REPORT ON FUNDING AND INVESTMENT OPPORTUNITIES FOR INCOME GENERATING ACTIVITIES THAT COULD COMPLEMENT STRATEGIES TO HALT ENVIRONMENTAL DEGRADATION IN THE GREATER AMAZON BASIN

By

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Executive Summary

This report summarizes the lessons learned from Cultural Survival's (CS) attempts to generate markets for Amazonian nontimber forest products. Based on CS's work, I identify key research, institution building, production and processing constraints that must be addressed and funded if income generating efforts are to become part of overall solutions to saving the biological and cultural diversity of the Amazon.

Conservation is a people issue more than a biological one. Environmental problems like acid rain and ozone depletion don't create themselves, people do. Likewise, rain forests don't cut themselves, people do. If we are to address these issues head on, we must look beyond the symptoms to the root causes. All to often, however, solutions have focussed on the symptoms.

The major causes of environmental degradation, including Amazonian rainforest destruction, are population pressure, poverty, greed and ignorance. Maintaining biodiversity in the Amazon through attempts to preserve it entirely are not viable options. Conservation, the wise use of resources, not preservation, is the key. In the Amazon, as in most of the Earth's fragile ecosystems, it is a use it or lose it proposition.

Conservation in the Amazon is a people issue in other ways. People have created and used the forests as we know them. According to some botanists there are not 10 sq.km. of Amazonian rain forests that have not been altered by people. In addition, the rain forests are already claimed by someone. To degrade them, the rights of the people who already live there must be denied. In Brazil, one indigenous group has disappeared each year since 1900, 90 groups out of 270. Cultural destruction preceeds and even out paces the destruction of the forests.

Since 1972, Cultural Survival has worked with rainforest peoples to help them preserve their ways of life as well as their land and resource rights that make a continuation of that lifestyle possible. Our direct assistance projects help forest peoples to help themselves by supporting their organizations, land rights, sustainable development projects, and, most recently, their attempts to enter the market economy more on their own terms.

We have learned over the years that the long-term survival of rain forests and rainforest residents depends on the development of successful strategies to maintain biodiversity while at the same time meet the economic needs of forest peoples. Scientists are coming to understand what forest residents have long known, namely that forests are capable of generating more income and employment than the same areas cleared for pasture or agriculture. Yet, to date, this is all theory. A practical model of sustainable development with more equitable relations with external markets has never been fully implemented or tested. CS's experiences, to date, give clear indications of what the next steps should be. They are outlined in the report that follows.

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General Background: Principles and Strategies for Developing Income Generating Programs to Protect Biodiversity in the Amazon

During the past three years, Cultural Survival Enterprises (CSE), the trading arm of the not-for-profit human rights organization Cultural Survival, has worked with a few specific groups to demonstrate that, in their areas, forests are worth more standing than they are when razed for pasture or agricultural lands. The efforts of CSE and local groups could be greatly enhanced in this regard if even some of the suggestions in this report are acted upon. Scientific research and subsequent calculations suggest that in the long term forest areas are worth more for their sustainably harvested timber and nontimber products than they are when clear cut for logging and/or conversion to pasture, agriculture or plantations. As a result of CSE's work with local groups, for the first time the calculations are not paper profits, theoretical calculations about the value of forest products; they are real incomes in real peoples' bank accounts.

CSE has concentrated on Nontimber Forest Products (NTFPs)--nuts, fruits, oils, resins, essences, pigments, flours, and handicrafts. This report will go further, exploring programs for generating sustainable sources of income from markets for timber and medicinal plants. In the past three years, CSE has brought 350 different NTFPs out of the Brazilian Amazon for sampling to some 120 different companies in the US and Europe, from Fortune 500 companies to small, start-up operations created solely to market rainforest products and return profits to rainforest groups.

The major lessons CSE has learned during this time, as listed below, provide the theoretical and practical backdrop for many of the program suggestions in this report.

1. Land and resource rights are esstenital for conservation of biodiversity. Forest residents are not likely to protect forest resources if they do not have clear rights or guaranteed access to resources or if they feel that at any time they can be displaced by outsiders. For example, why should a person save a valuable tree if someone else can come along at any time and cut it. Likewise, forest residents will not invest time or money in such activities as forest enrichment, sustainable harvesting techniques, processing equipment, facilities to reduce post harvest losses or the reclaiming of degraded areas if they do not have guarantees that their resource rights will be protected. Clear title to resources is one way to guarantee them, but zoning and restricted access constitute what can be effective variations where rights are shared by the state and forest residents.

2. Start with products already on the market. Existing products offer the best chance of quickly creating international markets

that can generate increased income in the short term for forest residents. Introducing new products, on the other hand, will take time: at least 5 years for foods, 10 years for personal care products, and 20 for pharmaceuticals. If we don't start generating income from forests in the short term, much of the forest that is left will already have been destroyed.

3. Increase Competitiveness. One of the main reasons that forest residents can be maintained in their current impoverished position is because they do not benefit from the value that their products generate. This situation has been created due to a lack of competition in the marketplace. In order to increase local revenues, competition should be increased. There are various ways to accomplish this. Alternative markets and buyers help. The breakup of trading and shiping monopolies also increases competition. Investing in production systems that reduce overall costs can help by making production and processing more efficient. (One of the curious effects of monopoly capitalism as it has been exercised in the Amazon has been to discourage either sustainable harvesting practices or economically viable production systems.) Enrichment programs or reclamation of degraded areas also increases competition forcing marketing or trading monopolies to compete when such programs are associated with processing or value added programs.

4. Diversify production and reduce dependence on a few products. The diversification of products is absolutely essential to the overall viability of extractivism as well as the maintenance of biodiversity. Strategies should be developed one product at a time, however, and should focus initially on the largest volume and highest value commodities. The resultant profits can then be reinvested to diversify production. Particular attention should be paid to commodities that generate high value per unit of labor, complement the seasonality of other products, and provide food or other essential goods to the producer group.

5. Diversify the markets for raw and processed forest products. To reduce the overall risk to producer groups, we need to diversify the number and type of end users for each product. For example, Brazil nuts can be used as nuts (shelled or unshelled), or in ice cream, baked goods, cereal, candy, oil, flour, and so on. Market diversification can also be achieved through market positioning--regular, organic, wild, or natural--and through local, regional, national, and/or international marketing strategies.

6. Add value locally. Evaluate the market for each product, determining where value is added, where risk exists and where local communities stand to gain the most in the short, medium, and long term. Sometimes, eliminating intermediaries through improved transportation might work; other times, adding value through local or regional processing could be most beneficial. Depending on the product, adding value locally does not always make economic sense. In general, though, even trading higher volumes through local organizations rather than one-on-one

through intermediaries will give individual producers access to higher prices. Furthermore, the same skills and institutional structures that allow groups to sell larger quantities of product into the market enable them to purchase manufactured items in bulk, and thus save money.

7. Capture the value that compounds as the products travel farther from the forest. Each transaction adds value to products. While value is added according to labor, risk, and capital investment, it is also compounded through scarcity and monopoly. Most forest residents who collect products that are ultimately exported, for example, currently receive less than 15 percent of the New York City wholesale price of the commodities that they sell. [Keep in mind that they often pay equal or higher prices than those in NYC for basic commodities-- sugar, rice, beans, meat, gasoline.] If they continue to receive such a small portion of their products' value, they will inevitably be forced to degrade their resource base as they try to make a living, or they will leave the forest altogether allowing colonists and ranchers to move in and degrade it.

8. Solutions must be equal to the problems. Model projects with built in subsidies are not viable solutions. Solutions that address only the needs of one of the different groups (Indians, rubbertappers, caboclos, colonists) are not viable. Solutions that do not address the principal commodities traded in the region are not solutions (rubber, Brazil nuts, acai, babassu) Solutions must be on the same scale as the problems, yet divisible, starting with one village or group at a time. Band-aids will not heal wounds that require tourniquets. This being said, no single solution will reverse the destruction of the Amazon.

9. There is strength in numbers. Individual producers or producer groups have little power in the marketplace. They cannot provide the quantities of product that even a small manufacturer would need. The Xapuri Brazil nut shelling factory, for example, produces 70 metric tons (MT) of Brazil nuts per year, but M & M Mars uses 70 MT of peanuts per 8-hour shift in Snickers candy bars. Individually, local Brazil nut shelling cooperatives could never convince large companies like M & M to use their nuts. By working together, producer groups can control larger market shares, exerting considerable influence over entire markets.

10. Make a decent profit, not a killing. It is possible to add value locally and to increase overall income. Pricing, however, is a tricky issue. High prices reduce overall markets for forest products and give manufacturers a reason to look for cheaper alternatives. Likewise, each decision to eliminate intermediaries as a way to add value locally must be carefully studied. Nut gatherers are quite keen on eliminating the Belem Brazil nut shelling monopoly; but if the monopoly was disolved today, who would collectors sell to? Would they even be able to stay in the forest? What other risks does that intermediary take, or services does he or she provide? Who will provide them in the future in that person's absence?

11. International markets are for the protection of ecosystems, not for the people who live in them. Thus it is essential to invest in monitoring systems which ensure the sustainability of production. The sale of commodities must be linked with systems that ensure that the quantity of products taken from the forest does not destroy it. By the same token, the harvest of any product will change the forest; we must beging to acknowledge that such manipulations have taken place forever and not destroyed the forests. What is needed, then, are careful environmental impact assessments and monitoring systems that examine at the outset the impact of increased trade on individual species. This is the type of monitoring that is required for products that are already being harvested and sold onto the market. For new products, such studies should be undertaken before the commodities are harvested. Monitoring and research should be undertaken for each commodity by scientists and forest residents. In the end, it is the local communities whose present markets and future livelihoods would depend on such certification. The authority to monitor and certify should be theirs alone.

These are the 11 major lessons that CSE has learned. Although they will probably be modified over time, they are offered here as ways to help policy makers think about their own strategies to conserve biodiversity. The program suggestions that follow build upon these lessons, and suggest a comprehensive short-term strategy that will be essential if we are to turn the tide of deforestation in the Amazon. The ultimate success of this strategy--both its more broad, theoretical issues and its specific, detailed suggestions--will only be possible if those interested in these issues work together, addressing the problems in as complementary and comprehensive a way as possible.

Throughout this report proposed projects are indicated sequentially by (PP #1), etc. At the end of the report I summarize the proposed projects indicating the amount of funding required and whether it should be grants, loans or both. In some cases, the returns on investments can be quantified, but in most cases that is not possible. The specifics of each investment should be studied and business plans developed. In most cases, the business planning and analysis should be financed with grants. In general, technical assistance and research should be funded with grants; production and processing facilities and working and trade capital should be provided with loans. Payback periods should be flexible, especially where similar investments have never been made and there is no baseline performance data. In the projects funded are successfully implemented, most will be one-time investments. Once they are operational, they will be replicated by forest residents if they have access to sufficient capital.

Research Needs

The research suggested in this section includes a number of general suggestions relating to currently traded nontimber forest products (NTFPs), timber and timber products, and medicinal plants and genetic resources. The scope of this report was limited to NTFPs, and I discuss in detail the types of investments that could generate increased NTFP trade in the future. However, the actual value of tropical forests is mostly realized at this time through trade in timber. For that reason, it is important to spend at least a little time discussing ways that such trade could become sustainable, and thus part of overall green marketing strategies that would generate increased incomes for forest residents. The section on medicinal and genetic resources is included because increasingly they are important for their potential return to forest residents. What is outlined here are ways in which the rights of forest residents to such resources could be guaranteed or respected through specific marketing as well as legal strategies.

Currently Traded Forest Products

Research should proceed on three general categories of forest products: timber, medicinal and herbal remedies, and nontimber forest products (NTFPs). This research needs to concentrate on four general areas for each product: existing and potential markets, sustainability of production over time, potential of each commodity for possible enrichment programs and the target groups that could benefit from market development.

As a rule of thumb, we need to focus our initial research efforts on commodities that are already being extracted, harvested, or otherwise produced and traded on the market. Such production and trade implies not only that there is already demand, but that some forest residents are supplying it and, depending on the length of time they have been doing so, that production and trade might not be environmentally destructive. Again, these are researchable hypotheses (see the sections below on sustainability and improved harvesting).

Furthermore, if products are already being sold into some markets, it should be easier, hypothetically, at least, to expand those markets. By contrast, creating markets for new or unknown products would take 5 to 20 years, as mentioned earlier. In addition, creating markets for commodities that forest residents have not previously collected require changing overall production schedules and habits and also could lead to environmental degradation and even species loss.

Research, then, needs to be undertaken on the history of trade of forest products in this century. The data can then be compared with information that we have about markets today. For example, what is or is not being traded today versus 90 years ago, and why? What is being collected and traded by some groups but not others, and why? How can costs be lowered by eliminating intermediaries. What implications does such research suggest for follow-up studies (e.g., on transport, processing, etc.)? What other potentially marketable by-products come from the same plant, fruit, or seed? What would it take to develop markets for those by-products? (See cashews in the section on processing, for example.) It would probably cost $10 to $15 thousand (M) to undertake the initial research on trade histories (PP #1). Research suggested by such surveys and analyses would, of course, be additional.

Timber

Research on tropical timber or timber products should focus on ways to increase income from tropical timber or timber products and to harvest sustainably timber. Tropical timber currently generates the highest value of any commodity exported from the Amazon, perhaps as much as all other commodities combined. There are serious questions, however, regarding how much of that timber is sustainably harvested. The International Tropical Timber Organization (ITTO), for example, estimates that less than one percent of all tropical timber exports are harvested sustainably. Given that timber is such an important income generator in the region and that it is likely to continue to dominate all other income-generating efforts, some immediate research suggestions are in order.

Are there any sustainable systems of tropical timber extraction in the Amazon that are not highly subsidized, e.g. not sustainable (PP #2)? (This would raise serious questions about the AID-funded Pichis-Palcazu project. Even if it is environmentally sustainable at the local level, it is highly subsidized from the point of view of the global environment. Could it endure without such subsidies?) What are the conditions that could insure the sustainable harvest of timber from rainforest areas?

Perhaps some of the most important areas that would benefit from the development of sustainable harvesting timber practices are degraded or reforested regions or those where agroforestry or more generalized forest manipulation and slash-and-burn agriculture are being or have been practiced. In these areas, much can be learned about growth, seed dispersal, harvest rates and techniques and the potential for culling trees to prevent canopy closure might serve as a form of sustainable timber extraction.

We need generally acceptable guidelines for determining sustainable extraction--or at least extraction that is being monitored so that timbering practices can be changed over time, if that seems warranted (PP #3). Such guidelines could be the basis for certification programs that would allow for the creation of higher demand and value for such timber. There would then be more of a positive incentive for loggers to change their practices in order to take advantage of the better markets. There would also, of course, be negative incentives (e.g. consumer boycotts) which would make those selling uncertified tropical timber explain why.

Policy shifts and legislation, even though intended to address important issues, do not always have the desired effects. Eliminating new subsidies for clearing forests for pasture in Brazil has apparently had an undesired side effect. In Acre and Rondonia, for example, local groups report that ranchers have stepped up logging a variety of trees in an attempt to use timber sales to cover their costs of pasture conversion. In order to understand how to curb clear-cutting, and even destructive selective cutting, we need to better comprehend why and how people are deforesting or degrading areas today (PP #4).

Given that the degraded areas of Brazil's former forests are increasing each year, it would make sense to undertake research on reforestation with specific species that have economic value either for their timber and/or NTFPs (PP #5). It is not enough to research what will grow in a degraded area. We must also focus our efforts on what has value and what therefore is an incentive for a peasant or a rancher to actually plant trees and bring them to the point of production.

<u>Medicinal Plants and Genetic Resources</u>

Many would argue that the largest potential market value of the Amazon's resources lies in the area of NTFPs, of which medicines and genetic material are arguably the most important. Unfortunately, if today's national laws and development priorities are not successfully challenged, the cure for cancer, AIDs or any other disease that might be cured with an ingredient found in the rainforest will certainly go up in smoke. Neither rainforest residents nor those who would use the regions' resources in different ways can eat theory. To make the genetic or medicinal potential a reality, the wealth of untapped information from the indigenous inhabitants must be tapped. How can we plumb this economic potential to better understand and consequently better protect the biodiversity of the region? Two areas stand out as good places to start.

We need to know more about what biodiversity exists in these forests, what types of selection and domestication are already changing this diveristy, and, finally, how plants are currently being used for medicines or to provide other basic necessities by forest residents (PP #6). We also know little about the complicated resource management strategies that currently maintains the region's biodiversity. Without doubt, the capacity should be created in the Amazon to screen plants and compounds for active medical ingredients. To date such investments (e.g. Merck in Costa Rica) have been used to monopolize the findings. Benefits derived from such institutions or labratories should be returned to the forest residents from which the original ideas and collections usually come. This issue of ownership has to be addressed before the capacity is installed (just like land rights should be guaranteed before road construction begins).

One of the ways to accelerate the process of identifying potential medicinal plants would be to interview local healers (indigenous and caboclo) to find out which plants they use to cure diseases. If they knew that something would come back to them if any marketable discoveries were made they would be more interested in taking part in such research. Studies indicate that plants identified by shamans contain a higher percentage of active medicinal properties than those selected solely by researchers on their own.

This raises the second point. Considerable money has been made from discoveries in the Amazon to date, and there is much more to come. The question is twofold. How can we protect the rights of people (usually indigenous groups of the region) to information with which that they might be induced to part? This is where we enter the realm of intellectual property rights. The US National Cancer Institute currently has an agreement to pay a royalty to Brazil upon the successful sale of any new drug discovered through NCI-Brazilian joint efforts. So far, so good. But what happens if the information comes from a tribe in the Amazon? Should NCI pay Brazil--whose programs, arguably, have at least attempted to destroy the Amazon's biodiversity, or should it pay the Indian group that invented or discovered the knowledge in the first place?

In cases where information is truly new and does not result from the knowledge of others, who then should "own" it, and how can the revenues that it generates be used to increase the value of the Amazon's resources in the eyes of those who might otherwise destroy it? Although there are no easy answers to such questions, a general research project that examines related Brazilian, US, and international laws would be a good start. Such a study would then make it easier to develop other specific programs for funding (PP #7).

In any case, more of the analyses regarding medicinal or genetic resources should be done in the Amazon. This would make it much easier for the ownership of such information to be assured. At that time, contracts, profit sharing agreements, patents or royalties could be negotiated with companies. At least some of the funds generated through such agreements should be use to fund related income generating or conservations activities in the Amazon. Certainly, it is in the self-interest of pharmaceutical and chemical companies to protect the largest single region of biodiversity on the planet. However, they must be convinced that they can gain competitive access to these resources even if they can not be allowed to own them outright.

Considerable funds would be needed to equip a lab with the tools for sreening medicinal plants and undertaking genetic research (PP #8). This, too, would require a consortium of funders, both public and private. The agreements should be structured in such a way that private funders are not buying collection rights to the Amazon, as oil companies do with drilling concessions or as the Pope did when dividing the souls and the lands of the New World between Spain and Portugal. Rather, the companies would be allowed to bid on the rights to information and the costs/fees that they untimately pay for specific types of use over specific periods could be seen as a cost of doing business (CODB).

Sustainability Research and Ongoing Monitoring

A tremendous amount of the botanical research in the Amazon--which probably does not differ from that in other parts of the world--is on plant species that are not used, that have no commercial value. Ironically, we know very little about some of the most economically rewarding plants in the area. For example, nobody knows how long a Brazil nut tree will live. Nobody knows what factors affect how the trees reproduce, the number of seeds that can actually take root in the forest, or if the seeds are planted by animals or Indians or simply drop to the ground. Nobody really knows how many nuts an average Brazil nut tree produces, or for how many years. Many botanists do not know that it takes more than a year to produce the commonly harvested Brazil nut.

Rubber, too, is a little-understood commodity. What effect does taking latex have on the rubber tree, both immediately and over the long term? Do trees become sterile? Has any botanist actually observed rubber extraction in the Amazon? Are there any young trees nearby? Such analyses are going to be crucial if we are to increase markets for these and other NTFP commodities from the region. Fortunately, the number of botanists willing to do this kind of research is increasing (PP #9).

Improved Harvesting Techniques for NTFPs

In many cases, the issue of sustainably producing NTFPs from tropical forests has more to do with harvesting than with actual levels of current off-take. Pau Rosa, an essential oil whose harvest has almost eliminated the species from the Amazon, can be harvested sustainably. Likewise, copaiba oil, chicle, and other latexes, and certain fruits, can be harvested sustainably, even though they often are not. If NTFPs are to become a more important part of overall solutions for generating income for forest residents, reducing overall levels of deforestation, and protecting biodiversity, then we must research the harvesting techniques for each NTFP and determine what it would take to convince collectors to use alternative methods. CSE has found that the initial screening for each commodity would cost $5 M or less. The longer term studies for those products with destructive harvesting practices would cost about $25 M (PP #10).

Guaranteed land and resource rights (or usufruct rights) are perhaps even more important than harvesting techniques in encouraging the sustainable harvest of NTFPs. Such rights, in fact, allow producers to develop sustainable processing techniques. Furthermore, they allow harvestors to develop long-term harvesting strategies for single and multiple species. Finally, they allow harvestors to make financial investments in the equipment needed to harvest or add value by processing their products.

Some new techniques would require education rather than equipment, others the reverse. For example, copaiba oil should only be harvested by drilling a hole with a brace and bit and tamping it, rather than making a hole with an ax, which does not heal. (Research could reveal if trees can be patched and made productive again, although it is not clear if it would be worth it financially.) The brace and bit could be sold at the depot where the copaiba is purchased. It need not be fancy or expensive: one bent piece of iron tooled on the end with a section of pipe on the other end serving as the handle. The braces and bits could be produced locally and sold to collectors.

Reducing Post-Harvest Losses

Most products from the Amazon have well defined and relatively short harvest seasons. Markets for such products, however, could easily be sustained throughout the year if produce were available. Harvest, itself, is usually an arduous task. Transportation to market is difficult and often must wait until a change of season. All of these factors make the reduction of post-harvest losses a potentially profitable activity. In short, once a product is harvested it makes sense to ensure that as much of it as possible can be sold. To the extent that the product can be sold for a longer period of time it will generally not only command a higher price during the "off" season, it will also raise or at the very least stabilize the price during the peak period of availability. (Most forest residents are offered very low prices for their product during periods of peak production.) To date, little time or energy has been invested in reducing post harvest losses.

The Brazil nut illustrates the point. Little is known, for example, about how to store Brazil nuts in the forest during the rainy season before they are transported to market. (What are the best storage facilities? Should they be elevated? Should they be thatched roofed, slat sided, etc? Should the nuts be picked up as soon as they fall of the trees, or is it better to leave them in the large canister on the forest floor until they can be sold?)

Once the nuts are sold to traders, they are traditionally shipped from the Western Amazon by open barge to Manaus or Belem where they are shelled and packaged for export. On these journeys, 25 to 35 percent of the nuts rot. Certainly covering the barges or, better still, processing the nuts closer to the forests would reduce the post-harvest losses and make financial sense.

The ways to reduce post-harvest loss should be examined for each commodity (PP #11). This information can be gathered in the commodity specific market research suggested below. (It should be noted, however, that such losses, often give the appearance of being value added, because they force the price up at the next market stage, e.g. processing in Belem.)

Upgrading/Enriching With More Valuable Species

As market demand for NTFPs increases, collectors will certainly seek out the more valuable species, depending on what is being harvested and how, potentially threatening their survival. (This is why linking markets to the monitoring of sustainability of harvesting rates is so important.) One way to take advantage of increased demand and stimulate overall production would be to increase the density of the species in the forest (PP #12). For example, instead of having two Brazil nut trees per hectare, there could be four. Such upgrading (along with value-added local processing) might be the only way for forest residents to continue to compete in international markets: by producing such commodities as Brazil nuts in plantation or even agroforestry systems.

Yet if such upgrading takes place, what happens to the forest? Again, the problem must be explored on a commodity-by-commodity basis. Doubling the number of Brazil nut trees would affect the overall forest canopy; increasing understory species, on the other hand, would not. Increasing the density of any species would have an impact, of course, but forests are always in a state of change, and people have long modified them. This is why zoning is so important. Perhaps intensification of species should only be supported or even encouraged in areas less rich in biodiversity. Depending on the research, then, upgrading strategies might usefully be restricted to certain zones (PP #13).

Another way to upgrade forests in certain areas would be to produce valuable species rather intensively in the undercanopy (PP #14). For example, technology exists today to propagate orchids by seed in sterile labs. Each plant can produce up to 100,000 seedlings from a single pod, depending on the species. After six months of growth in an agar/banana mixture under sterile conditions, the plants can be transferred outside. In this case, the forest could become a "greenhouse" in which orchids could grow for another two to three years and then be exported as cut flowers (flowers last 30 days when refrigerated and they travel well and could be air freighted out of cities near most forests), plants (they could become the preferred house plant of the 1990s), or essential oils (until the turn of the century, they were some of the most common essences in high-quality perfumes). This technique would also allow for the return of orchids from botanical gardens or private collections in the North to the regions from which they have become extinct.

Since vanilla is a member of the orchid family, it is likely that such techniques would allow for the selection of specific flavor profiles so that they could be produced in great numbers. This would reduce the price of all-natural vanilla, and especially the price of the highest quality vanilla from Madagascar (currently priced at $32 to $35 per pound). The new technology also would raise the overall quality of natural vanilla while increasing production tremendously. In fact, natural vanilla could regain some of the 90 percent of the market that it has lost to artificial vanilla.

Such systems could generate considerable income and employment at the local level while disturbing only small areas of forest. They would have the added advantage of introducing <u>in situ</u> propagation of rare or nearly extinct species. They would also reduce the energy-inefficient method of growing orchids in the North during the winter. Such labs could become the bases for genetic research, too.

Sterile labs, from which orchids could be produced, cost from $30 M to $50 M to build. Any additional equipment for other genetic research would, of course, raise the costs: personnel, supplies, and training would push the price up to $100 M or even $150 M for the original prototype (PP #15). (While private companies might be willing to invest in such ventures, it is not clear that they would want the prototype to be replicated by others or if they would even be interested in allowing the system to generate significant earnings for local forest residents, therey making the system a tool in retaining biodiversity in the region.) The price for subsequent labs, however, would decrease substantially and should be covered with loans with a three-year grace on interest and principle and a seven to ten year payback. In order to be traded globally, however, live orchids would have to have a new label that would exempt them from the CITES conventions on trade of endangered species (PP #16).

<u>Transport</u>

The development of markets for sustainably harvested commodities and the destruction of the rain forests, ironically, both depend on the same thing: improved transport systems. This usually means the construction of roads. Anyone familar with the Amazon has seen the satellite photos clearly documenting the impacts of road building or subsequent paving. Often the roads are built for a specific short-term purpose--oil or mineral exploration, surveys, and so on. Yet each year the deforestation creeps out further from the roads' radius as new feeder roads expose more and more forests to chainsaws.

Forest residents have long realized that roads are both their salvation and their demise. Unfortunately, roads make land too cheap; not valuable enough to protect. They make the supplies of land seem limitless so few invest in relatively more expensive conservation practices when it is simpler to simply move a few more miles down a road.

Roads also represent another kind of market freedom, however. In the past, every commodity traded in the Amazon was monopolized regionally by elites who controlled river transport, usually by ruling through violence the mouth of a river system. Without roads these monopolies would continue. However, if roads are built before land rights for forest residents are established, long-term residents are inevitably pushed aside in the rush of colonists, rich and poor alike. Rubbertappers in Xapuri now use river transport to export their nuts to the US even though only three years ago when CSE began to trade in the region, it was assumed that the large Brazil-nut trading monopoly in Belem was able to prevent "unauthorized" exports.

Although large roads are now inevitable, the alternative transport systems in the Amazon should not be overlooked (PP #17). River transport can surely regain some of its importance once the river trading monopolies are broken, land rights to large indigenous and extractive areas are guaranteed, and the high cost of constructing and maintaining roads and moving commodities by truck are better understood. River transport, though slow and in some cases seasonal as water levels drop, is far more effecient than overland transport. What is needed are good economic studies to determine which commodities would benefit most from investements in which types of riverine transport systems.

Another form of transport, blimps, should also be examined carefully as a nondestructive means of transporting goods out of and into inaccessible areas. The most common (thereby being the ones that are more cheaply produced and whose performance is better documented) manned blimps have been used by the US Navy. There are hundreds in existence that have carrying capacities varying from a few hundred pounds to 3,000 or so, excluding the pilot.

Recently a diverse group (composed of pilots, physicists, environmentalisms, airship designers and commodity traders) brought together by the MacArthur Foundation looked into the viability of using blimps to selectively harvest tropical hardwoods from inaccessible rain forests. It was assumed that many of these areas would eventually be logged through more destructive and less economically viable road building and clear-cutting or skidder trail systems. There are a number of environmental problems connected with the idea of using blimps for logging. Why, for instance, should environmentalists or anyone concerned with saving biodiversity want to help develop a system for logging old growth from the most inaccessible regions on the planet? Wouldn't this merely help increase trade in tropical timber under the guise of environmentalism without directly addressing issues of sustainable harvesting of timber?

Leaving the environmental issue of using blimps for old-growth logging aside for a moment, existing blimp designs simply do not have the thrust to lift logs that weigh an average of five tons (five cubic meters). Even if blimps could be designed with enough capacity for a five ton payload, the current price of mahogany or cedar in most of South America ranges from US$6 to US$30 per cubic meter (about 1 ton), a value that comes to only .3 to 1.5 cents per pound. Further complicating the issue is the fact that a blimp that would have such a capacity would cost at least two to three times the current $1 MM price tag and would take years to develop.

The idea of the blimp as the work horse of the rain forest still has merit, however--just not for logging. NTFPs have much higher per-pound values than even the most expensive tropical hardwoods. Furthermore, they occur in much smaller units. Brazil nuts in the shell, for example, are worth from 3 to 10 cents per pound depending on their distance to the shelling plant. If they were shelled in the forest prior to transport, they would increase in value to 30 to 40 cents per pound. Copaiba and patua oils are about $1.00 per pound. Andiroba oil is worth about 50 cents per pound. Vanilla from the western Amazon is worth $5.00 per pound. Cupuacu is worth about 40 cents per pound (and both seed and pulp can be sold). Handicrafts would range from $1.00 to $100 per pound. Even ecotourists or birders are worth 15 to 20 cents per pound per hour. (According to tour guides, blimps could be kept busy during the dry season at a rate of $200 per person for a group of six plus guide, on a four-hour trip.)

Blimps with a payload of 1,000 to 3,000 pounds now cost about $1 MM. With a cruise speed of 30 mph and a top speed of 45 to 50, they could easily serve an area of 100 to 500 square miles depending on the quantity of goods being harvested. Initially, they could be an ideal complement to either extractive reserves or Indian areas. It would take an additional $500 M to set up the hangar, get the blimp on site, and have it operational. Annual operating expenses thereafter would be under $500 M, however, and the blimp would have a life of about ten years. The price of the blimp and the set-up could be halved if the system appears to be economical and if an order for 20 or so could be placed (PP #18). (Of course, as with Brazil nuts and andiroba and patua oil, local processing in the forest would make the per-pound value of commodities much higher. The cost of decentralized processing is discussed on a commodity-by-commodity basis elsewhere in this report.)

It would cost $50 M to research the viability of a blimp and to produce a business plan (PP #19). No more than half of the funding would need to be provided by AID; it would be easy to secure matching grants for the remainder. If the plan works, the first blimp would cost approximately $2 MM. Such a project should be funded with grants. After two years it would be possible to evaluate the program and proceed to lend money for subsequent blimps. Of course, the business strategy would have to be written as if the first project were a $2 MM loan with 10% interest paid back over ten years. It is likely that the money could be obtained directly by a groups in the form of a program related investment (PRI) at 5% or through another NGO at about 10%.

<u>Chemical Analyses and Health and Safety Information</u>

The main impediment to the entry of NTFPs into the personal care products market is the lack of readily available health and safety data and chemical analyses. Manufacturers of soaps and shampoos, for example, are required in the US and England to have documented evidence that the products they use in manufacturing are safe for human use. In fact, the requirements are as strict for anything that goes on the skin (since it is porous) as for products that go into the body. Without health and safety data, NTFPs cannot be used. Although documentation of past use in the country of origin can supply important background, it is not sufficient to clear the product for use.

CSE has had numerous problems with this particular issue. While we are convinced that much of the health and safety information needed by manufacturers already exists, it is not readily available. It is only found in obscure or private sources. Much of this data probably was compiled during the heyday of the trade in NTFPs from 1880 to 1930. Even though the scientific techniques were less precise at that time, the information could be very useful nonetheless. Much of this data, probably stored in the old Brazilian Oil Institute library, has been lost since the library was split up in the early 1950s. A number of Brazilian government agencies probably have information on specific products, too, but no one has had the time or money needed to collect all the data in a comprehensive way. Likewise, Brazilian industries, research institutes, and individual scientists certainly must have much of the data, but no one has been able to pry it out of them. All in all, it would probably cost about $100 M to collect the existing health and safety data on the most promising 50 to 75 oils, essential oils, and essences for the personal care industry (PP #20). Once that research is completed, it would become clear what additional studies would need to be undertaken.

In addition to health and safety data, industries must know the standard chemical properties for each product as well as the acceptable ranges within and between categories (e.g., types of oils contained, where the fit on the carbon change, vitamins, proteins, water, ash). These are also the guidelines that are used to determine if a product has been diluted or otherwise contaminated. Often a number of varieties of a single oil might exist (there are more than 30 varieties of copaiba in the Amazon, for example), so it is important to know the variety being recieved and/or the range for that or all varieties. Full yet basic chemical analyses could cost up to $1 M per sample (PP #21). More than one sample of each commodity from each region where it grows would have to be analyzed in order to generate baseline data. The total cost would depend upon the number of commodities analyzed as well their overall distribution and the total number of varieties.

<u>Commodity Marketing Systems</u>

In order to understand how to best generate income for forest residents and other local producers, research must be undertaken on each potential commodity to determine the bottlenecks in the current system and the point where value can best be returned to producers (PP #22). Each commodity has a different production and marketing system. Copaiba oil is different from andiroba or babassu oil, and they are all different from Brazil nuts, cupuassu fruit, or honey. Traditionally each product has its own set of producers, traders, marketers, and processors. Gathering such information is essential to determine where to intercede in the system so that more value can be added closer to the forest. With this information, we can determine when it is possible for local producers or harvesters to process their products and when it is not worth the risk or capital investment, or when local groups do not have the skills.

Brazil nuts illustrate the point. In 1989, collectors were paid up to two to three percent of the New York value of their nuts. (Some were not paid cash at all, but instead they kept in a constant state of indebtedness--a company store system--by local traders.) Transporting their nuts to the regional market center would double the value. Shelling the nuts for export would allow collectors to earn as much as 20 to 40 times the in-forest value, because it adds value while reducing transport costs (shelled nuts are only one-third the weight and volume). In some instances only local shelling makes it even an option to sell Brazil nuts which in the shell are not worth the transport costs (at this time, it is estimated that only about half of the areas with Brazil nuts can be profitably harvested). Turning nuts into oil would double or even triple the shelled nut values. And so it goes. These are the types of data needed for each commodity.

Of course, this is just one commodity. Another--or rather, a better--way to increase the economic viability of extractive economies is to diversify production and sources of income (PP #23). Although this cannot be done overnight, each commodity can generate some of the money required to diversify income sources. For example, the export of Brazil nuts can be used to guarantee a loan to purchase equipment for processing a higher, more valuable grade of rubber, even though the rubber will only be marketed within Brazil. Copaiba, cupuassu, vanilla, tagua, and other products can be added to the mix. Groups should strive to be less dependent on single products or purchasers, but such a strategy makes more sense on a regional basis rather than the level of an individual producer.

Processing and Technology Transfer/Development

One of the ways in which local groups can benefit from the sale of NTFPs is to add value locally. (The section "Processing and Value Added Initiatives" explores some of these issues commodity by commodity.) Here I will explore some of the more general principles to be considered when thinking about investments in value-added initiatives.

In every instance, attempts should be made to determine ways to add value locally. In general, processing should be done to reduce post-harvest losses, reduce the weight and volume of raw products, increase their standardization, and guarantee consistent quality and acceptability into multiple markets. In general, local value added should increase the ability of NTFPs to enter multiple markets rather than restrict the number of markets that would accept them due to overprocessing.

Efforts to add value locally should not have built-in subsidies (PP #24). While it may be acceptable to subsidize processing in the short term, in the long term plans would have to show that the subsidies would be eliminated or else such programs would not be options in the real world. Nor should programs to add value be ecologically unsound. For example, what is gained through sawing tropical timber locally if it is done so inefficiently that more trees must be harvested? Why not leave the processing to the most efficient processors? Or, why not invest in more efficient local plants?

Whether or not it makes sense to add value locally is a complex decision. Such decisions about if it is appropriate to add value, how much value should be added, or when it is time to add value vary widely from group to group, commodity to commodity and region to region. The types of questions that should be considered when making such decisions include the following. What is the volume of the commodity in question? What is the seasonality of production? Could the facilities to add value be used in other ways during the off season? Is capital readily available? Is there sufficient labor? Would local people know how to manage a plant both in technical and financial terms? What are the easiest ways to add the most value? Which forms of processing open the product to a wider market? Which forms restrict its markets? Which forms of adding value expose the producers to unnecessary risks?

Although adding value locally is important, with the exception of crafts and houseplants, attempting to produce end-user commodities is probably not a good idea. Rarely does an area have on hand the different ingredients that would be required. Furthermore, manufacturing takes energy and often results in products that are larger and less efficiently transported than either raw materials or semiprocessed goods. Thus end products would require shipping not just the product, but the air and packaging, great distances at energy costs that could not justify the political impetus for local manufacture.

Initially, at least, groups should focus their efforts on production and sale in larger units. Quickly these efforts can be expanded into processing commodities into higher value, more efficiently transported commodities (e.g. shelled Brazil nuts, expelled oil, frozen fruit pulp. In fact, processing raw materials into more efficiently shipped, widely acceptable commodities generates considerable employment in its own right while allowing the commodities to penetrate more diverse markets.

Existing Cultivars

One of the concerns about the loss of biodiversity in areas such as the Amazon must certainly be related to the fact that at least part of the diversity being lost has economic potential. In some cases (cacao, rubber) the economic potential of former rainforest plants has been realized, but to assure production, _in situ_ gene banks must be preserved (PP #25a). In other instances, although the potential has been realized, the contribution of maintaining biodiversity in the Amazon may be less well identified. For example, cassava is the second most important root crop globally after the potato. Pineapple, which is from the Amazon, is one of the most important tropical fruits today. Timbo is the source of rotenone, a natural insecticide. Annatto/urucum and guarana are both important Amazonian products that are now mostly produced in monocrop plantation agricultural systems.

The continued existence of species variation in the wild will afford plant breeders a better chance of creating new disease-resistant strains for cultivation. Our history with domestication in general clearly shows that new diseases will attack the strains that we depend upon today. To put it more succinctly, a world without rain forests will surely be a world without chocolate. Regions identified for _in situ_ genetic conservation should definitely include the areas with the greatest number of plant varieties with known economic value (as described above), as well as those with the greatest economic potential (as described in the following section and in the section titled "Processing and Value Added Initiatives").

Pioneer Cultivars

Another aspect of undeveloped economic potential is in crops that are not yet utilized economically, or at least that are not produced for the market economy. This statement appears to contradict lesson number two which states that emphasis should be placed on commodities that are already marketed. This is suggestion is included here as a mid- to long-term goal. This focus is included here for three reasons. First, communities already have considerable experience producing these crops even if it is only for their own subsistence or local trade. Second, it is inevitable that some of the most promising of the currently traded commodities will eventually be produced on plantations and make it difficult at least in some instances for forest residents to compete. Finally, we need to continue to seach for crops that are better suited to the Amazon and that have incredible market potential.

One example illustrates the point. There is a palm fruit that is consumed by a number of indigenous groups in northern Brazil. The fruit is buried in the ground where it ages and ends up tasting like a cross between Saga and blue cheese. However, this is not a dairy product. It is a plant derived product that could be valuable enough to be the equivalent of rainforest caviar. Depending upon availability it could also be included in dressings, potato chips, etc.

The important list of Amazonian cultivars that have already found their way around the world is quite important, but it is merely a tiny fraction of what has already been domesticated by Indians and used by them and peasants throughout the region. There are about a dozen domesticated fruit crops in Amazonia and another 40 or 50 that have been or still are cultivated by Indians and peasants. A half dozen vegetable and root crops have been domesticated. Five to ten local nut species are similar to Brazil nuts and considered by many to be superior in quality. Up to 20 palms offer fruit with widely varying oil characteristics. Each Indian tribe has from 20 to 50 medicinal plants that have not been adequately screened for use in modern pharmacology. Numerous Amazonian plants have compounds that act as insecticides, fungicides, and preservatives.

Many rainforest species offer tremendous potential as both income and food sources for forest residents, not to mention for countries as a whole. Most Third World countries face the problem of feeding growing populations on shrinking per capita land bases. Amazonian countries are no exception. The problem, however, is that the crops being depended upon today in these countries, as well as the systems of land management, are imported, and are not well suited to the Amazon. What is often forgotten is that the immense biodiversity of the Amazon also includes large numbers of crop pests and diseases. There are, however, indigenous species and cultivation practices that not only produce high yields but also reduce overall dependence on chemical fertilizers as well as risks posed by insect and weed pests. More research would explore the possibility of isolating these pioneer cultivar species to make them part of the solution to the local population's food and income needs.

EMBRAPA has recently recognized that Amazonian agricultural development must include extractivism, forest management, and agroforestry, all unconventional practices more oriented toward the conservation of biodiversity than conventional development approaches. To make the production of marketable crops work within this framework, we will need new crops not just than the five well-studied perennial plantation options--rubber, oil palm, black pepper, cacao, and coffee.

Each of the five species currently produced in plantations has serious problems. Rubber is susceptible to blights when produced in plantations in the Amazon. It is not known how densely forests can be enriched with rubber before blight become a problem. Likewise, cacao is susceptible to witches broom and a new disease that attacks the pod. There are some 100,000 hectares planted in the Amazon. Most of the plantings are in large holdings and the owners are not willing to pay the necessary labor costs to maintain the plantations in a disease free state. The 200,000 hectares of coffee in the Amazon, mostly in Rondonia, are productive for only eight years. Black pepper produces for six years and then must be planted in a different area. It can never be replanted again in the same place.

Research must be undertaken to identify new species with economic potential and to initiate domesticating those most likely to have markets in the short and mid terms. In addition to strengthening work at existing institutes, an extractive/rainforest institute should be established to coordinate all research efforts (see also, for example, the section below, "Institution Building"). Capacity would have to be developed to improve the identified pioneer cultivars genetically, agronomically, and technologically for local agricultural and environmental conditions as well as for national and international markets. It is this scientific capacity that is a major limiting factor to the agroforestry development of the Amazon.

Specifically, the work on pioneer cultivars would include:

1. Producing a data base on Amazonian species (PP #25b), including historic and ethnobotanical uses as well as current research, experiments and field trials being undertaken by Indians, rubbertappers and caboclos/ribeirinos, which would result in the regular publication of compendiums on major groups of species (e.g., fruit, nut, root, vegetable, oil, essential oil, gum/resin/latex, medicinal, timber);

2. Evaluating the market potential of specific species and major species groups to establish priorities (PP #26);

3. Collecting, characterizing (including nutritive, chemical, and technical analyses), evaluating and conserving germplasm of priority species both _in situ_ and _ex situ_ (PP #27);

4. Developing propagation techniques for each priority species (PP #28);

5. Producing extension materials on new "crops" for forest residents, farmers, processors, and businesses (PP #29); and

6. Selecting outstanding germplasm of priority species to distribute to growers and for continued improvement (PP #30).

Such research would require an overall investment of tens, if not hundreds, of millions of dollars. A research institute could begin, however, with a specific focus. Income could be generated through selling information to businesses. Many of the projects identified in this report could be subsumed under the institute's overall activities, or the activities could be funded elsewhere but be utilized by the institute.

Land and Resource Rights, Zoning and Mapping

Clear land and resource rights for forest residents are essential first steps toward conserving biodiversity in the Amazon. There are three specific areas that deserve attention. First clear titling for those areas that are most densely occupied by traditional forest residents and new migrants (e.g. Indians, rubbertappers, caboclos, long-term peasant populations and recent colonists). Who are the groups? What are the areas? What are their rights (PP #31)? Such titles could take many forms including Indian areas, extractive reserves, or individual titles. In those areas where groups have only use rights (e.g. extractive reserves) clearly spelling out who has access to the resources, which resources can be used, and over what period of time is extremely important.

The second area of importance is to determine the regions in the Amazon with sufficient biodiversity to warrant protection either in the form of limited access or restricted economic use (PP #32). This issue will be particularly difficult if an area is already occupied. Then special efforts must be made to assist local groups meet their economic needs by having only a limited impact on the environment. This type of zoning will be extremely important in conserving the biodiversity of the Amazon.

The third important area is the identification of regions that have already been colonized and degraded (PP #33). Work on these areas should focus on titling and identification of resource management strategies to use the remaining forests sustainably while investing in programs to reclaim degraded areas. The point is to fix the colonists on this area so that they will not move on to another area and degrade it. Evidence from Para and Rondonia indicates that many colonists are already extracting resources from the remaining forests in their areas. What resources are they collecting? Could their efforts be assisted, e.g. by investing in transportation or processing systems, assisting colonists to learn better harvesting techniques, providing seedlings of valuable tree species, or creating markets (PP #34).

The physical act of delimiting and subsequently demarcating lands whether for individual or communal title would be greatly enhanced through the use of existing computer technology. At present two mapping efforts in Brazil are assisting Indians and rubbertappers to scan into computers (digitalize) all existing information about border coordinates. This not only allows individuals on the ground to use hand held locators to determine and mark precise boundaries (within 1 meter); it also allows satellite images to be scanned in order to determine where the boundaries are being illegally invaded by ranchers, colonists and gold miners. The large computer systems with scanning and mapping capacity would cost about $200,000 to set up and operate. The hand help locators cost less than $5,000 each. Demarcation of lands with up-to-date computer technology instead of traditional surveying technology would reduce demarcation costs by half (PP #35).

Inventories of biodiversity (PP #36) can be conducted using the same hand held locators which then store the data in a memory bank which can be dumped into a computer at the end of each day. Eventually, data from such on the ground systems can be used by computers to see what the inventoried plot looks like from the air and then do comuputer extrapolations from that area to neighboring ones. While this system would become more accurate over time, even in the beginning it could be a very useful tool for identifying regions to be zoned either due to their overall biodiversity or their potential economic interest.

Impact of Non-Sustainable Economic Activities

Most of those who dismiss the economic potential of extractive economies in the Amazon to develop sustainable sources of income for forest residents do so without ever examining critically the negative environmental impact of Amazonian development activities such as mining, logging, hydro-electric dams, colonization/farming, ranching or large-scale plantation agriculture. The relative value of extractivism can be better understood only if we understand the long term economic costs of the various types of environmental degradation associated with most traditional development programs in the Amazon today--water polution (soil, chemical and heavy metal--the 600,000 gold miners in the Amazon produce 8% of the mercury released into the Earth's atmosphere each year and have already contaminated some of the major tributaries of the Amazon), declining soil fertility and eventual abandonment of huge areas used inappropriately for agriculture and ranching, increases in malaria and other still-water born diseases associated with mining and colonization, loss of biodiversity, and the release of carbon (while Brazil does not release as much carbon as the US per year, recent research indicates that the average colonist in the Amazon produces more carbon than any other identifiable group on the planet).

It would cost no more than $100,000 to assess the state of knowledge regarding the economic costs of environmental degradation and to identify additional research projects which focussed on the economic costs of water contamination and stagnation, atmospheric pollution and climate change, loss of documentably valuable economic species, the loss of biodiversity, the reclamation of degraded areas (PP #37).

Institution Building

If sustainable income-generating programs are to become a viable reality in the Amazon, considerable investment must be made to strengthen existing institutions and/or to create new capacities for currently unmet needs. This section addresses needs that CS has identified in research libraries, financial analysis and planning, disemination of information, assessing and strengthening local organizational capacity, and perhaps the creation of a regional, internationally funded institute.

Libraries

The financial and administrative state of research institutes in the Amazon is atrocious. At INPA (National Institute for Amazonian Studies), for example, staff receive meager salaries, and no money exists for research, field trials, equipment, and even phone calls. Researchers must bring their own paper and ink cartridges to the photocopiers.

Nowhere is the lack of funding more evident than in the research libraries in the Amazon. Many of the holdings, particularly unpulished articles and reports are not even catalogued, and none are computerized. Libraries do not have the money to subscribe to even the limited number of journals that they carried ten or twenty years ago, and none carry new journals. What this means is that researchers outside of the Amazon often do not know about unpublished research results, and researchers in the Amazon know little about the published findings of their peers who have done research in the region or in other parts of the world. Each group ends up duplicating the research efforts of others, but not in any replicable way.

According to the head librarian at INPA (the National Institute of Amazonian Research), it would cost about $500 M for a computer system that would join Manaus and Belem with the existing system in Rio de Janeiro (PP #38). It would probably cost another $500 M to enter all the data from the existing INPA and Museu Goeldi (Belem) libraries (PP #39). An additional $500 M or so per year on top of that would bring the two research institutes' libraries up to date and keep them that way (PP #40). Funding for this particular project would be an ideal candidate for a debt swap, where part of the money could be used up front to purchase equipment and the rest put into an inflation-corrected endowment to generate the $500 M to $1 MM annually to maintain and update the libraries.

Foreign and domestic researchers should be required to send copies of all published findings and unpublished reports to Amazonian research institutes as a condition of their funding and/or research permits or visas. The question of who owns research paid for with public funds is an interesting one. In the 1980s, a group of INPA scientists received a grant to buy equipment and conduct research on some 50 essential oils in the Amazon. The director of the program subsequently moved to the Museu Goeldi, taking all the research data with him. Not only has the information not been published, it has not been made available to interested researchers, forest groups, development agencies or companies. Furthermore, the former director of the project is now attempting to sell the data as well as essential oil samples to the highest bidder, usually a perfume or personal care company. This type of situation must be prevented in future.

Scholars in the US and Europe should be encouraged to donate year old journals to Third World research institutes either directly or through associations such as AAAS (PP #41).

Financial Analyses/Planning

There is not a single organization in the Amazon--be it a small, forest-based group or the region's largest institution--that could not benefit from better financial analysis and planning. On one extreme, probably no more than 50 Indians in the Amazon can balance a checkbook. The training that they need to enter the market economy on their own terms is considerable. Groups like rubbertappers and peasants, both of whom are in the region for economic or market reasons, are much more likely to have better basic financial skills, but they cannot yet manage processing plants, revolving credit funds, or even complicated grant reporting on their own.

In the past, the tendency has been to provide consultants or specialists who consult with groups and provide on-the-spot training with follow-up visits. This has not worked well. Groups that need such basic training need full time employees. These people can then train their local counterparts/replacements in on-the-job training programs that cover every day decisions, not just the text book cases.

Other groups should be encouraged or required (as a condition of loans or grants) to hire outsiders to undertake their financial management and planning (PP #42). Perhaps a single institution could be identified and supported to provide this assistance to a number of groups (PP #43). While having outsiders involved to this extent with local project development might be a difficult political bone to swallow for some groups, it would give them a better chance of succeeding, whether they were trying to manage a Brazil nut shelling plant or a revolving fund to purchase rubber from members and sell merchandise back to them. To date, no institution in Brazil is fulfilling this role (most NGOs, in fact, could benefit from such expertise); few could do it even if they were willing to take on the staff.

This problem is not just restricted to local community organizations. The National Institute for Amazonian Studies (INPA) is a mess. The Technical Assistance Foundation of Acre (FUNTAC) is not much better. These groups need training in how to obtain funding and how to manage funds. Debt for endowment funding would be a godsend to most of these institutions; without better financial management in house, however, the funds will not stretch as far as they should. Learning to sell their results to interested parties would also put Amazonian institutes on the right track. Learning to leverage grants from one funder with those of another would increase their viability. Developing government-approved mechanisms to facilitate the use of debt swaps (see discussion below), or at the very least blue chip swaps to bring hard currency into the country, would increase their funding from 25 to 100 percent per transaction. Perhaps one financially savvy, imaginative individual, working closely with the director of each institute, would serve as a great way to financially support such groups in the medium and long terms.

Disseminating Information

One of the main bottlenecks to communication in this region is that so much of the information generated in or about the Amazon is never widely distributed. Nowhere is this more true than in the marketing system where the monopolization of information is an essential step toward the monopolization of trade. Few forest residents have any idea what the items they sell are worth in the next town much less in Manaus, Belem or New York. One way to get around this would be to distribute basic data to every newspaper and radio station in the region for commonly traded commodities. This would cost about $100,000 anually to set up a small office to make this information to the press and to the radio and television stations in the region (PP #44). Such information would return many times that investment to forest residents in the form of higher values for the commodities that they sell. Eventually, the office could also be used to prepare programs on sustainable harvesting techniques, or ways to reduce post harvest losses of NTFPs.

In a similar vein, information on plant or product inventories, new project initiatives, basic research, existing or potential markets, or commodity values never circulates. More importantly, there is no one place to turn to find everything. Well staffed and organized libraries, as discussed above, could function as a repository for such information. Increasingly, however, this information needs to get into the hands of local people--Indians, rubbertappers, peasants, or colonists--who, in fact, probably already undertake more than 95% of the field trials in the region.

Local Organization Capacity

There is now considerable experience in the Amazon with local, grassroots organizing and development. It would be good to reflect on what has been done and what might be learned from it (PP #45). For example, what are the experiences of Indian, rubbertapper and peasant organizations? What is to be learned from the religious organizing of the past 30 years or union work earlier in the century and since the political opening since the end of the military dictatorship? What are the differences between the experiences with Indians and peasants, small farmers and rubbertappers, and Indians and rubbertappers. If such a project is too large to undertake, maybe the Western Amazon could be the focus or even Acre. Clearly, however, the capacity of local groups to undertake or at least oversee their own development programs will vary tremendously from group to group and region to region. Without understanding what the present capacity is a lot of money could be wasted on inappropriate programs. At the very least, such research could indicate what alternative development schemes are currently under consideration or are already being undertaken (PP #46).

Amazon Ecosystem Institute

Given the importance of the greater Amazon (e.g., the entire ecosystem, not just what is in Brazil) to global warming and climate change, biodiversity and fresh water, it would make sense to set up an institute, or build on an existing one, that would serve the Amazon, extractivism, and rain forests much as the rice, potato, corn, cereal, manioc/cassava or livestock institutes serve specific commodities. The institute could concentrate on many of the topics outlined in this report (see, in particular, the section "Pioneer Cultivars"), but specific details would have to be worked out in conjunction with government officials, forest residents, researchers, and other end users of the information. This multi-million dollar investment would only work if several bilateral and multilateral agencies supported it. It would probably cost approximately $5 MM to $10 MM million per year during the first few years (PP #47).

An important aspect of the work undertaken at the institute would be to focus on resource economics. Classical and neo-classical economics pay little attention to "nature's" capital. Thus, resources that are not currently being used (e.g. have a market value) are consistently undervalued or not valued at all. Yet, many of these resources are finite, their misuse or degradation affects global climate as well as our response to future problems. Staff at the institute could also help to better understand the way tropical forest resources could be used sustainably.

Another important and innovative aspect of the work supported by the institute could be efforts to include the research needs of local communities in determining the problems to be addressed as well as the types of solutions considered. In order that the institute not be top down in orientation, specific links between research and development/extension would have to be considered from the outset. Perhaps a small budget could be set aside that would allow local groups to undertake their own research with Institute supervision (PP #48).

Production

AID should think carefully and strategically about which regions and which populations should benefit from its programs in the Amazon. For example, who should own the income generating infrastructure? How can local groups be included in and benefit from such investments (PP #49)? The following text presents useful guidelines for designing funding strategies to address specifically the protection of biodiversity.

Most of AID's development and production programs should concentrate on areas that are already well populated so as to prevent colonization in largely uninhabited regions. These areas would fall into two types. The first concerns areas that are currently inhabited by long-term extractivists--whether Indian, rubbertapper, or peasant. Helping these groups make a better living should be a priority knowing full well that what they see as a "decent" living has changed. In addition, the rules of the game are changing--laws, policies, markets, subsidies for pasture and agricultural alternatives to the sustainable use of forests--and this is why forests are being degraded so quickly. If forest residents cannot survive with the opportunities currently available to them they will be inclined to degrade their own areas, move to other areas and degrade them, be forced to work for others who would have them clear the forests for other purposes, or abandon their areas, not only leaving them defenseless to newcomers but also swelling the ranks of the urban unemployed in the region. Incidentally, most people in the Amazon already live in cities, and some 60 percent of them are un- or underemployed.

The other type of area that should receive considerable AID attention is the forest regions that have already been destroyed or degraded by recent colonists (PP #50). This type of region is important for three reasons. First, the area will not support agriculture or livestock in the mid to long term. It is imperative to get as many of these areas as possible back into tree crops before the soils become permanently degraded. Second, if we do not find a way to keep colonists in these areas by helping them make a decent living there, they will continue to migrate further into the forests, repeating their mistakes along the way. Third, whoever can institute programs that will turn a World Bank project failure (e.g., Rondonia) into a success will receive considerable attention and will have a great deal of influence in discussions on successful development programs for the region as a whole.

Whether they work with long-term residents or new colonists, programs must be tailored to the needs and skills of target beneficiaries. They all need land rights if they are to protect their resource bases in the short term, much less plant trees for some longer-term payoff. In fact, biodiversity conservation in the Amazon will not happen without land rights and land-use zoning for the entire region.

Land rights are only the first step. Land rights, whether through demarcated Indian areas, extractive reserves, or individual titles, are only token gestures unless the groups are organized to protect their rights and the legal system is prepared to hear their cases.

Even land rights and locally organized groups will not necessarily guarantee the conservation of biodiversity. There are probably no more than a handful of individuals out of the millions of people in the Amazon who want to live exactly as their parents did. Most have new wants and needs, and to fulfill them they are using resources differently--even the longtime residents Indian groups and extractivists. As they become more integrated into the market economy they need to know how to modify traditional production systems in ways that produce more for sale or trade while not degrading the resource base upon which they and future generations will depend (PP #51).

Many sections of this report address precisely these issues--adding value through transport or local processing of raw material, increasing the density of income-generating species, increasing existing markets and creating new ones, diversifying production, and so on. The important point, though, is to get beyond production in our thinking. Development programs can no longer center only on getting the product to the farm or forest gate. They also have to address the related issues of markets and value. Added value for products can lead to increased income from less overall production, thus conserving resources and also using less land, labor and capital. Adding value is also important socially. Traditionally both extractivists and their products have been looked down upon in Brazil and elsewhere. If we merely help such groups enter the market through production, they will end up in the marketplace exactly where they are in the social scheme of things--at the bottom. These people and these products can play a very important role in helping us save one of the most important ecosystems on the planet.

The market-oriented activities of forest groups and colonists both will change the forests forever. That is a fact. The forests of the Amazon cannot be preserved entirely in their natural state. Hopefully, they can be conserved--conservation through use. These forest residents, even though they use the Amazon's fragile resources, are the best hope of protecting it. But they will not be satisfied to live a life of poverty in order to insure the quality of our air or the genetic diversity that might save lives or feed others. We should work with forest groups and with recent colonists to zone the Amazon into areas of protected and restricted use, of extraction and limited clearing and agriculture, of intensively manipulated agroforestry and annual and perennial agriculture and/or livestock. We must think strategically about what is most important to zone against which kinds of uses. We could well lose the biodiversity of the region if we continue to try to save it all.

More than half of the Amazon's inhabitants are recent colonists or the descendents of those who moved into the region under the military government. No strategy to save the region's biodiversity will succeed if the needs of this group are not addressed. Many colonists in the Western Amazon, in areas like Rondonia and Acre, are attempting to live on areas that are half cleared. Many have begun to harvest NTFPs as part of their survival strategy. In those cases, programs to add value to such products could also benefit colonists. Likewise, programs to increase the density of income generating species in their remaining forests would eventually provide them with increased income as well (PP #52).

Perhaps the most important initiatives, though, would be to work with such groups to put more of their degraded areas back into perennial crops--coffee, cacao, palms of various types (PP #53). But, relatively few economic studies exist regarding the profitability of these tree crops. Without such information is is hard to determine which perennial crops should be encouraged. Emphasis should be placed on trees that produce marketable crops within a few years. Improved or state of the art processing can also help colonists who have plantings on degraded land benefit from improved market potential. For example, cacao from Rondonia is very high in quality, but is worth very little on the world market because it is so poorly processed. Better processing, then, would serve to assist colonists in making a living where they are. Incentives for such groups, however, should not focus on planting tree seedlings but on the number of trees that survive to the point of production.

Another important group in the Amazon that needs to become part of the overall effort to save the region's biodiversity is the urban poor (PP #54). If this group sees the Amazon as essential to its own survival, these people will begin to form political alliances with similar groups in rural areas. Together they can form a majority--and a potentially powerful political movement.

One way to involve the urban poor in the conservation of biodiversity, as well as in ongoing political relationships with the rural poor, is through processing NTFPs. It often makes little sense (depending, of course, on the commodity) to process forest products in the forest itself. Usually it is better to transport the NTFPs to neighboring towns or cities for processing and packaging for sale in national or international markets. One way to insure that local processing benefits both urban and rural poor is to set up the factories so that they are owned by both (PP #55). Collectors would own 50 percent, and those who work in the processing plant would own 50 percent. This agreement has the added advantage of encouraging both groups to insure that the factory be profitable.

Processing and Value-Added Initiatives for NTFPs

Virtually every product that comes from the forest is first processed within the forest as well as in nearby urban areas. Unfortunately, the value that is currently added is what makes the commodity marketable. In the sense that it could not be sold without such processing, then it adds value locally. This is true of rubber, Brazil nuts, babacu, acai and the other most commonly traded commodities. How and where additional processing could occur to add value locally will vary by commodity. Outlined below are a number of ways of adding value to different types of commodities. Each example is intended to allow the reader to understand the range of possibilities in order to think of ways to add value to products not discussed in this report. In general, strategies should serve to add value to products at many different stages of the marketing system, and to involve as many different groups in the process as possible.

Unfortunately, the implementation of these ideas could be dificult for at least three reasons. The politics of who owns the infrastucture, processing plants, etc. that are outlined will be a political issue. To the extent that states guarantee the loans they will possibly want to retain ownership. Likewise, collectors' groups are not the same as processors' groups and both might have legitimate claims to ownership. Furthermore, cooperatives or other local groups often have no history of cooperative financial endeavors. Finally, few local groups have the skills necessary to run such ventures. Thus, any investment in processing or value added initiatives will only have a chance of succeeding if issues of ownership are thought out ahead of time and if technical assistance is made available to local groups from the beginning.

Nuts

The nontimber forest product that the Amazon is perhaps best known for is the Brazil nut. Collector cooperatives which buy and then sell in large volume can increase the value of the nuts from the 2-3% of the New York price to some 10% (PP #56). The skills that are needed to run such cooperatives are the same that are needed to provide members with less expensive necessities that are purchased in bulk and then sold to members. Eventually, these skills can be used to set up and run local processing facilities which allow collectors to increase their gross revenues to some 60% of the New York price for the nuts they gather.

In 1990, CS financed the first nut shelling factory owned by nut collectors in Brazil. The initital cost of the Xapuri plant was $30 M. Subsequent modifications have brought the cost up to about $60 M. In addition to the cost of the plant, CS pays the $12 M annual salary of the plant manager and provides considerable technical assistance. Since 1990, CS has paid for technical assistance to the plant which has exceeded the financial investment in plant infrastructure. [NB: Building plants and processing facilities, regardless of the commodity produced, will often cost less than the technical and financial assistance and training that must accompany them if they are to succeed.] In 1992, the plant will become profitable for the first time if it reaches its overall production goal of 200 MT of nuts. During this time, CS has provided a total of $140 M to the plant in the form of 1-year, 10%-interest, working capital loans (PP #57).

The return on this investment is quite impressive. To date, the factory has shipped 84 MT of nuts to CS in the US and sold another 15 MT within Brazil. The factory employs some 80 people in Xapuri making it both the largest employer and the largest taxpayer in the town. The factory loses only about 10 percent of the nuts it purchases each year compared to the 25-35 percent rate of loss by commercial shellers in Manaus and Belem. Finally, the factory has increased the price paid to collectors for nuts in the shell by 40% in 1990 and 100% in 1991. Word of the doubling of the price in 1991 spread quickly in Acre, leading to other gatherers demanding the same price. Consequently, in that year alone, the price paid to collectors in the entire state increased from an estimated $600 M to $1.2 MM.

Decentralized shelling is another way to add value in the forest, reduce post harvest losses and reduce transport costs of nuts to market. Decentralized shelling systems are appealling because they cost even less than the small Xapuri-type plants and because they generate income in the forest itself. The main problem with decentralized shelling is maintaining quality control. For this reason, it is essential that a centralized facility be established with <u>each</u> decentralized system to maintain quality control and sort, dry and package for export. Provided a central processing plant exists, small groups can be brought into the system for an investment of only a few thousand dollars each (PP #58).

To date, CS has received proposals from 2 groups in Amapa, 2 in Rondonia, 2 in Para and 1 more in Acre for nut processing facilities ranging from the centralized Xapuri model to the decentralized system being experimented with in Cachoeira, Acre. CS has also been approached by 2 groups each from Bolivia and Peru. It would cost an estimated $150 M to $200 M to set up each system (PP #59). In some cases it would take a few years of buying and selling nuts in the shell in bulk before local groups would have the financial management skills necessary to run their own processing facilities, decentralized or not. Thus, the investments would not all be needed in the first few years.

<u>Oils</u>

Through the end of World War I and well into the 1920s, Brazil exported some 40 different vegetable oils from the Amazon (PP #60). Export of these oils declined precipitously with the advent of electricity (and the elimination of candles) and the extensive cultivation of corn and soybeans, which became the most commonly traded vegetable oils on the world market. During World

War II, the US and the UK pushed Brazil to encourage the collection of wild rubber in the Amazon at the expense of all other forest products. Consequently, many of the small Brazil nut shelling operations which had dominated local economies since the fall of rubber prices between 1910 and 1920 were put out of business. They were replaces by centralized Amazon-wide monopolies based in Manaus and Belem.

After World War II, Brazil made a strategic decision to abandon all attempts to use vegetable oil as the basis for its energy needs in favor of a petroleum-based approach. Until the 1950s, the Brazilian National Oil Institute and its associated library served as a clearinghouse on all information (e.g., chemical analyses, market data, export levels, distribution of species, health and safety data) relating to vegetable oils in Brazil, including those produced in the Amazon. In the 1950s the institute was dissolved and the library split up among several existing libraries, with part of its contents ending up in Rio de Janeiro's Botanical Garden library.

Today there is an increased global interest in vegetable oils, particularly those that are exotic or that can be produced without degrading the environment. Palm oil, for example, which has been embraced by a number of personal care manufacturers, has begun to lose its appeal as they realize that most palm oil is produced from plantations that have been carved out of rain forests.

The only oil in the Brazilian Amazon that can be produced in quantities sufficient for high volume trade is babacu. Today some 400,000 families in Maranhao and Para depend on babacu for most of their income during six months of the year. Babacu competes with coconut oil in Brazil for about six months of the year, but it is always at least 25 percent more expensive than palm oil. Babacu's costs come from the amount of hand labor associated with extracting the oil seed from its shell. Wages are miserably low for shellers--probably not even 25 percent of the minimum wage on average.

A prototype mechanical sheller has been developed that produces not only the oil seed, but a number of useful by-products: flour for human consumption, fiber and flour for animal rations, and the hard shell, which makes an extremely low sulphur charcoal. With only a little more development, shelling machines could be produced at about $25 M with each serving a handful of communities (PP #61). The machines would cut down on the shelling time and free family member to spend more time collecting babacu. Current estimates indicate that only 20 to 30% of all babacu is collected each year. With current prices, harvesters could collect in four hours what they spent 8 hours collecting and shelling in the past. The net effect would be to reduce labor requirements, reduce overall costs of the oil seeds, and consequently reduce the price for oil itself while increasing production. Thus, the mechanical sheller would generate employment in gathering and related industries while reducing the price of the finished product, thus making babacu more competitive in national and international markets.

Furthermore, the average babacu pod contains only 6 to 12% oil seed by weight. Some stands of naturally occuring babacu contain 23% oil seed by weight, however. It would be possible to enrich stands with seeds from such trees, but this will only happen if collectors can obtain land or collection rights to areas that they now use and if the technology is widely distributed which allows the market for babacu oil to increase.

Another way to add value and generate more income locally with babacu would be to introduce village-level oil presses, each at a cost of about $5 M to $10 M (PP #62). Such technology would more than triple the value of the product while reducing its overall weight, volume, and transportation costs. In addition, a by-product would be the cake left after pressing the seed that could provide good rations locally for chickens and pigs, thus improving the diet of local residents. Currently, the cake that is left over from expelling the oil is sold to commercial producers of livestock.

If the babacu is sustainably harvested, then all by-products would be as well. Thus, the flour for human and animal consumption, the oil seed cake and the charcoal are all sustainable products (PP #63). Sustainably harvested, low-sulfur charcoal is an extremely important product in a country that relies considerably on charcoal for cooking.

The creation of markets for babacu oil raises another interesting point, however. If its value is increased prior to having clear land titles established, a number of collectors will not benefit from those increases, and others are certain to be worse off (PP #64). Most of the areas where babacu is collected were forests that were cleared for agriculture and then turned into pasture and large landholdings. These, in turn, became degraded and their owners most often abandoned them. What has evolved is a complex system of squatters and smallholders existing side by side with large landholdings. Where large landholdings still exist, peasants sometimes can have access to collect babacu if they provide labor on a regular basis. In other cases, they are forced to sell the nuts they shell by hand back to the landowners at a fixed price. In fact, this issue is not limited to babacu oil, it is likely to be encountered in each area where products are sourced prior to the resolution of land rights issues.

One way to avoid many of these problems would be to create extractive reserves in babacu areas (PP #65). In addition to sorting out the issues of land rights in the area, such reserves could keep the peasants and squatters in the area through a recognition of their land rights and the creation of a viable livelihood. Today these areas produce as much poverty as they do babacu oil. Many of the region's poor migrate further into forested areas, cutting them as they go. These extractive reserves, then, could be an economically viable buffer zone. While babacu would not generate enough income to sustain the area's entire economy, it would be a good start. Each extractive economy needs one product with a large market that provides the income necessary to diversify the economy. Similar village-level oil presses could be set up for patua, bacuri, buriti, inaja, or muru-muru, to name but a few.

Another useful investment relating to oil processing would be to create the capacity to produce sodium laurel sulfate (SLS) from Brazilian vegetable oils (PP #66); which requires four processing steps. The equipment required to produce SLS is expensive. It would cost several million dollars. SLS (or a variant), however, is an ingredient in virtually all soft soaps (shampoos, conditioners, hand soaps), and because Brazil currently does not produce SLS, it is imported at great cost. In addition, a large international market exists for SLS if Brazil could export it.

Other Amazonian oils with potential are copaiba, andiroba, and Brazil nut oil. Copaiba and andiroba have long been exported from the region. During the 1920s, copaiba was exported primarily for the perfume industry, where it still has a steady but dwindling market. Andiroba oil reached 350 MT of exports in the 1920s; today, it is not exported, and andiroba trees are being cut for timber because they have no other value.

Harvesting each of these oils seeds or resins raises different problems. Copaiba needs to be tapped with a brace and bit, and then plugged so that it can be tapped for its entire life. However, people often cut permanently damaging holes in the trunk with axes, cutting off the trees' future bounty. Copaiba should be purchased from local organizations that teach their members how to tap copaiba sustainably.

The traditional production of andiroba oil is very labor intensive (only 1 to 2 liters per person per work day). Production of andiroba oil from the seed could be improved considerably with manual oil seed expelling machines which cost less than $5 M each. Since the oil in the seed is in a complex relationship with the solids, it is traditionally ground or pulverized and cooked prior to pressing. How exactly the processing would need to be done should be explored, but according to CSE's past work, the research would not cost more than $10 M to $15 M (PP #67). Ideally, such research would proceed by sending a ton or so of the nuts to a manufacturer of grinding and expressing machines and letting them determine the best method. (There is such a manufacturer in Vermont who has considerable experience in Africa with village-level oil extraction, but as of this time it is illegal to ship seeds out of Brazil without authorization. I do not know of an appropriate oil press manufacturer in Brazil.)

Essential Oils

Anyone who has been to the Ver-O-Peso public market in Belem becomes immediately aware of the wide number of essences and essential oils in the Amazon. With the exception of Pau Rosa, however, all pure essence extracts are imported into the region to make the personal care products that it is known for within Brazil. Some are imported from Sao Paulo, but most actually come from or via Europe. A vapor essence or essential oil extraction plant would cost about $1 MM to set up (PP #68). Research should be undertaken on the existing essence manufacturing capacity in Brazil and other Amazonian countries to determine what could be done to increase capacity and to improve the quality of production.

CSE has found that there is a huge market for essences, particularly ones that are new and exotic. The cheapest perfume that one might buy contains at least 40 essences; the more expensive ones are even more complex. Essential oils of many of the fruits in the region would find markets in soaps, shampoos, and other personal care products. Likewise, oil extracts from fruits or their seeds would also find markets (e.g., passionfruit, avocado, mango, and a whole host of more exotic, lesser known species). Companies have taken considerable interest in other seeds as well--puxuri and cumaru, for instance. Priprioca, a root crop, is also of interest, but it would need to be converted into an agricultural crop. Flowers, such as propogated orchids, and various plants could also be used to produce essential oils (PP #69).

As mentioned earlier, pau rosa is the only essential oil that is now produced for export from Brazil. A good source of linalool, which is used as a fixer by the French perfume industry, pau rosa was in such demand that it nearly depleted the species. Subsequently its production cost increases and high prices finally led to the substitution of synthetic linalool for most uses.

Part of the problem with pau rosa was that forest residents and those running the extraction facility assumed that highest levels of the essence were in the wood--you could actually smell it when splitting the wood open. So they chopped down the trees to harvest it. Research, however, has since shown that the highest concentrations of linalool are actually contained in the leaves. Harvesting can be undertaken sustainably by carefully lopping off the branches with the leaves and leaving the tree to releaf (PP #70).

Two other plants in the Amazon, sacaca and pimenta longa, are good sources of linalool, and each contains at least a hundredfold higher concentration than pau rosa. Sacaca, a bush that grows from 2 to 5 meters in height, has leaves that can be harvested after six to eight months. After drying, the leaves produce .8% essential oil by weight. The leaves of sacaca are currently dried and shipped from Manaus directly to Japan where they are processed; no value is being added in Brazil. Pimenta longa, a low-growing plant, is not currently exploited commercially. These two could be cultivated rather than harvested from the wild (PP #71).

Flours

With the exception of manioc flour, flours are not major commodities in the Amazon today. Yet markets for manioc flour could be expanded considerably and other flours could offer considerable revenues to specific groups, diversify sources of income, and make use of presently neglected products or by-products. Pupunha (peach palm) flour is quite nutritious and has been used as a food staple by indigenous peoples in the Amazon for thousands of years. There is evidence to suggest that peach palm was, in fact, the first domesticated food crop in the Americas (before corn, beans, or potatoes). (In a sixteenth century court case in Costa Rica, the King of Spain sued colonists for destroying Crown property by chopping down 20,000 peach palm trees. The colonists claimed that starvation was the only way to force the Indians to work for them.)

Peach palm (PP #72) field trials demonstrate that it produces six times as much edible fruit as corn. The ground fruit, which is also high in oils, makes excellent animal rations (corn for chickens and pigs in the region is currently trucked in from the south of the country at high energy costs). In Costa Rica there is a rapidly growing demand for peach palm flour for bread, pasta, cakes, rolls, and so on. At the very least peach palm could be used in Brazil as a highly nutritious substitute for manioc farinha, and since it is a tree crop it does not require the same clearing, planting, and digging up as manioc. [In addition to flour, peach palm also has market potential for fresh fruit and for sustainably harvested palm heart or rainforest chips made from the soft heart wood below the palm heart (about twice the volume and weight of the palm heart).]

Jatoba has long been an emergency food in the Amazon. Its large, distinctive seed pods contain a flour that is the consistency of oat flour, and is unique for its aromatic qualities (although this varies somewhat between the three species) (PP #73). Although its scent would indicate good potential in the personal care products industry, it would probably detract from its acceptability as a food product (it smells a little like carob tastes). If the seeds are collected in a timely fashion, the flour is in good condition; otherwise, it begins to mold. To sell the product in ton or container quantities, more health and safety data would have to be compiled. Despite this, there is currently market interest in the product.

Brazil nuts have long been consumed by forest peoples, generally as nuts or pounded into a milky substance to cook vegetables, fish, chicken or meat. Now CSE has begun to develop markets for Brazil nut oil. When the oil is extracted from good nuts, a highly nutritious Brazil nut cake remains (about 50% the weight of the original nut) (PP #74). The cake is about 50% protein, and when mixed with flour it could be used to make bread and pasta higher in protein than meat. (Perhaps it could be used in regional school lunch programs.) The protein in Brazil nuts also appears to be easily digested. Recent studies suggest that it is particularly good for patients undergoing chemotherapy or those with AIDS. The advantage of the cake over the whole nuts is that most oils have been removed.

Fruits

Tropical fruits, probably more than any other single food category, are associated with the Amazon in the minds of Western consumers. In addition, the tropical fruit juice category is the most rapidly expanding juice market in the US. As the US population ages, more sophisticated nonalcoholic adult drinks are developing large market niches. It is therefore odd that with all these marketing angles, there is only one functioning mechanical fruit processing plant in the entire Amazon--the factory at Tome Acu, which was built with the assistance of the Japanese government and that today exports most of its product to Japanese companies.

To date, fruit processing in the Amazon, whether by hand or machine, has consisted of freezing fruit pulp. Given the high cost of energy in freezing and high costs associated with transporting products that are mostly water, other methods of processing Amazonian fruit should be examined carefully. While frozen fruit pulp is of interest to most manufacturers, the high costs associated with transporting such products from the Amazon have deterred most companies from their initial desire to produce juices, ice creams, yogurts, and so on.

Three new technologies should be introduced in the Amazon to overcome the current problems associated with creating markets for the region's fruit. First, the method of processing frozen fruits should be changed. Instead of simply limiting processing to the fruits that have the strongest flavors (e.g., acerola and cupuassu) and thereby fetching higher prices because they can be diluted more, efforts should be focussed on processing fruit juices with higher bric concentrations (a measurement of natural sugar percentage). For example, by doubling the bric levels, we reduce the water content by half and thus the overall weight and volume by somewhat less. In short, it makes no sense to ship frozen water halfway around the world. To construct a fruit processing plant in the Amazon that could produce concentrates would cost anywhere from $1 MM to $5 MM depending on its size, volume desired, number of fruits processed simultaneously, and needed infrastructure (PP #75).

The second type of fruit processing that should be explored in the Amazon is aseptic packaging. With this technology, the fruit can be packaged without freezing it. This type of packaging would be good in combination with a fruit processing plant that produces concentrates. Aseptic packaging plants would cost from $500 M and $1 MM to set up (PP #76). This size of plant could run 24 hours per day, an especially useful framework for the short, intense fruiting season of many Amazonian species. This size plant also can produce individual containers of as large as 300 gallons (about one ton; these are the collapsable pallet containers with metal/plastic bags that are used to ship oil). By comparison, an aseptic plant that produces individual drink boxes would cost about $1 MM to build (PP #77). Neither plant requires sterile water during operation, only potable water to clean the equipment during downtime.

Aseptic packaging units have been used all over the world, even off semitrailers in China. MAPS (mobile aceptic processing systems) might be the perfect solution in the Amazon, particularly if they, the fruit processing units, and a water purification plant could be mounted on barges and floated to the sources of the fruit, rather than having the fruits, which often spoil very quickly, taken to the factory. In this scenario, it would be possible to put a container right on the same barge so that it could be filled as the fruit is processed, then taken off by crane at the dock for direct export by boat or tractor-trailer to other parts of the country.

The third form of fruit processing to look into is drying. There are ever-increasing markets for dried fruits as well as fruit leathers (dried fruit products made from pulp). The advantage of these items, too, is that they have relatively high values per weight and volume and customers are not paying to ship water. Village-level drying technology is well known. The main necessity for drying fruit is air movement rather than heat. Black plastic, plastic screens, and other inexpensive materials have revolutionized the industry. Village-level dryers financed by CSE in Honduras are capable of producing 10 to 20 tons of dried fruit per season. They cost between $5 M and $10 M to construct (PP #78). Adequately maintained systems can last ten years.

In the Amazon and its buffer areas, four fruits could be processed immediately: acai, cupuacu, camu camu, and cashew. Each of these fruits illustrate the importance of one or more of the above-described processing systems, and each represents both the problems and prospects with development and conservation in the region.

Acai is found in nearly monocrop stands, both naturally occuring and created, near the mouth of the Amazon and in varying densities along the river all the way to Bolivia. In 1990, the market for acai fruit, which was entirely domestic, was nearly $100 MM. The main market for the fruit is in Belem, where as many as 50,000 liters of unprocessed fruit are sold daily. Harvesters in the area can earn as much as US$10 to $15 per hour.

Unfortunately, the Belem market can be supplied only with fruit that is no further away than a single night's boat trip because after 24 hours the fruit spoils. Within an evening's ride of Belem, then, acai fruit is very valuable. Outside of this radius, however, acai stands are decimated and sold for palm heart. Attempts to process the fruit locally with sugar to preserve it work well technically but do not appear to be acceptable in taste for the Belem market. Developing a system to process the fruit from a much wider area would have the double advantage of reducing deforestation associated with palm heart harvesting and generating considerable income.

A floating processing plant would provide a perfect solution to the processing/transport problem (PP #79). However, simply introducing the technology without expanding the market would reduce the price currently paid to collectors, and more likely than not would make the currently productive acai areas less valuable and thus more likely to be developed for housing and vacation spots due to their proximity to the metropolitan area of Belem.

Since acai seeds that have had the hard fruit stripped from them have no problem sprouting, taking the seeds from the forest would not pose problems to the distributing the species, provided the processed seeds were dispersed in the rivers with the ebb and flow of the tides. Although areas not affected by tides could face problems from overexploitation, scattering the seeds manually in the forest would not be difficult.

Camu camu is extremely high in vitamin C (PP #80). It, too, is found in monocrop densities in vast areas of the Peruvian Amazon and could be processed in a floating processing plant. However, camu camu does not currently have a large local market. Any development of a market would increase the value of the land locally, not for destructive forms of development but for NTFPs. Furthermore, the harvesting of the seed would not pose problems to the plant's reproduction, since more than 95 percent is done through the root system.

Cupuacu represents yet a different challenge and potential for Amazon residents. A close relative of cacao, cupuacu has long been known as a source of cocoa butter, which is particularly high in white chocolate. What is of most interest about cupuacu is the distinctive flavored fruit pulp that surrounds the seeds. In addition, cupuacu also has a strong flavor; it is mixed into ice cream at a rate of one to twenty. Thus, although the fruit is expensive, a little goes a long way.

The fact that cupuacu is a valuable crop and that demand within Brazil is growing rapidly explains why so many government officials are promoting its planting and why so many forest residents, colonists, and mid-sized landowners are planting it throughout the Amazon. Unfortunately, no one is as yet actively funding processing plants or the creation of markets for the crop. While most plants begin to produce in three to five years, only one centrifugal processing plant exists to process the fruit. Most of the areas with large plantings have no processing capacity, and although the fruit will last up to a week after being harvested, it is likely that a few wealthy individuals will gain control of the processing and thus the fruit's market. This scenario is likely to keep forest residents impoverished and forests endangered. Cupuacu represents a problem typical of planting-based development programs. Too little attention is given to processing and marketing (other crops with similar problems are coffee, cacao, cashew and annatto/urucuum). A village-level processing plant would cost about $30 M; larger, regional plants could cost more than $500 M (PP #81a,b).

As mentioned above, cupuacu seeds are a good source of white chocolate (PP #82). The main problem with the fat of the seed is that its melting point is very low, meaning that chocolate made from it literally melts in your hand. The market for this cocoa fat, then, is not candy, but rather chocolate for refrigerated products (ice cream or yogurt) or for centers of filled chocolates. Cupuacu cocoa would also fetch a good price in personal care products, where the name and the exotic origin of the fruit would command premium prices.

Cashew fruit has excellent market potential, too. Cashew plants are ideal for reforestation. They grow on extremely degraded soils and they begin to produce fruit within two to three years. By-products from the cashew tree could diversify the sources of income for local peasants and colonists. For example, each year in Brazil 900,000 MT of cashew fruit are thrown away when the nuts are harvested for processing. [Dried sap from the cashew tree also has a market as a substitute for gum arabic which has an international price of more than $2,000 per pound (PP #83).] Cashew is an excellent exotic fruit for international markets. Its juice, which is high in tannic acid, could be stripped of the acid and become a white grape juice substitute as one of the major secondary fruit juice flavors. The fruit could also be dried or concentrated. Adding fruit processing capacity to nut shelling plants or in close proximity to growers would probably cost about $250 M to $500 M (PP #84).

Natural Dyes

As more and more of the world's synthetic, chemical dyes are found to be carcinogenic, manufacturers and consumers alike are turning to natural, vegetable dyes (PP #85). Two from the Amazon have long been used by indigenous peoples: annatto and genipapo. Annatto (urucuum/achiote) is now the only known red dye to be a totally safe and acceptable for foods. Currently used in ice cream, cheese, and other processed foods, it quite possibly could become more common in the personal care industry as well, in particular it can be used for red tints, blushes, lipsticks, and sunscreens. Unfortunately, like cupuacu, annatto planting has been encourged by a number of bi- and multilateral development agencies around the world. Today the market value is already declining and most of the plantings have yet to come into full production.

Genipapo is a source of black dye that was traditionally used by indigenous people throughout the Amazon to paint body designs that would last up to a month, withstanding even the most rigorous multiple baths per day that most groups undergo. While the staying power of the dye is well known, it has not yet been used as a hair dye, nor has anyone explored its potential as a vegetable-based printer's ink. Research on its properties could determine if genipapo ink would be easier to de-ink on newsprint than chemical inks. If this proved the case, then there would be tremendous demand for increased production.

Marketing

Marketing of NTFPs is not easy; nor does it just happen on its own. A considerable amount of time and money must be invested to make it happen in a way that will return the most revenues to forest residents and the countries that they live in. As in the past most development programs in the Amazon take a production oriented approach. They focus on selling into the market rather than attempting to get higher value in the market or even changing the market entirely. Because of their production orientation, many development efforts have the net effect of creating increased supply of commodities and thus reducing prices, profitability and new income to producers. A marketing orientation increases demand and value, thus allowing more product to enter the market without reducing the overall price of the commodity.

Numerous constraints and guidelines for marketing NTFPs are featured throughout this document. Some of them, however, should be underscored at this point. Each community or regional association should attempt to market a number of different products and find a number of different markets for each product. Sometimes, groups may be able to market their own products in local, regional, national, or even international markets. At other times, local groups will want to limit and specialize their marketing efforts in certain areas and turn the rest of the marketing over to another group (or groups).

As AID supports NTFP production and processing initiatives, it should insist that local groups actively consider the ultimate marketing of their goods, even if it takes years to get to that point. To be sure, such groups will probably always be able to sell their products; but if they want good markets they will have to work for them. Markets that benefit forest groups do not just emerge overnight; they are created only with considerable effort. CSE has found that it takes at least one full time staff person for every commodity that we trade. Marketing works best if that person has come on staff at least one year prior to the commencing of trade.

If Amazonian groups wish to market their own products, they will need to establish offices and warehouses in each market they intend to penetrate (e.g., the south of Brazil, New York, Europe, Japan). It would perhaps be better if many Amazonian groups worked through a single broker so as to spread the costs of such an operation over a large number of commodities. Setting up such offices will cost about $1 MM in Brazil until it becomes self-sufficient (PP #86a), and about $4 MM in the US (PP #86b) and $6 MM each in Europe (PP #86c) and Japan (PP #86d). These figures are based on CSE's past, present and anticipated costs. CSE's current five-year marketing strategy based solely in the US shows costs of $3.4 MM to be covered by grants. During the same time, the program will generate $48 MM in overall trade and $5.7 MM in grants and profit sharing to local groups. CSE grew 450% in 1990 and 350% in 1991. If CSE averages 30% growth for 20 years starting in 1990, by 2010 nearly $1 billion will be returned to forest based groups either through direct purchases, environmental premiums or profit sharing agreements each year (PP #86).

Whether or not local groups decide to open such offices on their own, the more their representatives travel to the US and Europe to view such operations and understand their workings, the more informed they will be. In the short term, Amazonian groups will be forced to market their products through others. There is simply too much to be learned about harvesting and processing at this stage without adding another whole dimension of complexity.

Thus, in the short term, at least, AID should support some of those international efforts to develop markets for NTFPs, sustainably harvested timber, or medicinals that benefit local populations. However, AID should only direct such efforts at those international NGOs or groups that guarantee to return to forest residents and national NGOs working in the Amazon 100 percent of the funds generated through licensing and environmental premium agreements with companies that use Amazon-based products and use the concept of saving rain forests as a selling tool.

Financial Mechanisms

While funds are not the primary limitation in developing programs that utilize the Amazon's resources sustainably and generate increased levels of income, certain things can be done to use all available funds more effectively. A few that we have used or learned about through the efforts of CSE are outlined here. Further research could elaborate these and new mechanisms which could result in a report to be distributed to multi- and bilateral donors, NGOs and community groups.

Loans, Not Grants, for Income-Generating Projects

Most Amazonian residents need a hand, not a handout. The high levels of grants going into the region have already made it clear that some groups are beginning to expect assistance from others as if it were their right. This is as dangerous a mentality as thinking that writing a grant proposal solves a problem. Furthermore, when groups are given grants to establish income-generating activities they do not invest as much of their own money or effort into the project to insure its success.

This is not to say that grants should not be given. In many cases a mix of loans and grants may be most appropriate. There are a number of activities that help prevent the destruction of the Amazon's biodiversity that will never pay for themselves (at least in the short term), but they are nonetheless important.

Likewise, when experimental models of income-generating projects are being developed, it is not fair to ask the potential beneficiaries to take unknown risks. By the same token, though, grants often create dependence, and have the strange effect of actually disempowering local groups. Long-term (and not so long-term) grant recipients tend to come to rely on outsiders for funds, ideas, know-how, and so on. This does not give them the confidence or the skills to think for themselves or to solve the unexpected problems that one can encounter almost every day.

Direct and Indirect Loans

AID recently lent CSE $3 MM to finance trade in NTFPs and to lend to local Amazonian producer groups. AID also lends money to Acion International for small business development in the region. In CSE's case, at least, the loan is conditional on our ability to match the loan from other sources (commercial, foundation, or individual). An AID loan mechanism could be used as a way to generate or lever much-needed investment funding in countries where interest rates for start-up companies are often in the double digits per month if they are available at all. Last year the AID loan budget was nearly eliminated by Congress. Perhaps a stronger link between the loans and biodiversity would make Congressional budget approval easier in the future.

Loans to producer groups should be made at levels matching the needs of the local group rather than what AID wants to lend. Most groups need small amounts of money. Too much money can be as much of a problem as too little. Perhaps it would be best to lend larger sums to American or Amazonian NGOs or regional banks who would then parcel the loan out to local groups. There are already a number of precidents for such loans. AID loans should be accompanied by grants for technical assistance to enable NGOs or local groups to gain the skills and establish the financial mananagement systems that they will ultimately need to make their operations viable in the long term. As a result, groups would have a better chance of repaying the loans as well as providing technical assistance to others. In addition to loan levels, interest rates, and technical assistance, grace periods and appropriate payback linkages must also be considered and established, perhaps for each group.

Loans to groups that are already exporting products or who propose to do so with loan money can be repaid through the hard currency generated by exports. To be legal, however, this might require some changes by the Brazilian government regarding the discounting of declared values on letters of credit (L/Cs).

Loan Guarantees

AID can guarantee loans for local processing equipment for village-level projects, regional fruit processing plants, or Amazon-wide essential oil extraction plants. This could be done in some countries with blocked currency (PL-480 or other); or it might also be done without any money ever leaving the US. For example, the US government could establish a fund with which it could guarantee the Bank of Brazil that it would cover 50% of that bank's loans for agreed-upon types of income-generating projects in the Amazon that protect biodiversity. The US also has considerable loan money in Puerto Rico that cannot be brought back to the US. This money might, however, be used as loan guarantees in Latin America.

Blue Chip Swaps

AID and other donors should insist that NGOs use every means available to enhance their loans or grants through such mechanisms as endowments, government or foundation matches, hard or local currency hedges. A common business transaction used to increase the value available to corportations in Third World countries is the Blue Chip Swap (BCS). NGOs should also take advantage of this mechanism whenever possible. BCSs would enable an NGO, on 24 to 48 hours' notice, to legally purchase blocked corporate assets in countries such as Brazil. During the past three years, transferring funds to Brazil through the BCS mechanism would have allowed NGOs to gain from 15 to 40% on the local currency value of their foreign exchange. The higher the local inflation, the more the gain.

Most international banks do BCS transfers on a regular basis. In some instances, however, banks will not bother with sums of less than $50 M; their fee is usually 1% of the value of the transaction. Gold is the medium that is used. Since the currency conversion occurs within seconds of the gold purchase, there is very little chance of the transaction being affected by fluctuations in the value of gold.

The funds could be transfered by a group of NGOs in the US to Brazil, and they could be transfered to a group of NGOs in Brazil. Most groups, however, receive grants and other funds from outside the country. CSE helps them by keeping their money in interest-bearing US dollar accounts, and each month we transfer it. What CSE has explored doing is making regular monthly transfers through BCSs to one group in Brazil each month. Within 24 hours that group will then wire the money to each of the other participating groups who will use it to pay monthly bills (including salaries), thereby saving them from losing money through inflation by having their money in local currency for even a few days. If such swaps are done on a regular basis, banks are willing to transfer as little as $25 M per month. In any case, monetary transfers for the construction of a processing plant or some other similarly large price-tag item can always be done by BCS without the delays of "debt for" swaps. To satisfy the political wishes of some groups, the initiator of BCSs can even choose which multinationals to work with and which to avoid.

Debt for Investment/Equity/Endowment

Debt-for-nature swaps have become one of the financial tools available to conservation NGOs to preserve biodiversity. They have even been used recently to generate hard currency for Third World students to study abroad. While there has been little use of debt swaps in Brazil to date, a major one is now in the works and the current government seems much more receptive to the idea.

It is time to move beyond the NGO debt-for-nature swap, however, if this mechanism is to become a significant part of the solution to conserving biodiversity. New debt swaps should be explored--debt for investment, debt for equity, debt for endowment. Debt for investment swaps could be used, for example, to finance the construction of nut processing plants, vegetable oil expelling and refining plants, fruit processing plants or just about any of the income generating investments described in this paper. Debt for equity swaps raise the political issue of who owns the factory, infrastructure, etc that is being financed and whether they would have voting rights. This is the classic venture capitalist strategy for gaining control of new ventures through early investments. Local groups are certainly aware of this issue, so non-voting equity could perhaps solve the problem. Transferring equity to a number of groups (e.g., various collecting groups, those working in the factories to process the goods, research institutes).

Bilateral and multilateral agencies should be involved in writing off some of their own debts, using this concession to pressure governments such as Brazil not only to permit the swaps but to accommodate some of their more innovative aspects and to make policy changes that would encourage investing in sustainable development in the Amazon. Additionally, such agencies could use this mechanism to transfer their own funds into countries. Most of the projects described in this report that I suggest should be funded with loans could be undertaken with debt swaps, and the loans could be repaid through the export of commodities or by the government which takes control of the hard currency generated by exports.

CSE currently uses the 5% environmental premiums and profit-sharing agreements that it requires of each company it sells commodities to as collateral when lending funds to forest-based groups in the Amazon, Africa, Asia, or even the US. In this instance, AID might find it easier to lend through trading NGOs, even though it might be able to better insure an advantageous debt swap.

Swaps would, after all, decrease considerably the total money (in dollars) a group would need to borrow. Swaps would also be a cheap way to create endowments for research, local institutes, or revolving credit funds, provided they could begin to be undertaken in a more timely way and could either be kept in hard currency or indexed accounts. Waiting years for loan monies does not help local producer groups. Swap created endowments would also allow a pool of venture capital to be created and maintained within developing countries.

Policy Changes

Many policy changes that would affect positively the trade in sustainably harvested forest products have already been mentioned in this report. This is the place to underscore the most important of those. AID should directly, or through its offices, lobby the US government to:

1. Adopt policies that would eliminate any import tax or duty on sustainably harvested timber, medicinals, or NTFPs;

2. Encourage Amazonian countries to also reduce or eliminate export duty or tax on the items outlined in point 1. (In the past two years, for example, Brazilian Brazil nuts are no longer competitive with Bolivian-sourced nuts because Brazil has a 16 percent export tax on its nuts. Sadly, Bolivian nuts can be exported through Brazil without being subjected to the same export tax as those produced domestically. This is the single most important factor which has contributed to the financial weakness of the largest Belem nut houses in 1991.);

3. Examine carefully its overall assistance programs to countries with Amazonian regions to insure that US policies and programs do not contribute to displacing people who will then migrate to the Amazon;

4. Recognize the importance of intellectual property rights and insure that none of its activities support the appropriation of such rights without compensation agreed upon by the US and the beneficiaries;

5. Adopt policies that would restrict AID funds from being used in forest areas already occupied by indigenous peoples unless those groups are satisfied that sufficient attention has been paid to guaranteeing their rights in those regions;

6. Help to prepare and then adopt certification guidelines for tropical hardwoods, medicinals, and NTFPs;

7. Lobby other signatories to CITES to allow products to be traded internationally that can be certified as having been produced sustainably. This would be immediately relevant for orchids, but would probably be important for other items as well;

8. Evaluate the impact of national counterpart funding (or national funds which are freed by multi- or bi-lateral funding) which is going into uneconomic and environmentally degrading programs; and

9. Develop innovative land rights or land reform mechanisms, and make AID assistance in the Amazon conditional on compliance, that recognize the contribution of forest residents to the maintenance of fragile ecosystems such as the Amazon.

Summary of Proposed Funding and Investment Opportunities

PP	Pg	Short Project Description	Est. Cost	Type Funds
1	9	NTFP Trade Histories in the Amazon	$15M	G
2	9	Survey of Sustainable Timber Extraction	$20M	G
3	9	Sustainability Guidelines/Species	$2M	G
4	10	Research RE Why People Degrade Forests	$25M	G
5	10	Reforestation in Degraded Areas	?	G
6	10	Medicinal Plant Research	?	G
7	11	Intellectual Property Rights Research	$30M	G
8	11	Lab for Medicinal and Genetic Research	$1-$5MM	G/L
9	12	Sustainability Monitoring/Species	$10M	G
10	12	Improved Harvesting Techniques Research	$5-$25M	G
11	13	Reduce Post-Harvest Losses/Species	$5M	G
12	14	Enrichment Studies	?	G
13	14	Test Enrichment Programs	?	G
14	14	Under Canopy Agroforestry Research	?	G
15	15	Sterile Lab Orchid Propogation	$50-$150M	G/L
16	15	CITES Work	?	G
17	16	Evaluation of Transportation Systems	$25M	G
18	17	Purchase and Field Trial of Blimp	$2MM	G/L
19	17	Research RE Blimp Viability	$50M	G
20	18	Health & Safety Data on Oils	$100M	G
21	18	Chemical Analysis/Sample	$1M	G
22	18	Contemporary Market System by Commodity	$5M	G
23	19	Diversification of Prod. & Income Research	?	G
24	20	Overview Research RE Adding Value Locally	$20M	G
25a	21	<u>In Situ</u> Gene Banks	$1MM	G
25b	23	Data Base on Pioneer Cultivars	$100M	G
26	23	Evaluate Markets for Pioneer Cultivars	$5M/	G
27	23	Collection and Analysis of Genetic Diversity of Pioneer Cultivars	?	G
28	23	Propogation Tech. for Pioneer Cultivars	?	G
29	23	Extension Materials on "New" Crops	$25M	G
30	23	Selection and Distribution of Germplasm	?	G
31	24	Land Rights of Forest Residents Research	$25M	G
32	24	Mapping of Biodiversity in the Amazon	?	G
33	24	Identification of Degraded Areas	$100M	G
34	24	Reseach RE Assistance to Colonists	$50M	G
35	24	Computer Mapping Technology	$250M	G
36	24	Local Inventories of Biodiversity	?	G
37	25	Economic Costs of Envt'l. Degradation	$100M	G
38	26	Library Computer for Amazon Research	$500M	G
39	26	Data Entry from Existing Institutes	$500M	G
40	26	Library Maintenance	$500M/yr	G/E
41	27	Donantion of Journals to Library	$5M/yr	G
42	27	Financial Consultants	?	G
43	27	Financial Assistance Through 1 NGO	$100M/yr	G
44	28	Dissemination of Information	$100M/yr	G
45	28	Lessons from Past Local Devt. Programs	$40M	G
46	29	Inventory of Current Local Devt. Programs	$40M	G

PP	Pg	Short Project Description	Est. Cost	Type Funds
47	29	Amazon Ecosystem Institute	$5-$10MM/yr	G
48	29	Research By Communities (AEI Supervised)	$100/yr	G
49	30	Research RE Ownership of Proc. Facilities	$25M	G
50	30	Research on Programs for Degraded Areas	$50M	G
51	31	Adapting Trad. Resource Management Systems	?	G
52	32	Colonists and NTFPs (Value Added Tie Ins)	$100M	G/L
53	32	Colonists and Perennial Crops/Agroforestry on Degraded Areas	?	G
54	32	Research RE Income Generation and Urban Poor in the Amazon	$50M	G
55	32	Rural/Urban Poor Ownership of Factories	$30M	G
56	33	Transport & Bulk Trade Coop (working cap.)	?	L
57	34	Working Capital Loans to Processing Plants	?	L
58	34	Decentralized Shelling (/Group)	$5M	L
59	34	Local Shelling and/or QC Packing Plant	$150-$200M	L
60	34	Research RE Oil Exports from Amazon	$10M	G
61	35	Babacu Mechanical Nut Sheller	$25M	L
62	36	Village Level Oil Presses (/Press)	$5-$10M	L
63	36	Research RE Babacu By-products	$10M	G
64	36	Research RE Land Rights of Babacu Collectors	$15M	G
65	36	Creation of Extractive Reserves in Babacu Areas	$100M	G
66	37	Sodium Laurel Sulfate Plant	$5MM	L
67	37	Local Level Oil Processing (/Oil)	$10-$15M	G/L
68	38	Essential Oil Extraction Plant	$1MM	L
69	38	Small Oil Extraction Plants	$50M	G/L
70	38	Research RE Pau Rosa Harvesting	$10M	G
71	38	Research RE Sacaca and Pimental Longa	$15M	G
72	39	Survey of Peach Palm Potential	$10M	G
73	39	Research RE Jatoba Flour	$5M	G
74	39	Production & Potential of Brazil Nut Flour	$10M	G
75	40	Centralized Fruit Processing Plant	$1-$5MM	L
76	40	Aceptic Fruit Processing Capcity	$500M-$1MM	L
77	41	Aceptic Plant for Individual Drinks	$1MM	L
78	41	Village-Level Fruit Drying Systems	$5-$10M	L
79	42	Floating Processing Plant for Acai	$1MM	L
80	42	Floating Processing Plant for Camu Camu	$1MM	L
81a	43	Village-Level Cupuacu Processing	$30M	G/L
81b	43	Regional Cupuacu Processing Facility	$500M	L
82	43	Research RE Cupuacu Chocolate By-Product	$10M	G
83	43	Research RE Cashew Sap By-Product	$10M	G
84	43	Cashew Fruit Processing	$500M	L
85	43	Research RE Amazonian Vegetable Dyes	$20M	G
86a	44	Brazilian NTFP Marketing Efforts	$1MM	G
86b	44	US NTFP Marketing Efforts	$4MM	G
86c	44	European NTFP Marketing Efforts	$6MM	G
86d	44	Japanese NTFP Marketing Efforts	$6MM	G
87	45	Research and Dissemination of Innovative Conservation Finance Mechanisms	$50M	G