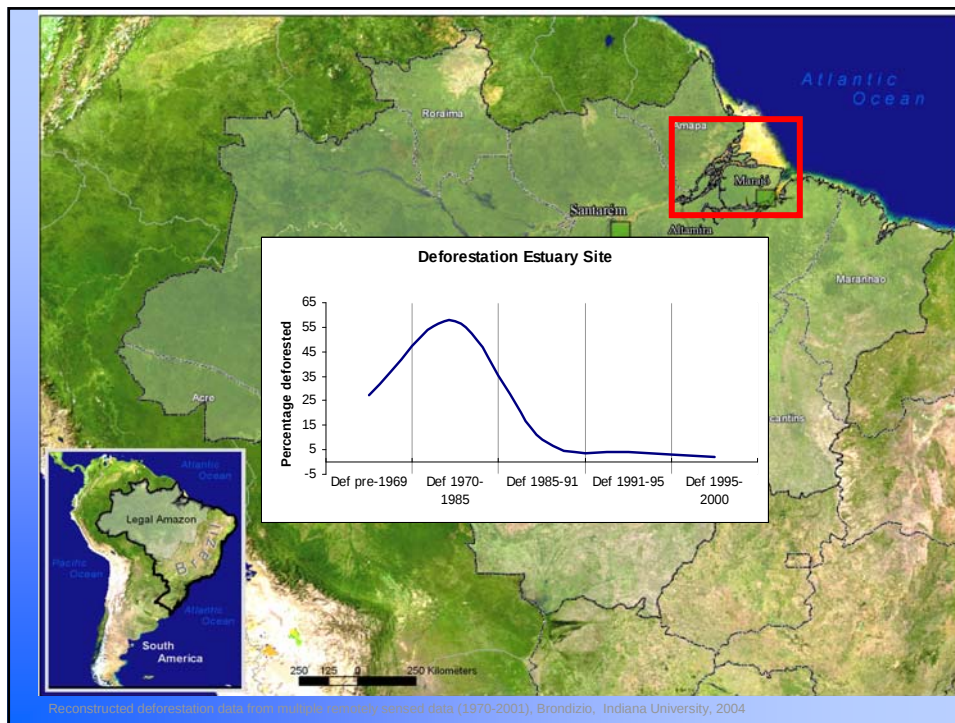


Alternatives

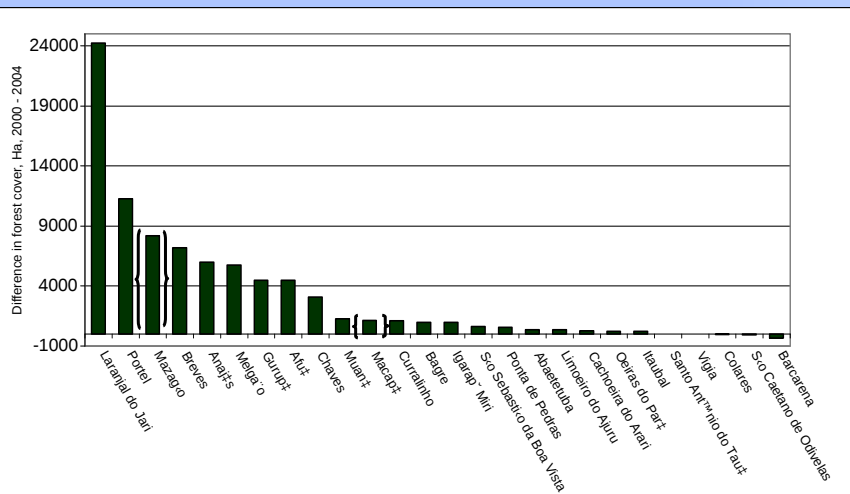
- Adaptation, mitigation, and policies in the Andes
- Local adaptation strategies



MITIGATION CASE STUDY

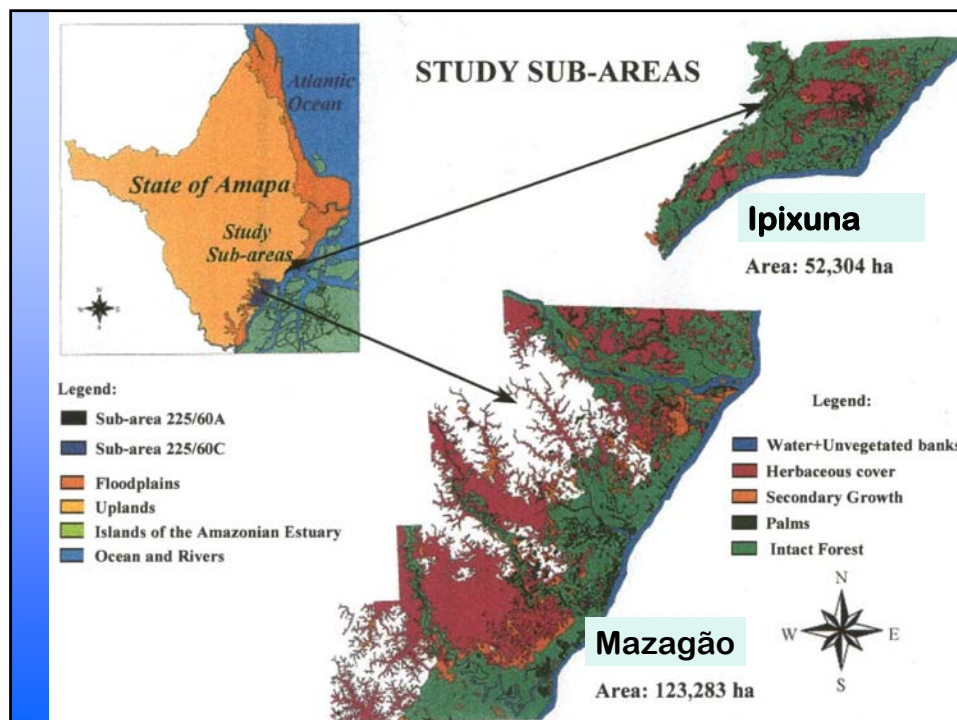
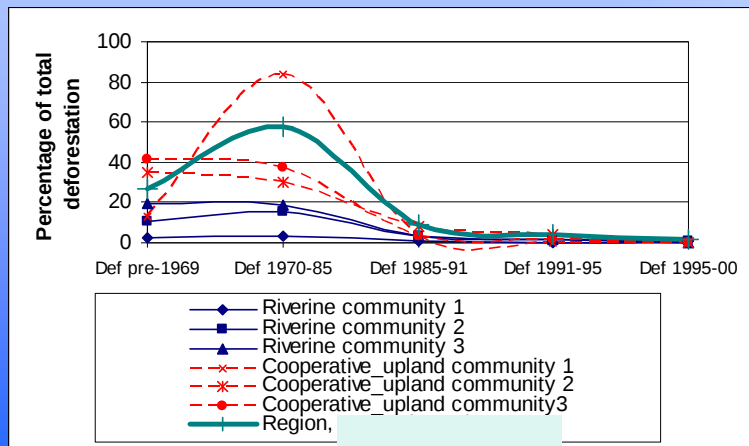


Changes in forest cover in municipalities in the Amazon estuary 2000-2004 (PRODES INPE, 2000-2004)



An encouraging deforestation trend

No new deforestation recently in Estuarine Area



The estuarine region experiencing a process of afforestation

- **Causes**: Caboclos are changing from an emphasis on agriculture to an **emphasis** on agroforestry and forest management
- **Processes**: Caboclos are managing vegetation in a number of ways for a number of economic products, without **radically** changing their systems
- **Consequences**: These changes in **emphasis** are leading to a process of “**forest transition**”

We look at the process of afforestation:

- **Spatially**: We focus on two relatively small areas to understand changes in depth and to quantify these changes
- **Temporally**: We are conducting long-term studies to understand changes as a long process and not an isolated event
- **Socially**: We are working with households to identify their land use systems and quantify their impact on land cover

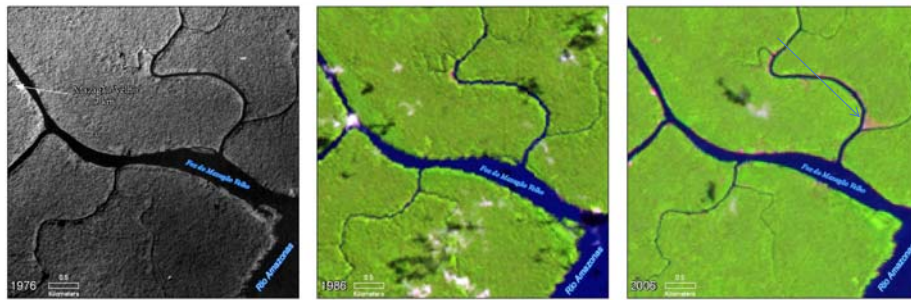
We gather data on land use changes:

- We conducted household surveys in 1999, 2002 and 2006 in Ipixuna and Mazagao
- We conducted land surveys in 148 landholdings (86 in Mazagao and 62 in Ipixuna) in 1999, 2002, and 2006
- We conducted floristic inventories of forests, fallows, housegardens and fields in 1999, 2002, and 2006

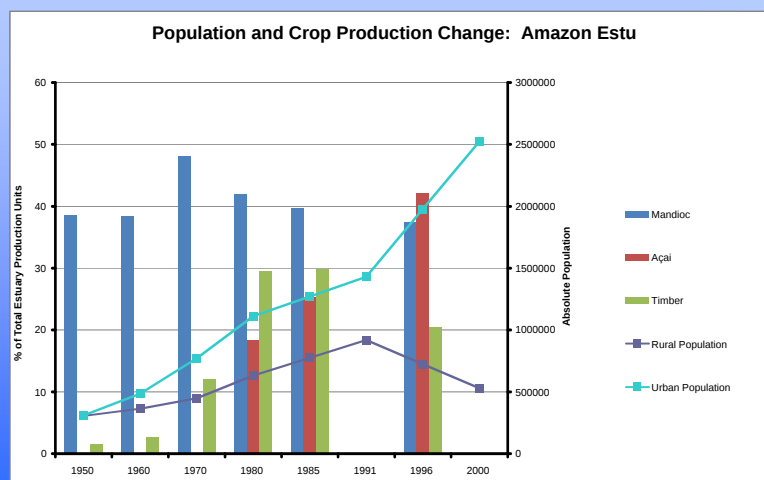


Ipixuna:

- o An aerial photo from 1976
- o A Landsat TM from July 1986
- o A Landsat TM from October 2006
- o All images displayed in scale 1:30,000



- Mazagao:
- o An aerial photo from 1976
 - o A Landsat TM from July 1986
 - o A Landsat TM from October 2006
 - o All images displayed in scale 1:35,000



Two important land use systems that are changing land cover in the two sites:

- Management of fallows for the production of fast-growing timber species
- Management of forests and agroforestry practices for the production of açai and other fruits

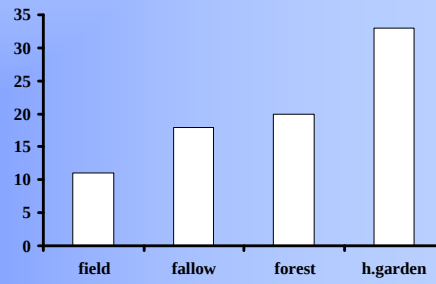
Forest management for both timber and açai often starts in the field, even as annual crop production is waning



- Leaving seed trees
- Selective weeding
- Transplanting
- Uprooting
- Broadcasting seeds
- Enriching with selected species

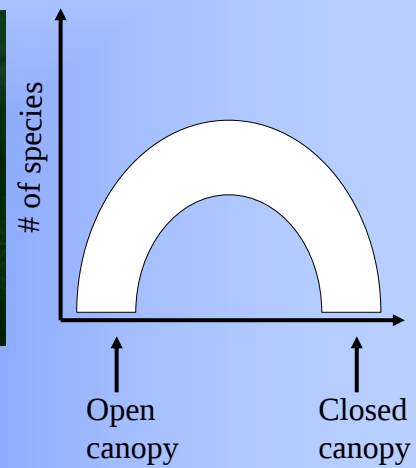


Average number of seed trees/ha

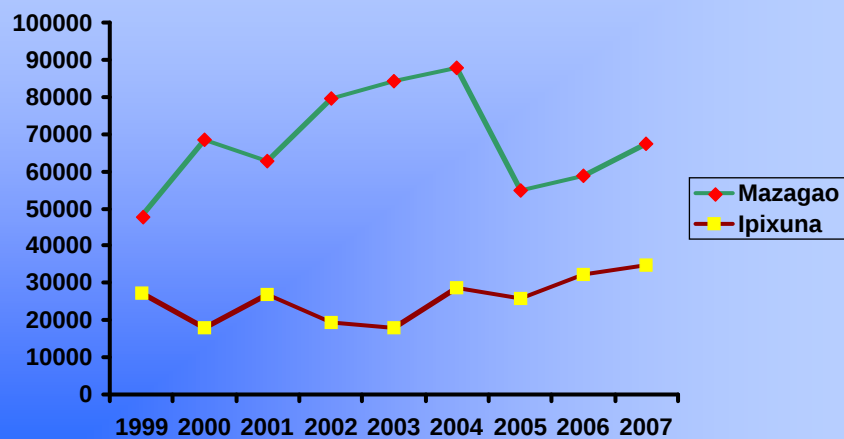


**Managing healthy
natural regeneration
within the stand**

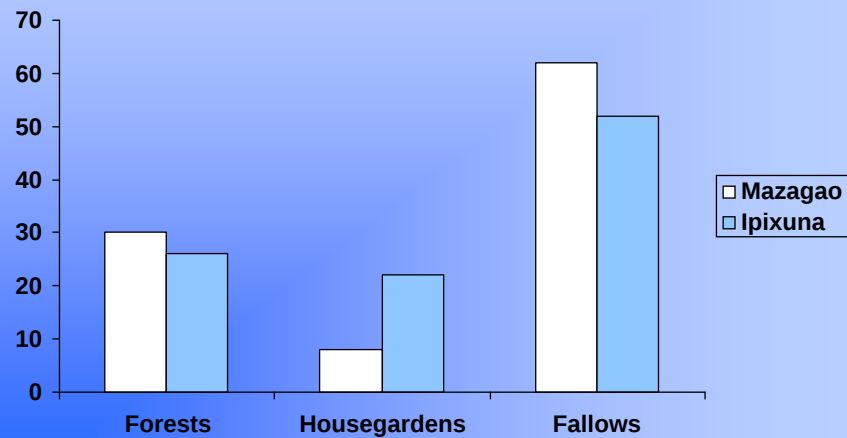
Thinning Stands for Growth (Height and Diameter)



Timber extraction (m3) in Mazagao and Ipixuna from 1999 to 2007



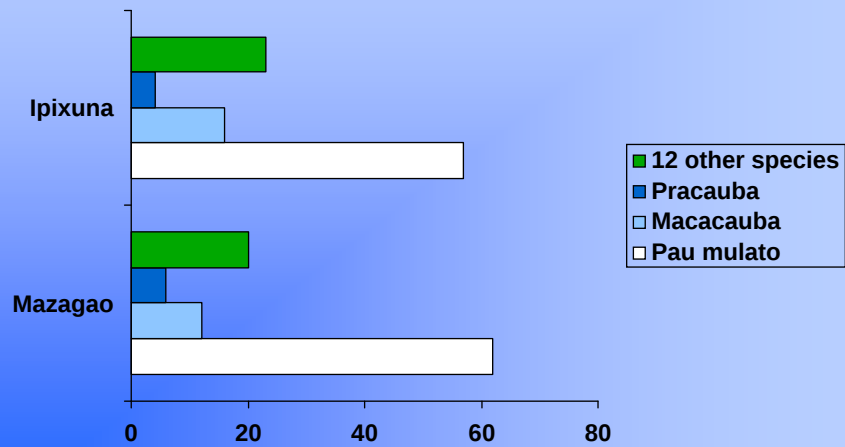
Percent of timber extracted by land units



Managed fallows in the estuary are rich in timber species



Percent of timber extracted by species



Extraction and transport of timber is relatively easy
(without roads)



Processing is done manually by small mill owners



Fields, fallows, forests, and housegardens are managed not just for timber: Timber and açai is managed together in many stands



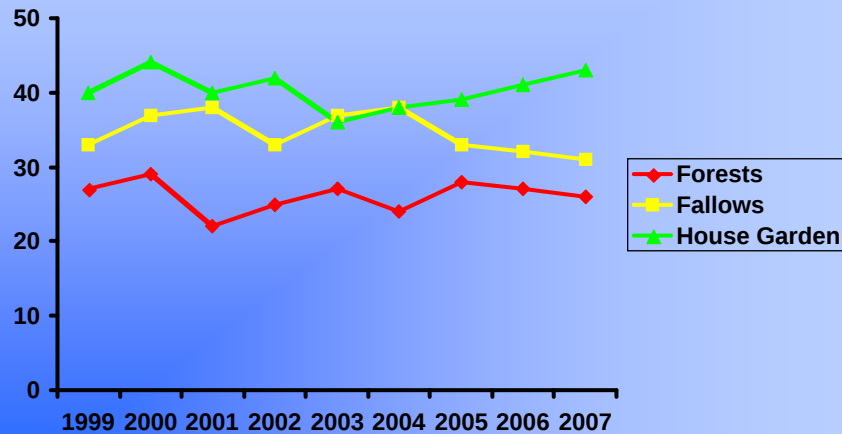
Acai agroforestry cultivation using floodplain gardens “Rocado de Varzea” techniques



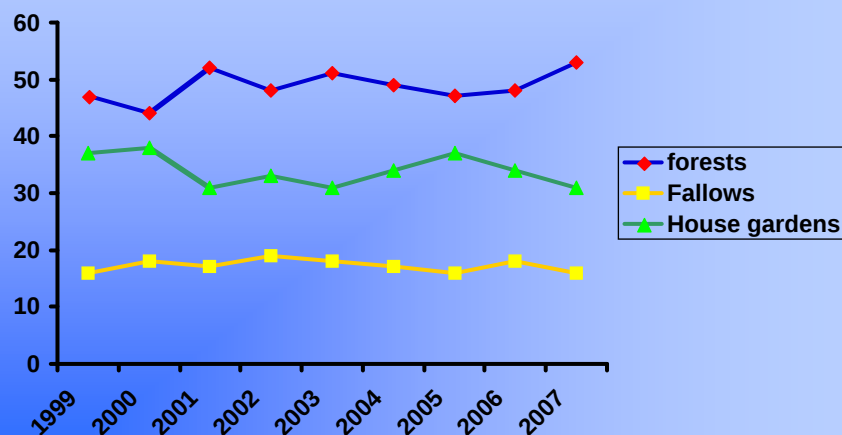
Acai agroforestry using forest management techniques



Percent of açai produced by 36 sample households per land units in Mazagao from 1999 to 2007



Percent of açai produced by 34 sample households per land units in Ipixuna from 1999 to 2007



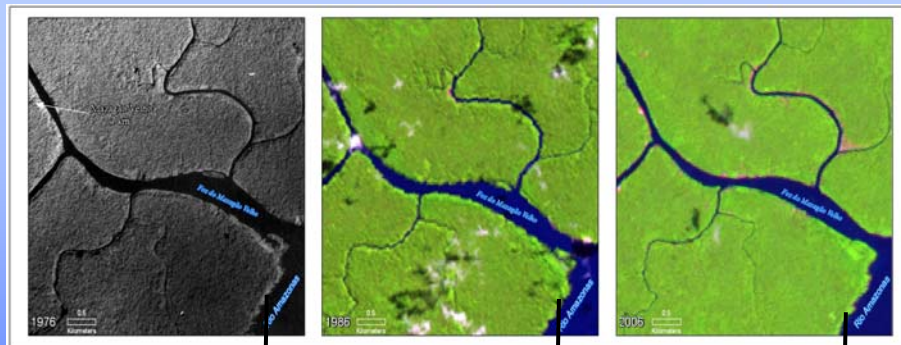
Managed açazal produces a great variety of products including fish and shrimp

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Smallholder management operations

Smallholder management operations

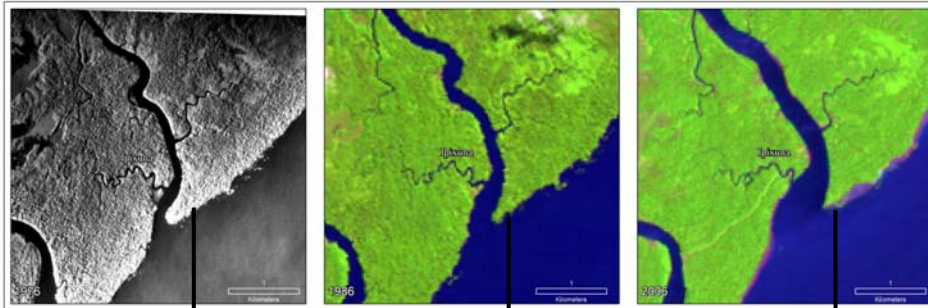
Field:	Selective weeding and enrichment
Fallow:	Thinning and management of coppice
Forest:	Selection, thinning and girdling or removal of individual trees
Landscape:	Network of gaps, edges and canopy environments
Individuals:	Slashing under trees, vine removal, control of pests
Species:	Selecting and collecting seeds, producing seedlings <i>ex situ</i> , enrichment
Germplasm:	Maintaining seed producer trees, broadcasting seeds and managing seed dispersers



Agriculture fields

Agriculture fields, house gardens and fallows

House gardens and fallows

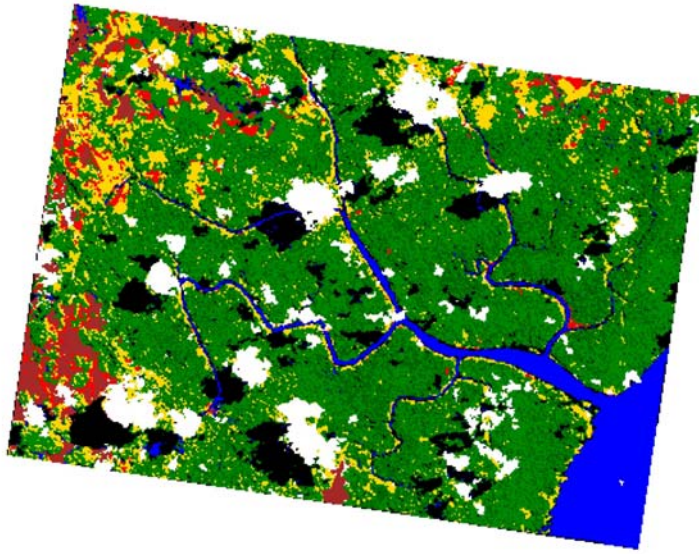


Cattle ranch

Cattle ranch and fallow

Cattle ranch and açazal

Land cover changes in Ipixuna



- A simple transition image showing land cover change between two dates, 1986 and 2006.
- Gold represents areas of pastures and new made fields.
- Areas in red represent fallows with açai in the land of cattle ranchers