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1. PRELIMINARY THOUGHTS AND CRITERIA

Any nation-wide reforestation plan developed around multiple criteria and designed to cover a variety of purposes — including phytomass breeding, ecological reforestation, corrective reforestation, and raw material reserves for rational use — can be expected to generate unease and doubt among experts, environmentalists, and politicians with an honest interest in preserving the environment and in proper land use. We have all been forced to accept technocratic, generic and detrimental programs and plans translated into reports of poor scientific content and critical evaluation and therefore we tend to feel a native and well-founded mistrust. We have resorted to demanding impact assessment studies on the physiographic and environmental dynamics, and on the economic and social implications of projects. Such demands, however, have quickly been overcome and turned into consulting services for the most part biased and skewed to hasten project approval. Huge distortions were apparent at public hearings, where in-depth discussion of the most controversial issues is often impossible and the debate is limited to diametrically opposed opinions. However, we are on the right track to reach a new level of intelligence thanks to a more fully multidisciplinary approach and to a methodology suitable to internalize impact assessment and cost-benefit exercises on the environment, the society, the country, and other nations.

2. TYPES OF GEOGRAPHIC AND SOCIAL SPACES IN BRAZIL: HOW THEY, TIE INTO FLORAM PROJECT

Any project involving the use of the remaining free areas in the Tropical World must first and foremost have an accurate picture of the existing mosaic of native sites in each country.

This applies as much to Africa, India, Malaysia, and Indonesia as to Brazil.

We have a sizable body of knowledge about the native spatial organization of the native Brazilian subtropical and tropical landscape. Determining each area's ecological

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vocation, however, is still a challenge. In as much as the Amazon is composed of a number of sites very difficult to use for profitable and self-sustained farming, we have been forced into a continuous search for development-oriented ecological models, for a variety of reasons.

In addition to basic knowledge of nature's domains and ecosystems, it is vital to grasp the typology of geographical and social spaces created by human activity along the years against a backdrop of underdevelopment. Cross-checking such complex scenarios is not a simple and transparent task, however.

Brazil's social and geographic space types

The existing dynamic and integrated knowledge of our geographical spaces may be sufficient input for projects focusing on macroregions. It is far more complex and difficult, however, to visualize a division of the natural dominion at the local level in terms of detailed knowledge of each ecosystem's functionality. In fact, the amount of knowledge concerning the mosaic of regions and their intra and interdomain patterns is quite uneven and generic. Nevertheless, it is against this spatial reality that planners, technicians and administrators must work, in terms of land use level, as they seek to define new rural property allocations, environmental/economic, and landscape rehabilitation models. The same is true at a local and regional level in the design of forest farming, afforestation and reforestation projects. To overcome the challenge of scant geoecological data, in Floram Project we have largely tapped our own field research experience to survey and map the potentials of target areas. Luckily there are many charts available specifically on the subject and at several scales on Brazilian vegetation, local soils, geology, geomorphology, and some even on potential land use.

The bottleneck, however, has always been information about the types of geographic and social space patterns existing in Brazil at the end of this decade (1990). Our basic reference material - used to exhaustion - has been a geographical space typology of underdeveloped countries developed by French geographer Bernard Kayser from the University of Toulouse (1966). Brazil certainly presents a wider geographic and social space diversity than the countries listed by the author (areas still in the process of organizing, with nature virtually untapped; agricultural experimentation and urban pocket regions; regions planned by voluntary economic intervention, and finally self- organized and complex highly developed regions). However, his classification is an important reference for future discussions on a variety of internal and external issues related to

previously identified spaces. Some of these involve multiple infrastructure projects; customized environmental control; specific local proposals for truly development-oriented policies including ecodevelopment models and matching economic functions; control of the road system's development; and the patterns of intermodal transportation as well as the wealth and human settlement distribution most suitable for each case.

To cover the entire Brazilian territory and its requirements until the end of this century, the regional types proposed by Kayser would have to be extended to include at least some highly specific spaces of unique dynamics in terms of their activities. Examples of this would be our extensive coastline which is broken down into special segments where a close plateau-coast association prevails; and urban centers and recreational sites connected to more or less remote hinterlands. Another type involves regions of sharply different climate amid very humid zones (e.g. the dry northeastern countryside) where, nevertheless, the urban, road and economic infrastructure creates a unique sense of demographic, social and cultural order.

The dry Brazilian Northeast, under semiarid climatic and hydrological conditions, behaves like a human and ecological region with strong ties to local inland cultural groups, its bioclimatic and hydrological rhythmic patterns. Because of its sheer size estimated at 800,000 to 1,000,000 square kilometers, high birth rates and a scattering of several urban/ rural inland towns, the Brazilian semiarid tends to converge upon its coastal urban centers (mainly Fortaleza and Recife). The region comprises a number of hierarchically interlaced urban basins. This pattern helps maintain the local physical and environmental uniqueness and determines migration flows in multiple directions toward the nearest regional or distant national development hubs. The problem is compounded by some perverse and virtually insurmountable factors such as a rigid local land ownership structure and the incidence of long periods of drought.

A third addition to Kayser's typology would be the *interface seams* existing between very distinct and far-apart human environmental and economic areas where pioneer settlements are encouraged but with very little chance of economic and social success. These pioneer settlements are not interconnected and usually leads to land property expansion rather than to extension of our agricultural frontiers. Such is the case largely in Rondônia, northern and northeastern Mato Grosso, and southern Para. This is obviously the kind of area ripe for empirical and haphazard settlement patterns difficult to control. However, it would be safe to say that, after an initial stage of major confrontation,

areas suitable for hybrid reforestation of remarkable environmental value and some economic return might be found.

The variety of geographic and social universes that make up the Brazilian territory are native and historic heritages requiring local plans designed around entirely different approaches. Relatively untapped and extensive pristine tropical areas need totally unique models employing the principles of ecodevelopment. An illustration of this are the vast northern lowland forests — the Amazon — the focus of our keenest and most sensitive scientific brains, in a permanent as well as methodical search for ecodevelopment models and strategies.

It is understandable that areas equipped with stratified infrastructure, considered as complex organized spaces require plans and strategies designed around different starting points and planning guidelines. In this regard, the State of São Paulo with its massive urban network, extensive and high-yield agricultural areas, and industrial centers still has enough countryside for a reforestation project (four million hectares, according to the Instituto Florestal de São Paulo - IFSP). If 40.000 km2 are available in the 250,000 km2 of Sao Paulo State, the country's most densely populated and complex human organization, one can imagine how much room for forest development there is in other non-Amazonian locations.

Spanning the two extremes of Brazil, the Amazon and the south/ southeast regions, lies a mosaic of unique situations: vast land tracts unsuitable for industrial forests (the drought-stricken Northeast) but nonetheless requiring reforestation programs for environmental, microclimatic and economic reasons; areas fully prepared for widespread planting in Central Brazil such as the *cerrados* and two or more of its subdomains (crystalline, sedimentary, basaltic areas or plateau areas as opposed, for example, to the low *chapadões* of Tocantins State).

Proper cross-checking of data on the status of environmental spaces and current forms of activities, demographic pressures, and available infrastructure is vital for a reliable and accurate national reforestation plan. Otherwise, any set of guidelines would be doomed to become empty theorizing and defeat the effort to grasp the attributes of our geographical spaces in their totality. Good examples are the Parana pine plateaus where, in principle, conditions are outstanding for reforestation with native species. However, these impressive southern plateaus have turned into one of leading Brazilian cash crop areas on the strength of single-cropped soybean. This is a powerful constraint against the renewal of pine tree plantations. Since the region has a strong potential for Parana pine breeding, new

We have a sizable body of knowledge about native spatial organization.

subspaces of poor agricultural soil but suitable to native pine growth must be found along plateau rims, valley slopes, and on rocky soil patches.

The situation is more severe and constraining for reforestation efforts on the inland plateaus of São Paulo because coffee plantations stimulated the growth of a well-developed urban network. A brief period of agricultural diversification (coffee, cotton, and grains) was followed by the unrestrained spread of sugar cane plantations and then by a rotation of sugar cane, orange, soybean, and coffee crops. On the wake of this agricultural calamity most forests along rivers and creeks bordering on farming properties died out. During rainy seasons, fertilizers and chemicals flow from drainage ditches into the micro watersheds of the properties. The staggered reservoirs act as semiclosed systems and trap toxic residues. Fish breeding has been dealt a blow and solutions for water quality improvement are very remote. The replacement of plateau vegetation by prairies has gone beyond the limits of minimum environmental safety standards. Several biodiversity shelters found in farm woodlands were either destroyed or substantially reduced. The preharvest slash-and-burn practices in sugar cane plantations have caused massive deforestation. Nevertheless, there are still many sites suitable for reforestation: the rim of rough plateaus; patches of infertile soils; and creek and river banks on non-sugar territory. Add to them a number of reservoir banks, tributary basins of dam lakes located along slopes not adequate for industrial plants, strips of land still available in urban areas undergoing conurbation, deforested sections of state parks, forest reserves, and mountain ranges surrounding metropolitan areas.

In short, the actual approach will depend on local peculiarities and human settlement patterns. In the Amazon the problem is to find management solutions to ensure preservation of standing forests and unpolluted rivers. São Paulo, northern Paraná, Rio de Janeiro, Minas Gerais, Santa Catarina, and Rio Grande do Sul face a different set of problems. They basically involve: reintroduction of native species; introduction of fast growing tree species; landscape and environmental rehabilitation of deteriorated sites; recovery of major water supply sources; and systematic clean-up of rivers and reservoirs polluted by heavy population growth, industrial pollution, and chemical waste from crops farmed on tablelands located in the interior of the state. The ultimate priority, however, is to preserve the yield of fertile soils and to strike a social balance between the rural and urban worlds. Reforestation plans for intertropical and subtropical areas of underdeveloped countries must be improved, highly transparent, and above all, managed by intelligent persons with a keen social sense, cultural energy, and managerial and professional skills.

3. GUIDELINES FOR SITE SELECTION

Such were the reflections underlying phase one of the reforestation plan for Brazil in terms of site selection and project differentiation. The proposed reforestation pattern was designed in line with data on the country's several phytogeographic and geoecological sites and with the various activities currently under way in each region identified and outlined. Some key starting points were crucial for accurate development of this comprehensive and surely ambitious plan that will necessarily have to undergo constant revision.

— The plan assigns priority to non-Amazonian areas in an effort to minimize if not to block the devastation of Brazil's remarkable biological heritage of equatorial lands. Anything that can be done to find suitable sites for reforestation in deteriorated or naturally low fertility soils outside the Amazon will result in both specific benefits and in a strategic protection belt for the vast native forests of the North.

— The plan does not contemplate actions in the Mato Grosso Pantanal in the short run. However, it emphasizes the need to reintroduce native species in all gallery forests and cliffs of the surrounding tablelands (Maracaju and Aquidauana ranges). The plan stresses the overall preservation of plant canopy on the sloping rim of the Guimarães Plateau. In this sense, there are plans for environmental replanting of the gallery forests and for protection and reinforcement of the slope forest belts of Mato Grosso and Mato Grosso do Sul. Future plans include blocking deforestation along the infertile soil belt of Guapore Valley and northwest of the Mato Grosso Pantanal.

— In the northeastern hinterland, where the semiarid prevails nearly unbroken (750,000 Km2), a dual reforestation plan is suggested. It involves reintroduction of native species along the high banks of seasonal intermittent rivers, where gallery forests existed in the past - the "c'raiba"; and a major effort to introduce rugged species adaptable to the local climate and environmental conditions, e.g. the mesquite and many others yet to be determined. Given the current land use pattern of the "Forest Zone," carefully designed strategies are required to reintroduce native species along the valleys (or part of them) and steep plateau slopes. For industrial plantations, companies should be encouraged to select infertile or low fertility soils such as the white sandy tracts located between rivers on mesa formations.

— The plan does not cover most farming areas like the Northeastern Forest, the São Paulo hinterland and northern Paraná, Mato Grosso do Sul and Mato Grosso farming

chapadões, western Paraná and Santa Catarina, northwestern Rio Grande do Sul and Bagé, southeastern areas of Goiás, and Triângulo Mineiro.

Excluding the three areas where unique features prevail — the Amazon, Mato Grosso Pantanal, and the semiarid *sertões*— plans and specific suggestions focus on Central Brazil, the outer peripheral Amazon, the Tropical Atlantic coastline, the Parana pine plateau, and the combined pasturelands of Rio Grande do Sul. These are widely diverse geographic environmental sites with different types of soil use, generally low yielding agricultural and cattle raising activities. Actually, technical reports drafted — on every site identified in these areas or domains — indicate they are each unique. Therefore, different approaches to reforestation, additional economic activities, and environmental/landscape treatment are required. At this early stage in the reforestation plan, our work was limited to identifying areas and proposing reasonable reforestation rates or *maximum tolerable occupation rates.* A particular effort was made to determine the different local occupation rates considering the intraproperty occupation rates. This is necessarily a tentative proposal to be reviewed, corrected and, above all, recycled in line with the overall potential activities envisaged for an integrated development of the regions under consideration. Reforestation cannot be thought of as a sort of monotonous and uniform scenario divorced from other trends or consistent and flexible approaches, disregarding all ties to historical dynamics.

4. A PROPOSED REFORESTATION TYPOLOGY

The Brazilian project thus involves preserving the Amazonian tropical forests to the extent possible and, in a planned and strategic way, introducing massive plant cover in viable sites, and replanting forests throughout the Tropical and Atlantic areas of Brazil. Although there is little to be clone in terms of reforestation in the unbroken Amazonian forests, five or six sites might be used in multipurpose special projects, to wit:

I. Forest development in devastated "Carajás — São Luiz Corridor" to supply new steel works under construction, avoiding the use of charcoal produced from native tropical trees;

II. Expansion of forest developments in the Amapá fields where overgrazed "sub-standard" native savannas are near irreversible depletion;

III. Managed redevelopment of forest tracts planted by "Project Jari" to take advantage of its successful technological standards, when extrapolated to other Brazilian regions;

IV. Placing an all-out ban on destruction of any land in the Amazon for subsequent reforestation with alien species, and very cautious deliberation on whether or not to offer fallow lands for industrial forest development;

V. Requiring sound and rational practices in harvesting hardwood from the unbroken rain forest, reinforcing the idea of self-sustained exploration with a 30 to 35 years rotation period under strict tropical forest management technologies. Avoiding at all cost practices leading to soil compacting or biodiversity losses. Finally, encouraging tropical fruit tree plantations in open spaces (Brazil nut) or under shade on the fringes of deforested properties (cacao, coffee, oil palm).

Southeastern Brazil, where once extensive tropical Atlantic forests bloomed, presents the hardest challenges to experts and planners involved in any reforestation plan hoping to encompass the largest possible number of ecological sites in the country.

Starting very near the coast on the domain of polyconvex hill slopes, the eastern and southeastern tropical forests went all the way up the slopes of the Brazilian Plateau (Serra do Mar), interior highlands and ranges. They spanned the Doce, Paraiba do Sul, Ribeira do Sul, Ribeira de Iguape, Middle and Low Itajaí river watersheds. The "capitanias" (royal land grants in the 1500s) were parceled out in Atlantic forest tracts. Reaching the environmentally diverse hinterland required long journeys across those forests in their coastal sections. Sugar cane plantations spread along the northeastern "Forest Zone", gradually eating away the forest biomass canopy of local ecological sites from Paraiba and Pernambuco state to the hollows of Bahia. Many years later, coffee crops were responsible for destroying the forest covered hills and mountains of the Paraiba do Sul river basin before encroaching on the forested tablelands of inland São Paulo and northern Paraná. Cacao plantations were set up under a shaded crop system in southern Bahia and northern Espírito Santo, while charcoal production for smelters contributed to the massive devastation of Minas Gerais state forests, from the Paraiba River valley to the central Doce River basin. The damage has been partially reverted only in recent years.

In the Amazon the problem is to find the management solutions to ensure preservation of standing forests and unpolluted rivers.

The northeastern Atlantic forests change abruptly to scrub savannas with only narrow strips of dry and wild woods and brushlands. In Minas Gerais state tropical forests were confined to the eastern foothills beyond which lay endless *cerrados.* At high altitudes

in southeastern Brazil, dense forests yielded to cyme fields and Parana pine woods. The tree canopy covered valleys and lowlands, including all of the Atlantic Plateau in São Paulo, southern Minas Gerais and lowers pockets of the Upper Rio Grande Atlantic Plateau, before it reached São Paulo and northern Paraná. In this patchwork pattern region, heavily planted with coffee and several other major crops, the most densely populated area of the American Continent, ecosystems were disturbed and rivers polluted by farming practices and urban settlements. Very little remained of the original forest ecosystems like Serra do Mar. As a result, hybrid reforestation is required for devastated areas as well as a stronger strategy to preserve the Serra do Mar and Serra da Mantiqueira crests. Protection is also needed for the scattered lowland forests, sea cliffs, island slopes, and the rims of inland plateaus where the foothills are of the tropical coastal type (Serra de Botucatu and its mountain system).

Any reforestation plan must follow a combination pattern adapted to the peculiarities of each section of this narrow and complex Atlantic strip of tropical America. Degraded portions of the Atlantic forests along the transition zone between Serra do Mar and the first sections of Serra Acima will have to be replanted. A particular reforestation effort with native species should be directed to headwaters located in hilly areas now turned into barren and unkempt grazing lands. The cost involved, however, is high.

Around the reservoirs created amid now naked rounded sloping hills, conditions are excellent for rehabilitation of the banks by reintroducing native species in well-planned combinations, at different band widths along the whole perimeter of each lake. Each land owner with properties at hills and slopes should be advised to plant fast growth trees surrounding their land like a wide hedge. This would provide shade and shelter for draft and dairy cattle in addition to bringing in additional income for families or small businesses with the sale of firewood. The area set aside for these tracts should not exceed 15 or 20% of the entire property area, except for parcels developed near pulp, paper or plywood plants.

A hybrid reforestation system in southeastern and central Atlantic Brazil is a must to improve activities in the poorer rural centers of tropical Brazil. We consider reforestation of hills and slopes is both urgent and crucial to restore and revitalize former coffee growing lands now reduced to small dairy farms. They make up one of the most highly devastated and poorest areas in the country although just a few dozen kilometers away from the most successful industrialized and urban centers. Reclaiming such low efficiency lands is viable within a nation-wide reforestation plan.

5. REGIONAL CONDITIONS FOR REFORESTATION-BASED DEVELOPMENT

Once the most suitable areas for reforestation were identified, it was easier to examine the demands connected to each site targeted for forest development. Each set of basic guidelines for the different areas selected comprises the goals we hope to achieve and includes a detailed study of foreseeable impacts. The methodology saves time and steers discussions. At the same time, it is open to new constructive and critical ideas or even to objections. In short, it constitutes a practical application of the sciences based on the best ethical and social concerns.

The types of reforestation practices identified were:

I. *corrective reforestation* to solve emerging problems or to provide environmental and landscape development in critical areas, including programmed reclamation, reestablishment of permanent river flows, and stemming further anthropic desertification;

II. *extensive harvest reforestation,* in line with the typology and mosaic-like pattern determined for each parcel according to local landscape and environmental considerations, involving enough phytomass to trap carbon and to provide raw material on a continuing basis while retaining 7/8 of the tree stock (either through coppices or replanting);

III. *hybrid reforestation* to enhance the local environmental dynamics, i.e. restoring headwater drainage and protection against overevaporation of still and running waters. On the other hand, intraparcel programs would bring additional new resources to rural owners of highly devastated areas (like the naked hills around the Paraiba do Sul and Rio Doce valleys). Each such type involves subtypes and special precautions to avoid inconsistencies between the more environmental functions and the more pragmatic actions. These must be organized albeit limited reforestation efforts of little economic interest but major social interest.

Reforestation plans for intertropical and subtropical areas of underdeveloped countries must be improved, highly transparent...

The megareforestation proposed for some existing *cerrado* domains, with a 30% maximum occupancy rate, can become Brazil's strongest contribution to sequestering CO_2 through a considerable amount of phytomass. The example might be followed by other tropical countries provided that the highly industrialized nations in turn develop efficient

strategies to minimize the negative effects of industrial development built up over the past century. These would be commercial forests with outstanding economic returns.

6. THE BRAZILIAN ATLANTIC COAST AND FLORAM PROJECT

We have been especially concerned with the land nearest to the coastline in developing Floram Project. We already know that certain equatorial and subequatorial shores should not undergo any sort of anthropic intervention except for additional phytomass at former forest lands. An example is the estuary coast of northwestern Maranhão, Para, and Amapá, where the mangroves developed along the last 6,000 years have silted the banks of numerous estuaries to form the only tidal plains and seashore mangrove combination found along the Brazilian coast. It is an area most suitable to integrated preservation in the form of a Parque Nacional Costeiro or some such unit. In fact, there is consensus in this regard among the Brazilian technical and scientific communities.

There are other types of coastal sites already under extensive afforestation and reforestation programs carried out by private companies. Such is the case of extensive plantations made by CURD and Aracruz Celulose in the undulated lowlands of eastern tropical Atlantic Brazil (Espírito Santo and Bahia). These are among the densest, vastest, and most successful forest developments in the country. Nevertheless, coastal areas have been excessively filled, with high occupancy rates within the parcels. A survey of occupancy patterns found in reforested areas along Espírito Santo and Bahia has provided invaluable data for a comprehensive study of their current status. The goal was to devise more appropriate and — more importantly — less detrimental environmental models. The ideal would be to have forests cover 30 to 35% of the area. The maximum intraparcel (parcel by parcel) occupancy rate should be 35 to 40%. In addition, each parcel should be organized in such a way as to include preservation sites for native vegetation, areas for afforestation, and a certain percentage of land for farming activities. Whatever the case may be, industrial forests must never cover the entire slopes and river valleys. The usual practice in eastern. Brazil is to preserve native forests along valleys and foothills and to plant forests at higher altitudes. For several reasons, we propose a radical change in this approach which would result in greater social gains with no losses to business ventures.

Another example of expanding forest development on the Brazilian coast is the long spit of land in Rio Grande do Sul. The axis of the huge stretch of land comprises a

marine terrace (probably dating back to the Pleistocene) where conditions favor the growth of *pinus* forests. Just a few years back, the area was a mostly discontinuous farming site where the "Rio Grande" breed of onion was cropped. The small plots worked by poor onion growers were not very profitable because prices were depressed and shipping expensive. This made it easy to extend the industrial *pinus* concerns through a number of financial operations and land ownership deals, to the detriment of one of our oldest and most traditional agricultural landscape. A regional soil occupancy plan based on strong assumptions might avoid the gradual and widespread sedimentation of the vast sand bank. Such a plan would set occupancy rates per parcel, proper ecological reserves (palm trees), and a combination of new crops and the practices traditional to the Mostardas/Tavares/São José do Norte area.

Following much discussion within Floram Project we decided not to include coastal tablelands and hills (eastern Brazil) or large sandbank plains (southern Brazil) for industrial afforestation. These areas already harbor major plantations established according to objectionable agricultural patterns that must not be encouraged. Commercial gains should not be an excuse to duplicate this model at other vast tracts of seaside land. Especially not until a hybrid solution more socially-oriented and acceptable can be found. The philosophy of ecodevelopment calls for practices of the "social forestry" kind.

Several coastal areas in tropical and subtropical Atlantic Brazil require unique reforestation models using native species to enrich and thicken our rain forests. They are: the coastal and island mountain ranges in the south-southeast made up of hills of varying altitudes, sierra spurs, and ancient crests that have drifted away from inland ranges, dating back to the Quaternary. Despite the strong pressures for housing developments everywhere along the coast, differentiated strategies must be sought to preserve to the extent possible the remaining forest canopy. This will depend of master plans for local control of coastal and adjacent areas, including detailed master plans for islands already settled with major cities, some of which are capitals of several Brazilian states (Florianópolis, Vitória, São Luiz, Santos/São Vicente, Guarujá). Forest slopes — like Serra do Mar — must be immediately preserved as a national heritage.

Any reforestation plan must follow a combination pattern adapted to the peculiarities of each section of this narrow and complex Atlantic strip of tropical America.

7. REFORESTATION AT RESERVOIR BANKS AND ENCOURAGEMENT OF URBAN TREE PLANTING

Under Floram Project's guidelines, special reforestation sites would be set aside along reservoir banks and highway aprons. Cities, towns, and suburbs are also to receive

appropriate trees. Each class of reforestation scheduled for the different target areas where phytomass will be introduced will be studied on a case-by-case basis and in greater detail. However, it is crucial first to determine the key requirements and specific reforestation needs regarding dams, roads, and urban centers.

Dams come in a variety of types. Some are reservoirs built amid barren hills, others are weirs located in the northeastern hinterland or in the heart of the Amazon jungle, where neither time nor consideration was given to remove the tree canopy to be subsequently flooded. Regarding dams located on hills denuded of their ancient forest cover, there is quite a body of knowledge, well-designed strategies, and examples of success stories (Centrais Elétricas de São Paulo- CESP dams built on the Upper Paraiba valley slopes). The situation is more delicate as far as the large weirs of the dry northeastern backlands. It is hard to find tree species adaptable to long droughts on the local slopes. The downstream valleys dotted with alluvial plains are more amenable to dense tree cover and excellent phytomass from fruit and palm trees (coconut, mango, and banana), in addition to some scattered agricultural tracts providing acceptable yields. Reforestation of the southern reservoirs located on basalt highlands and on fertile ground (the dark-colored soil known as "terra roxa") is a very sensitive issue. In some instances, neighboring farmers have extended their soya plantations all the way to the waterside. Others have tampered with the banks of these artificial lakes to gains a few thousand additional meters for tillage. The broth of ferromagnesium particles encroaching on reservoir waters feeding into the Uruguay and Paraná river systems downstream has unimaginable impacts in terms of soil depletion. This is the result of negligence on the part of agencies and local authorities in the management and control of reservoir banks. After a dam is gated and the lake flooded, adjacent lands are freely offered to farmers who have already been compensated (or are assured compensation) for their flooded properties. Since no ecological buffer zone is planned to act as a filter between the dam water and farmlands, after the floodgates are closed all sorts of disputes and speculation occur.

More serious and ongoing consideration of the possible impacts of dam and reservoir building would have helped solve these recurring conflicts and illegalities. The vast majority of officials from regional development agencies seem to lack intelligence, consistent knowledge, public mindedness, cultural energy, and the ability to foresee impacts or propose solutions. A massive drive is needed to substantially improve these behaviors to effectively modernize Brazilian public administration.

The knowledge available here on roadside tree planting is quite adequate but not enough to be properly applied to the different environmental domains unique to Brazil. Tree planting patterns or models adapted to the physical and environmental conditions of each country region are required to take into account each physical, ecological, and social peculiarity. It is impossible to translate patterns successfully employed in Rio Grande do Sul or Paraná to the northeastern, central or Amazonian regions. On the other hand, the spread of four-lane, six-lane and wider highways and the virtual absence of speed limits on Brazilian highways call for tree planting patterns at the same time creative and functional. There is no other alternative, despite the resistance and simplistic ideas prevailing among those in charge of this planning. Time-worn and routine practices inherited from old city ordinances and careless reports merely recycle an obsolete line of research that should be totally revised.

The starting point should be the most critical issues. The new studies on urban heat cells have highlighted the need for a sharper look at microclimate problems caused by highways to the climate of metropolitan areas. Entire districts of big cities suffer from overbuilding, the enlargement of roads from downtown to suburbs, and intercity highways (e.g., Dutra highway in the Guarulhos area and Avenida Brasil in Rio de Janeiro), as well as avenues opened in the lower valleys of greater São Paulo. These densely traveled roads comprising six central and four side lanes severely affect the local climate of our metropolitan areas. Addition of asphalt roads surgically cut through top value real estate counteracts any serious attempt at landscaping. Torn between breaking ground for new lanes and setting aside areas for tree bordered ways or copses with preselected species, decisions usually tip against any sort of pressing environmental concern. So the urban heat cell simmers and spreads, bringing an additional annoyance to the population: the unpleasant odors of beltways and sweltering heat, particularly in summer.

8. TREE PLANTING IN URBAN AND ADJACENT AREAS

Tree planting in Brazilian cities is an old and active practice. From north to south, our cities and towns have a long tradition of green areas planted at different times, including public parks and gardens. There is a widespread and deeply ingrained care for trees especially, from villages of the northeastern hinterland to border towns in Rio Grande do Sul or small urban settlements on the upper rim of the Mato Grosso Pantanal.

A first, more far-reaching approach to tree planting in urban ecosystems requires consideration of a number of factors such as: 1) existing inner city green areas and open spaces; 2) the environmental status of city outskirts; 3) in-depth review of plans for green area reserves in general, including housing developments within and without city limits; and 4) strategies to minimize regional conurbation.

Evidently each of the issues above will require distinct tree planting and afforestation patterns and guidelines. Common sense and cultural concerns must guide any ecological landscaping plan developed for the suburbs of Brazilian cities. Poor understanding of the urban environment in metropolitan areas in a setting of underdevelopment may undermine or distort a heavily skewed or socially simplistic plan. The whole exercise is further tainted by fads and the shameless demagoguery of local or regional political systems. Plans for the impressive Tietê Ecological Park in São Paulo were turned into a sort of "old boys" project by professional politickers. The "Chico Mendes" Park project evolved from an ingenious idea and perfect planning after lengthy discussion with local communities. But it too was prey to intruders from unconnected sectors, to fads, and the unethical and inflexible attitude of individuals from other fields of expertise. The lesson has been that any delay in carrying out a good plan gives free-riders with apparently humanitarian goals a chance to steamroll in, barring all other alternatives.

Some tree planting and reforestation projects suitable for immediate action involve the creation of forest buffer zones or extensive woodlands at intercity stretches under strong and uncontrolled conurbation. Densely populated and nearly adjacent urban grids like the middle Paraiba river valley in São Paulo State or between Campinas and Limeira, or the "big beaches" or "long islands" offer a unique chance to demand planned forest development to prevent haphazard industrial or urban expansion. These considerations apply particularly to administratively complex centers in São Paulo and northern Paraná, and the coastal zones of Rio de Janeiro, Santa Catarina, Pernambuco, Espírito Santo, Rio Grande do Sul, and São Paulo. Unless the critical spots of major highways that attract conurbation — e.g. the middle Paraiba river valley — are addressed fast and firmly, no strategy in the world will be able to revert or slow the move toward an undesirable global village.

9. SOCIAL AND ECONOMIC IMPACTS

Brazil is one of the few countries in the world with areas still available for a large scale reforestation plan without encroaching on other activities. However, such a massive plan involving vast amounts of new phytomass introduced over a relatively short period of time gives rise to understandable concern about possible impacts. Risk levels must be examined very carefully on the basis of our forest management know-how and of the environmental response of each area involved, the species or clones under consideration. Economic impact is another issue requiring in-depth analysis. It would be dishonest to plan reforestation of a large expanse to serve primarily the interests of the industrial sector. Depressing raw material prices does not benefit anyone from local communities, and least of all the work force involved in forest harvesting, farming and cattle raising activities. This is a strong reminder that any reforestation plan must be pegged to simultaneous plans for regional development. We stand firmly for a truly integrated plan involving a set of proposals to benefit the entire land system. The overall approach must include a combination of managed forests, a flexible, modern and diversified agriculture, improved cattle raising practices, and processing plants to turn out value-added commodities. Efforts should simultaneously focus on new settlements for farm workers, complete with recreational opportunities, schools and cultural facilities (community halls, small libraries, auditoriums, and music centers).

The matter of funding for such a wide scope and diversified reforestation plan starts with a fund allocation strategy. It also involves mobilizing a variety of key government and community institutions. We feel sure that a well developed, viable, and credible plan will earn both domestic and international support. Mostly, however, it will depend on an enlightened government addressing national issues from an overall perspective, taking into consideration its diverse social and ecological realities: local and territorial differences; its physical, biotic and human realms; and the country's economic and social peculiarities. All of this must be approached against a background of unstable conditions affecting the lives of Brazilians quite differently.

Brazil is one of the few countries in the world with areas still available for a large scale reforest-ation plan.

10. THE APPEAL AND GUIDELINES FOR A SOCIAL FORESTRY

Encouraging small and medium-size properties to include tree plantation among their activities has not been easy. For many years, the belief was that a well managed farm

was one where forests had been totally felled to make room for rolling pastures. After the decline of coffee plantations along the Paraiba River valley, farmland prices plummeted. The value of property in towns built around the coffee boom followed the same downward trend (Bananal, Areias, São Luiz do Piraitinga, Lagoinha, Jambeiro, Paraibuna, and Monteiro Lobato -formerly known as Buquira). Farms of all sizes were picked up for next to nothing by ranchers migrating from traditional dairy cattle areas. The frenzy to replace coffee plantations by grazing fields on the slopes resulted in a vulnerable agroecosystem yielding short-lived profits.

Coffee plantations were eradicated, secondary woodlands *(capoeiras)* were razed and pastures crept up the rounded slopes of the local hills. Because of its geomorphology of deep and largely decomposed rock formations, the entire area was exposed to erosion of varying magnitudes. Soon the carrying capacity per hectare decreased and with it the profits of dairy farmers, and the region became a mosaic of impoverished dairy ranches. Another wave of settlers — now from the big city — with money to spend from their capital gains started to buy farms or parcels of real estate and to turn them into resorts or vacation homes, boosting land prices for non-farming purposes. The mountainous countryside was left with a somewhat complex rural structure of old poverty-stricken families with some farming skills, plus the newcomers anxious to remodel their properties for leisure with no concern for profits. Both classes, however, might be priority targets for hybrid reforestation spanning all the way from the Paraiba do Sul hills to the western slopes of the Mantiqueira Mountains and the Doce River basin.

Reforestation must include headwaters, small creeks and streams, the tall banks of river valley (in the form of pockets or chutes), the steepest and more humid slopes (once known as "Norwegian Coast" for its cooler, moist, and shady environment). This would be an ecological reforestation model targeted to the more critical geomorphologic sites. The success of this plan would hinge on a concerted effort of the "farming assistance posts" or similar state agencies already in operation. The model could be disseminated first by having a number of those farming assistance posts built at strategic locations around the mountainous regions of São Paulo, Minas Gerais, Espírito Santo and Rio de Janeiro. The process should be carried out in well-measured steps.

The basic strategy behind this environmentally-oriented reforestation model — involving several fast growing native species — is to simultaneously foster the planting of a certain percentage of the area (10 to 20%) with strips or tracts of energy-producing forests. This will require plans to grow thick hedges of eucalyptus or pinus along property

limits. Spaced bosquets of about 0.5 to 2 hectares could also to provide wood for domestic use, shade and shelter for dairy cattle. Some land should be set aside for firewood or charcoal to be sold on a minor scale or used domestically. The trees in this case could be harvested and still ensure a reserve of phytomass through coppices or new planting.

The challenge of reintroducing native species along gallery forests or highly degraded river bank woods cannot be overcome without prior knowledge of the main ecosystems prevailing in valleys and river banks all over Brazil from north to south. In order to improve this plant cover reliable data are needed on the structure, make-up, genesis, and functionality of the ecosystems under consideration. Knowledge available on just one gallery forest cannot be extrapolated to other river side forests throughout the country.

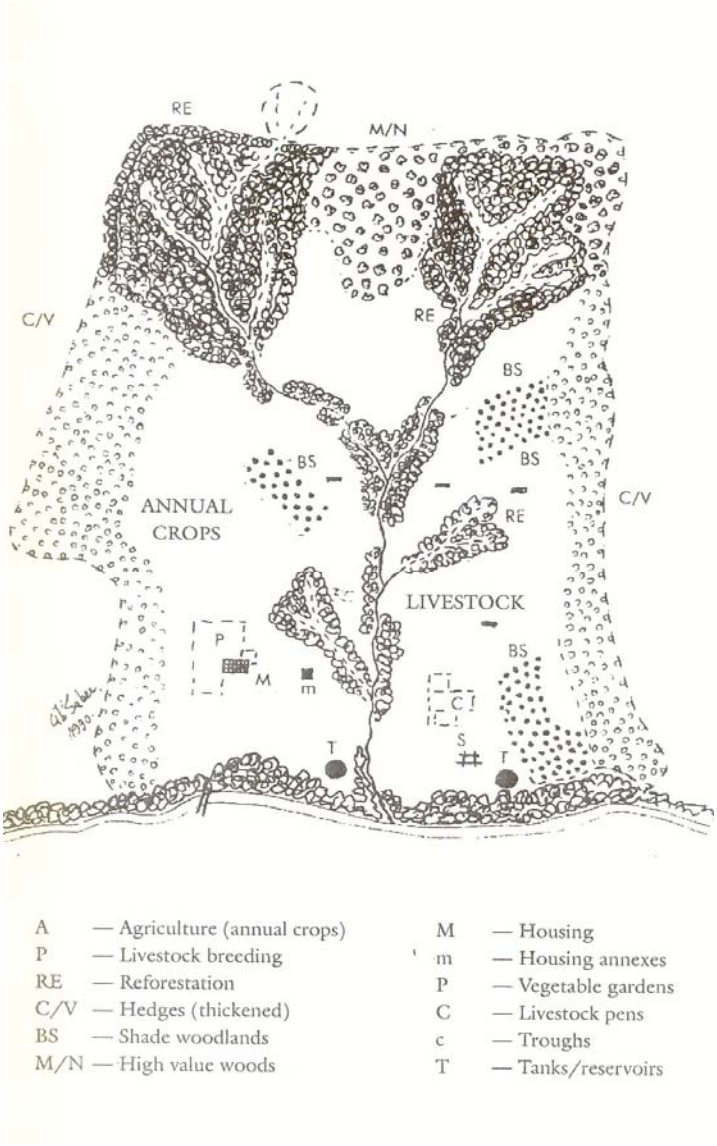
A combination of reforestation in critical areas with native essences and the use of suitable fast growing tree species on the property limits, not to exceed 20 to 30% of the total area, would help perpetuate watersheds, increase timber, firewood and charcoal production, boost family income somewhat, and provide shade and water for cattle on range lands. It might also encourage wood crafts; formation of cooperatives for the manufacture of country furniture, standardized woodwork, troughs, fence poles, vegetable garden fences, livestock pens, corn silos, home improvements, and many other activities. This would accomplish the goals of the approach known as "social forestry." Such practices would be welcomed by developed and underdeveloped countries alike, not to mention the reversal of devastated landscapes and the rise of a new cultural dimension of comfort, productivity, and financial and economic independence. Reaching such modern standards evidently demands concomitant actions in agricultural development, rural education, creation of vegetable gardens and seed banks, health care services, community meeting halls, sports clubs, and an unpretentious but well devised incentive program. But "social forestry" would be to no avail unless the causes of impoverishment of the target locations are well understood. Nor is there any chance for improvement or success implementation of plans in the absence of a whole range of simultaneous initiatives to promote effective agricultural and cultural modernization of these forsaken country sites.

11. MULTIPLIER AGENTS AND FACTORS: GERMPLASM BANK, NURSERIES AND DIFFUSION CENTERS

The first step to a differentiated reforestation plan is multiplication of germplasm banks to ensure the use and supply of seedlings for the several developments. Companies involved in fuel and industrial afforestation run their own nurseries, some of them of gigantic proportions. However, they cannot shoulder the full responsibility of supplying seedlings to all the different types of forest developments involved in a project as ambitious and far-reaching as Floram.

The first step is to stimulate the creation of three classes of germplasm banks: I. seedling banks for fast growing tree species easily adaptable to the several Brazilian bioclimate environments and involving sets of diversified clones; 2. seedling banks containing native local species at strategically located centers throughout Brazil to reintroduce species at critical rural property sites under expert and flexible technical assistance; 3. hybrid germplasm banks located at county seats, including sectors for breeding alien species and native seedlings selected among a sized group of local tree species.

The information gained will certainly help set up extensive stands of Paraná pine, eucalyptus, and tropical pines. Special care must be taken in planning, establishment, and management of germplasm banks for plant selection to reflect the local biodiversity. This requires special strategies. Experienced woodsmen and seed or seedling gatherers familiar with the remaining forest canopy are essential in organizing and setting up nurseries. Permission must also be secured from property owners or officials in charge of forest reserves, parks or ecological stations. On the other hand, site selection has to be very careful, making sure that a building or shed is already there to house the seedlings. There must also be room for seed bank storage, and for the dispensing center where plant materials are to be supplied to the different types of parcels in line with their respective implementation plans.



Building up a large seedling stock is not enough to get the Project going. It is also vital to develop proper criteria, to evaluate land available at each parcel for afforestation and reforestation, and to carefully monitor the progress of small, simple but creative projects tailored to each property according to size, topographical, soil and ecological composition. The overall success of new developments calls for careful selection of municipalities to house and operate the germplasm banks, while local and regional strategies should focus on diffusion of practices, action enhancement, and Project management. However, the Project can only be properly managed by pooling the efforts of the proper federal, state, and local government institutions. In view of its diversity and scope, the overall Project should be under the federal sphere. Regional detailing should be done by states, with the necessary interaction between Floram guidelines and existing reforestation plans developed under state jurisdiction. Finally, county seats and

municipalities must be the launching pad for dissemination and utilization of Project-generated resources and outputs. The Project will be ensured success provided that the administrative officials of microregions or municipalities make available the facilities and infrastructure needed to set up and operate germplasm banks. Even if this contribution takes the form of branch nurseries or seedling banks for reforestation of critical areas, local assistance is vital for implementation, dissemination, and monitoring actions.

The management and evaluation of the project in its broader sense would profit from a central institution working as a source of new ideas and guidelines. Its role would be to motivate planting activities, to provide the necessary interregional liaisons, and to help monitor the progress of Floram Project within the scope of its capabilities. However, hands-on management and actions would fall under federal and state agencies in close cooperation with local technical experts.

The developers of Floram Project are fully aware of the pressing need to bridge the gap between basic research and agricultural extension, a "sine qua non" in any revitalizing agrarian program. An old problem comes up with the same constraining power in the context of Floram: there can be no practical results unless there is a technical and scientific will to trigger the multiple reforestation and/or afforestation projects. There must be stronger involvement in the project's guidelines and foundations; more investment in rural education; and better assessment of the inherent potentials of larger properties. In short, agronomic skills must be directed to determining the most suitable activities while setting aside areas for forestry. There is a need to introduce new species and to reclaim devastated lands and partially destroyed watersheds. And this must not affect existing agricultural or cattle raising in small or medium size properties of impoverished mountainous areas located in southeastern and western Brazil. Land is more plentiful in Central Brazil, where large properties have been selected for more extensive forest development. Reforestation might cover 40 to 45% of total property areas, while the remainder can be diversified under traditional activities (ranching) or new crops (grains, soybean, rice). Another 15 or 20% of the area can be set aside as preservation units of native gene pools *(cerrados*, interfluvial woodlands, wood stands, and gallery forests). Owners who join the project will have better organized farms and will take part in the miracle of turning large unproductive farms into productive properties, a social and economic asset for the region and country alike.

The successful performance of the Project hinges on the amount of information built up, on honesty of purpose, and willingness to initiate subprojects on a "retail" basis.

Not to mention administrative continuity, resource availability, and alternative strategies to correct the course of operations.

12. THE ROLE OF IEA/UNIVERSITY OF SÃO PAULO (USP)

To start such a massive reforestation plan, it is essential to secure the support of government officials, enlightened businessmen, land owners (even in fallow and deteriorated areas), scientists and technicians, industrial and agricultural workers, graduates and professors to help sustain the phytomass deployed at preselected locations or in other suitable sites. No country under the private property system can be expected to lay out a plan that fails to consider these practicalities. On the contrary, the reforestation plan's strategies should encourage participation in view of regional land ownership patterns. Alliances must be struck for the difficult task of regional revitalization through forestry combined with improved cattle raising practices and higher crop yields.

Many successful forest developers will be interested in acquiring land for reforestation at sites pinpointed by the plan. It is good business to buy real estate in areas unsuitable for agriculture and difficult to manage, located away from the mainstream of cash crop farmlands. However, extra care is needed in planning for forestry management. Sections must be set aside for preservation of ecosystems containing samples from the several domains of local nature while at the same time upholding traditional farming practices.

Thanks to the multidisciplinary nature of its actions and the strong social concerns underlying ideas and proposals arising in its campus, and given its deeply ingrained social commitment, the University must warn against the risk of land ownership distortions that a program like Floram might cause. Some negative consequences would be new waves of landless farmers flocking to city slums and to the fringes of native forest reserves. They might pressure local governments to break up areas of great ecological significance into small farm holdings that would shortly become another set of poverty pockets surviving hand-to-mouth.

The model proposed by Floram Project emphasizes customized "afforestation" for each property to be carried out by the current owner. This would prevent simplistic solutions like the sale of properties at lower than market prices and the resulting deterioration of social inequalities that have already done their share of harm to the

country. The Plan advocates its own set of reforms, but not to the detriment of other much-needed reforms.

The University's role, therefore, is to offer its best resources in terms of accrued information and a multidisciplinary approach, as well as parameters for a new spatial organization of vital inland areas around Brazil. Redirecting entire regions to new reforestation patterns may lead to appreciation of unproductive land, to additional local income, and above all to the rehabilitation of critical sites highly vulnerable to deterioration sources present in southeastern Brazil.

13. REGIONAL OCCUPANCY RATES *VERSUS* INTRAPROPERTY OCCUPANCY RATES

The regional versus intraproperty occupancy rates are of prime importance to ensure the success of any reforestation plan laid out for a huge country of great social and geographic complexity. Covering vast expanses with planted forests must be prevented. Every effort must be made to avoid development of massive continuous and undiversified forests eucalyptus, pine or other species. A reforestation program of vast proportions that may ultimately drive out small farmers or hinder farming activities (agriculture and/or cattle raising) is not suitable for the country. Nor is it advisable — considering the future — to establish permanent and irreversibly homogeneous settings that might block the introduction of other activities or discovery of new uses for any length of time.

In order to correct these distortions, Floram Project has set two constraints regarding the maximum allowable area for afforestation and/ or reforestation in predetermined sites. First, we established a clear distinction between the concept of regional occupancy rate and the occupancy rate inside a given property (farms, ranches and large commercial properties). The term regional occupancy rate is defined as the maximum new forest cover allowed or advisable for a given area without affecting current or future rural activities. It assumes the establishment of geoecological subsections as native wildlife shelters and protected sites for native gene pools and conservation units. The idea of intraproperty reforestation rate involves other variables, including the cost/effectiveness of each undertaking in financial and social terms, customized project management, geometrical and functional organization models for property land, the overall status of surrounding areas, etc. Thus, the intraproperty occupancy rate varies according to the proposed reforestation typology and might accommodate slightly higher occupancy rates than the ones generally determined for the region as a whole. At industrial reforestation

sites preselected in non-Amazonian Brazil, the ideal regional occupancy rate is around 25 to 30%. In contrast, maximum intraproperty occupancy rates could go as high as 30 to 45% but non-forest areas are required to accommodate miscellaneous socially profitable rural activities, and a minimum 20% devoted to preservation (of gallery forests, headwaters, natural springs, trails, mountain top or interfluvial woodlands to serve as germplasm banks or wildlife shelters).

Unless these assumptions are fully met, Floram will definitely not take off. To ensure that the project's approach is observed, however, monitoring and management action plans are essential. They are to be performed by dedicated and qualified technicians and administrators under the aegis of committed and far-sighted public institutions and non-government advisers. Failing this, the Project will not be endorsed by the scientific community.

14. CONSERVING BIODIVERSITY: A BRAZILIAN RESPONSIBILITY

As we near the end of this century, no other country in the world has been charged with such responsibility for preservation of the living biosphere as Brazil. It is true that the burden of conserving marine biodiversity must be shared by all world nations. But the preservation of biotic stocks — as they coexist in harmony in a hot and humid environment — is predominantly a Brazilian challenge.

For purposes of such studies and surveys, IEA/USP will make all technical and scientific papers concerning reforesta-tion in Brazil and Latin America.

Informed groups and individuals from all over the world committed to rethinking the fate of planet earth are always ready to caution and pressure the Brazilian people and decision-makers on the need to develop preservation policies for the biodiversity existing in each Brazilian environmental domain. We acknowledge their concern and do not question the earnest approach underlying biodiversity preservation strategies suggested. Nevertheless, we must stress that preservation is our responsibility, from the Amazon to Rio Grande do Sul State. It is a tough struggle fought at several fronts against individuals and systems insensitive to genocide, "ecocide," and ethnocide. The fight is also against individuals who have generic information but have no means of formulating strategies or taking part in serious public debates. The haste to enact legislation, write up platforms, advertise topical projects or simply obtain research grants for which there is no critical mass yet, generalized chaos has taken hold despite the dedication and missionary-like attitude of many. Everything happens in a synchrony often hard to visualize, from Roraima to southeastern Rio Grande do Sul, from the beaches and big cities of the east to the Mato

Grosso Wetland in the far west. Goals seem to be shortsighted. Any plan suggested by others is labeled as technocratic, while we are empty handed with no far-reaching plans or actions. Meanwhile, pollution, deforestation and burning of natural resources continues unchecked throughout a country as large as a continent.

The balance of regional biodiversity is alarming, not only because of the slow depletion of past centuries but mainly due to rate of destruction experienced over the last thirty years (1960-1990). For obvious reasons, most of the damage was done along the Atlantic coast where our massive urban systems gradually developed since the agricultural cycles of early colonial days. For centuries native forests were used for firewood and charcoal production. The main industrial hubs and districts flocked there with their obsolete and environmentally harmful technologies. Such is the case of the chemical, petrochemical, cement, pesticide, oil refining, thermo power plants, and many other industries. Luckily, however, carbon dioxide released by industrial plants cannot compare to the total emissions recorded in industrial zones of developed countries.

Friedel (1977) summed up the basic issues regarding the connection between plants and the CO, cycle in the atmosphere, including considerations about the use of fossil fuels and their role in releasing CO_2. At a certain point in his analysis, the author gives careful thought to the use of reforestation programs to prevent the risks of "overcarboxylation".

Although the term biodiversity is implicit in any discussion about the living world which makes the planet Earth unique, only recently was it added to the vocabulary of ecologists and environmentalists. Few dictionaries or bibliographical essays have managed to incorporate this term to usual scientific jargon before the late eighties. In fact, this word that expresses the diversity of life existing in each zone, domain or region of the earth's environment was first coined and spread by militant ecologists, by individuals committed to the awesome task of ensuring the integrated preservation of major wildlife species that have survived man's predatory actions for centuries. Words like biodiversity, germplasm bank, and nature's gene pools were introduced just a short time ago, and reflect strategic concerns with the earth's future. Anyone preoccupied with the future of planet Earth must direct their attention to the biodiversity of past centuries and particularly that which has managed to survive to date. Economists consider the changing trends over the short term or focus on critical periods caused by a change in government of exogenous factors. Ecologists, on the other hand, must take a longer term approach. They consider the permanence and equilibrium of the biological world in a time frame covering past

geological periods, the changing climates and biogeography of the Quaternary era involving millions or dozens of thousands of years.

It is true that developed countries did little or nothing to preserve biodiversity of their ecological zones or biogeographical domains. On the contrary, they let things go unchecked during the late industrial revolution: destruction of biodiversity; air, land, marine and river pollution; planting of homogeneous forests; limited food or cash crop agriculture; and livestock breeding centered around a handful of domestic animals. Now many voices are raised in an appeal to the cultural leaders of developing countries, begging them to use their judgment for the sake of preserving the exuberant biodiversity of the humid Tropics. We have no quarrel with foreign encouragement or pressure, but the solution to problems will best be found by Brazilians. We ourselves must try to smooth out conflicting situations with carefully balanced programs and suitable solutions to rid the country of the shackles of a foreign debt built up by a few in the name of the entire Brazilian people. This must be accomplished in such a way as to allow us to advance without at the same time destroying our biodiversity legacy or squandering our natural resources. In order to do so, we need to familiarize ourselves with spatial make-up of a developing country of vast territorial dimensions. We must seek unique and viable environmentally friendly approaches to development for each region of the country in terms of physical and ecological attributes, regional infrastructure, social, economic and environmental status, and basic social needs.

H. Friedel's thoughts demand some reflection about strategies needed to sequester the carbon dioxide released into the atmosphere. He advocates massive not-for-profit introduction of fast growing plant material as well as reintroduction of native species in damaged areas, taking care not to harm any existing agricultural or livestock breeding activity. Any well managed reforestation policy must consider a set of guidelines specific to each land type involved. Additional factors are the length of time required for development of afforestation/reforestation programs; the determination of administrative continuity; and the power and perseverance of the technical/scientific communities and cultural leaders involved in domestic and world environmental policy. We cannot rely on forestry technology alone or ignore the information and techniques amassed by the academic and business communities. It is vital to select each area according to multiple inclusion and exclusion criteria; to understand the potentials and limitations of soil mosaics for introduction and/or reintroduction of species; to assess and reexamine why previous afforestation initiatives have either succeeded or failed; to design new mixed farming

models involving productive forests and sites specifically set aside for preservation space at different topographical levels and compartments; to provide some subspaces for improved traditional activities in redeveloped properties. It is not enough to sustain a proper biodiversity rate on the lower or flat portions of valleys, saving slopes and interfluvial areas for extensive afforestation with fast growing species. Recovering and redeveloping biodiversity requires a tailored approach for each type or size of property. Different strategies and procedures are needed to avoid unnecessarily reclaiming large forest areas to the detriment of agroecosystems or combination agroforestry and ranching systems. This is a challenge to be overcome through ingenious and targeted reforestation/afforestation programs through a realistic evaluation of environmental criteria involving the atmosphere as well as urban, rural and wild spaces everywhere around the world. Nations with wider spaces and land available for extensive reforestation have a historical obligation to design and develop protection policies for the surviving biodiversity. They must further work on the means to trap the carbon dioxide released by industrial polluters, by the burning of fossil fuels, and by slash-and burn practices criminally perpetrated against the native forests of a few privileged countries like Brazil.

Floram Project is a vast and integrated national program to improve the global environment; to ensure preservation of the remaining biodiversity; to redevelop biodiversity in heavily damaged areas; to mitigate predatory pressures on the Amazon; and to plant productive forests on a gradual basis at preset regional rates and in line with rural development models of widespread social benefit. The Project can have a positive impact in terms of country-wide development as a result of its concern with the social and economic rehabilitation of poorer segments and of a proper organization of expansive and largely underutilized interior highlands.

15. PLANS, STRATEGIES AND GUIDELINES FOR REGIONAL BIODIVERSITY PRESERVATION

A few key concerns on biodiversity preservation underlie Floram Project, to wit: 1. As in the case of productive forests, to encourage a new internal organization of properties space-wise in order to ensure the survival of rural activities unique to each locality, to preserve low valleys and foothills, and in particular to provide for wildlife refuges in one or more interfluvial areas; 2. In the same vein, to help turn large idle lands located at inland plateaus into real active farms both economically and socially profitable (aside from profits earned by timber operations); 3. To consider a possible relocation of a few industrial plants

to sites near (or adjacent to) the newly established productive forests within the next ten years; and to develop tighter registration and control requirements on property sections harboring regional biodiversity (in low valleys, slopes or between rivers).

Maximum intraproperty occupancy rates were set so as to reserve slightly more than half of each property for development of traditional farming activities (with room for improvement). A good portion of the total area would be turned over to the compulsory preservation of wildlife shelters. Under this approach, the farms eventually developed at *cerrado-covered* plateaus — with poor river drainage — will have massive forest tracts in up to 40 to 45% of the total property area, 25 to 30% set aside for preservation of unique regional ecosystems (interfluvial *cerrados* and slopes, gallery forests, and river terraces, and 25 to 30% for agricultural and grazing activities downstream to river headwaters. Farms organized in this pattern, whether in the tablelands of northwest Minas Gerais, on the western plateaus of Bahia (Urucuia) or similar areas, will certainly be profitable, create jobs, and effectively contribute to regional development. There are additional details perhaps as important as the internal partition proposed for these properties. For example, no effort should be spared to avoid depletion of gallery forests (Central Brazil) and of the peculiar bands of vegetation along river banks (Amazon). However, to move cattle to natural watering holes at different spots, it is advisable to adopt a sort of zigzagging pattern of clearing and to cut trails wide apart along river side forests. With a "bayonet" or "crankshaft" pattern of clearing applied as sparingly as possible, herds can be led to watering wholes with as little damage as possible. Some of these ideas could be adopted for mixed reforestation, which is more limited and less extensive, at small and medium size properties located in overdegraded areas of Tropical Atlantic Brazil.

A few key concerns on biodiversity preservation underlie Floram Project...

Among standardized strategies to protect major Amazonian forest areas, Floram Project has included a medium-term effort of hybrid reforestation for the belt girding the Amazon (northern Mato Grosso, Rondônia, southern Pali). Given the amount of sunlight and the average rainfall occurring in these areas, reforestation and afforestation programs are helped by nature itself in the introduction, reintroduction and redevelopment of tree species.

The environmental limitations to agriculture in the Amazon —painstakingly emphasized over the years by highly qualified scientists —represent a stimulus to the preservation of most of its area for quite some time to come, although a permanent search for and experimentation with environmentally friendly development strategies cannot be discarded. For all these reasons, the Amazon is the largest and densest biodiversity reserve

on earth. Despite the damage already done, 90% of the Amazon forest is still preserved to a large extent. A vast majority of conscientious Brazilians advocate preservation of the Amazon, adoption of regionalized environmentally friendly development standards for the benefit of local populations, and for economic and social integration with the rest of the country. Provisions to set up and expand subsistence harvesting reserves; unwavering surveillance of Indian reservations; increase in the number of preservation units; a search for new agricultural and forestry standards; objection to any kind of polluting activity that might affect the quality of water with negative implications for local fish species; a permanent critical attitude against river impoundment in the heart of the jungle; and control of the loggers' increasing appetite for wood — these are some of the requirements to help preserve the Amazon as the world's main biodiversity reserve, barring any political injunctions along the way.

A immense range of biodiversity in non-flooded forests; biodiversity unique to our plains, involving riverside forests, flooded forests, river valley plains, prairies, and flood plains; and a particularly significant biodiversity throughout our waterways such as rivers, creeks, flood plain lakes, inland lakes, and regional estuaries will be totally lost unless protective action is taken.

An extraordinary amount of tropical biomass can be preserved in the Amazon, but the situation verges on calamity in the old Atlantic forest. Vast biomass areas have been lost (90% of once forested areas), and as a result coastal, subcoastal and plateau biodiversity has vanished. Few people are aware of how many biodiversities have been lost in Tropical Atlantic Brazil. These so-called Atlantic forests began in Rio Grande do Norte State (on the border with Paraiba) and extended in a continuum all the way to southern Santa Catarina. It went deep into the high plateaus of southeast Brazil and its biodiversity blended smoothly from North to South and from the plains, piedmonts and foothills to the inland plateaus. It varied in composition because of its azonal span, attitudinal zoning, and Quaternary origin. To a certain extent, biodiversity variations along the Brazilian Atlantic forests may have been considerably greater than in the vast Amazon lowlands. The extent and intensity of devastation account for major losses in biotic diversity, particularly the extinction of species and species combinations at a phytosociological level.

The massive destruction of genetic wealth in the Atlantic forest justifies the enactment of legal controls for full preservation of the forests still remaining at farms, tropical slopes and steep forest covered hills in eastern and southeastern mountain ranges. In farms located under the tropical Atlantic domain from the northeastern forest to Santa

Catarina State, secondary forests or *capoeirões* have shrunk to less than 20% of their original size. Thus, strict and straightforward protection laws must be enforced to try to preserve what is left. This calls for the cultural sensitivity and administrative efforts of the proper agencies under the surveillance of independent and enlightened individuals. Floram Project's guidelines might then be tapped to reintroduce species and to perform a tailor-made rehabilitation of existing plant cover in rural properties located on mountain ranges.

In addition to policies especially addressed to the Amazon and Tropical Atlantic Brazil, all other native domains require specific approaches and guidelines to preserve germplasm banks and the mosaic of ecosystems in their natural condition. These include programs to protect samples and unique ecosystem combinations in areas like the *cerrados,* the dry northeast, the Paraná pine plateaus, and the mixed prairies covered by gallery forests in Rio Grande do Sul (profoundly damaged by overcropping of rice). Floram Project has suitable and low cost suggestions for preserving the biodiversity in all these areas, an invaluable biotic heritage.

16. FLORAM PROJECT: THE FUTURE CHALLENGE

The Project's embryo — which is being developed at IEA/USP by an eclectic work group — now needs to expand gradually via more detailed contributions translated into a variety of badly needed technical and operational studies. IEA/USP work group will develop or arrange for these additional contributions focusing on: *risk assessment* of the overall Project; *development of fund-raising strategies* from different sources to render the Project viable; proposals for Project *institutionalization; critical assessment of the old reforestation subsidy system,* bearing in mind the major changes made in Project structure, staffing, and functionality; *economic impact assessment* and evaluation of socioeconomic goals; *development of scenarios* for the different properties selected; *survey of strategic dissemination hubs or centers* for gradual implementation; last but not least, *development of a reliable and dynamic remote sensing system to monitor* and manage forest developments from space. A listing of the studies and surveys required is enough to show how much is yet to be done and, above all, the variety of multidisciplinary studies and surveys needed at the shortest possible notice. For purposes of such studies and surveys, IEA/USP will make all technical and scientific papers concerning reforestation in Brazil and Latin America available for permanent consultation by any interested party.

Monographs and technical plans, maps and remote sensing charts, as well as studies done for the forest rehabilitation in critical areas such as Cubatão will be equally useful.

We are aware that not all areas selected by the Reforestation Plan prepared by experts at the Institute for Advanced Studies are familiar to every group of entrepreneurs, environmentalists or politicians. There may be insufficient information and understanding of the areas involved given their vast scope and sheer size. Suggestions to trim down the scope of the Project and naive questions will certainly come. Undoubtedly we will again hear the classical question: "will reforestation necessarily use only native local species?" It may be hard to explain once more that in areas where there never was any forest cover such as the *cerrados* or mixed prairies in the extreme south reforestation is just a major "afforestation" of open spaces with alien species adaptable to local climatic and ecological conditions.

It will never be easy to give a convincing answer to the favorite question asked by our more affluent consumers: "If I can buy a mahogany or cedar door, why should I choose one made out of eucalyptus or pine?" Someday people will be better informed about the processing of lion-hardwoods and this question will be satisfactorily answered. Increasing awareness of the need to preserve our biosphere may be another argument to cut down the overharvesting of native hardwoods. Finally, improving self-sustained exploitation may contribute to settle these painful and pragmatic doubts.

It may be harder still to argue softly that to offset the huge amounts of carbon dioxide dumped into the atmosphere, a country blessed with idle land may have to increase its forest biomass in sufficient volumes and extent to minimize the negative impact of forest burning, mindless deforestation, and harmful industrial processes. It is up to Brazil — if a massive reforestation plan is indeed adopted — to review the critical pressure exerted by developed countries and force them to participate in a collective effort to alleviate the harmful practices that now threaten our biosphere's very survival.

BIBLIOGRAPHY

AB'SÁBER, Aziz Nacib.
1966 — Domínio dos "mares de morros no Brasil — Instituto de Geografia - USP, Geomorfologia n. 2, São Paulo.
1971 — A organização natural das paisagens inter e subtropicais brasileiras. — In: III Simpósio sobre o Cerrado , ED. Da USP e ED. E. Blucher Ltda ., pp. 1-14, São Paulo.
1974 — O Domínio morfoclimático semi-árido das caatingas brasileiras. — Geomorfologia n. 43, IGEOG-USP, São Paulo.
1977 — O caráter diferencial das diretrizes para use e preservação da natureza, a nível regional, no Brasil. — (Sinopse) Geogr. e Planejamento n. 30, pp. 9-26, IGEOG-USP, São Paulo.
1981 — Domínios morfoclimáticos atuais e quaternários na região dos cerrados. — Graton Intracratan n. 14,

IBILCE-UNESP, São José do Rio Preto, SP.
1984 — Ecossistemas Continentais. — In: "Relatório da Qualidade Meio Ambiente" (ROMA) SEMA, Brasilia.
1986 — Geomorfologia da Região (Carajás). — In: "Carajás: Desafio Político, Ecologia e Desenvolvimento (J.M. Gonçalves de Almeida Jr. (Org.) pp. 88-124. CNPq e Brasiliense, São Paulo.
1987 — Gênese de uma nova Região siderúirgíca: acertos e distorções de origem, na faixa Carajás/São Luiz. — Desenvolvimento n. 22 (jul./Dez. 1987), pp. 315, IDESP, Belém, Pará.

AB'SÁBER, A.N., CHACEL, F.M. e TSUKUMO, N.M.J.
1975 — Tratamento paisagístico da usina de Paraibuna e Barragem de Paraitinga. Geografia e Planejamento n. 17, IGEOG-USP, São Paulo.

ALMEIDA, D.G. de.
1946 — Madeiras imunes ou muito resistentes ao cupim. — Revista Florestal, vol. 5, n. 2, pp.13-23.

ALMEIDA, D.G. de e Costa, J.R. da.
1956 — Madeiras do Brasil — Serv. Da Econ. Rural. Ministério Da Agricultura, Rio De Janeiro.

ALMEIDA, Sergio Alberto de Oliveira.
1986 — Programa de Monitoramento da Cobertura Florestal do Brasil. — In: "Simpósio sobre a Caatinga e sua Exploração Racional", pp. 271-279, Univ. Est. de Feira De Santana, EMBRAPA, Brasília, DF.

ARANHA PEREIRA, J. e MAINIERE, G.
1949 — Madeiras do Brasil. — Anuário Brasileiro de Economia Florestal, vol. 2, pp. 285-351, Rio de Janeiro.

ARKCOLL, David B.
1979 — Uma avaliação das opções agrossilviculturais para a Amazônia. — Anais do Simpósio sobre Ciências Básicas e Aplicadas. Publ. da ACIESP, n. 19, pp. 101-111, São Paulo.

ASSIS RIBEIRO, Paulo de.
1975 — Os recursos naturais e o planejamento. — SUPREN. IBGE, Rio de Janeiro.

AUBREVILLE, A.
1961 — EtuDe Ecologique des Principales Formations Forestieres Du Brésil. — Centre Techn. de Foret Trop., Paris.

AZEVEDO, M.L. e PHILLIPP.
1979 — Bibliografia de eucalipto: autores e publicações nacionais. — IPT (Publ. 1148). Inst. de Pesqs. Tecns., São Paulo.

BASTOS, A. de M.
1951 — O mogno brasileiro. — Anuário Brasileiro de Economia Florestal, n. 4, pp. 136-141.

BRISCOE, C.
1979 — Agroforesteria en jari Florestales y Agropecuaria, Brasil. actas — Taller Sistemas Agroforestales en America Latina. Turrialba Costa Rica, Centro Agron. Tropic. Invests y Enseñ. LATIE. Turrialba.

BRONBANI, E.J. e SILVA, L.C. da.
1983 — Arborização de nudes e barragens. — DRNR (Secretaria da Agricultura —Est. Rio Grande do Sul), Porto Alegre.

BORGONOVI, M. (e outros).
1967 — Cobertura Vegetal do Estado de São Paulo, II — Levantamento por Fotointerpretação das Áreas Cobertas com Floresta Natural e Reflorestamento — Bragantia, ano 26, n. 6, pp. 93-117, Campinas, SP.

CABRERA, A.L. e WILLINK, A.
1973 — Biogeografia de América Latina. — OEA — Depto. de Assuntos Científicos. Washington D.C.

CARLETON RAY, G.
1988 — Ecological Diversity in Coastal Zones and Oceans. — In: "Biodiversity" (Wilson, E.O. — 1988), pp. 36-50, National Acad. Press. Washington D.C.

CARVALHAL, C. M.
1979 — Generalidades sobre a fixação e consolidação de dunas com vegetação. — AGROS, vol. 14, n. 2, pp. 55-66, Pelotas.

CAVALCANTE, M.S., IELO, P.K.Y. e OLIVEIRA, A.M.F.
1984 — Bibliografia brasileira em preservação de madeiras. — IPT (Publ. 15/2). Inst. de Pesqs. Tecns., São Paulo.

CHARBONNNEAU, J.P. (e outros).
1979 — Enciclopédia de Ecologia — Conclusão de R. Dumont. Prefácio de M.G. Ferri. Superv. Técnica de A. Lamberti., Edit. Pedag. Ltda. e EDUSP, São Paulo.

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE.
1971 — La Regionalisation de l'espace au Brésil. — CEDE/CNRS, Bordeaux/ Talance.

CENTRO DE PLANEJAMENTO DA BAHIA.
1978 — Atlas climatológico do Estado da Bahia. 0 clima e a organização do espaço geográfico. — (Dir. De C.A. de Figueiredo Monteiro). Documento-Síntese. CBP Secr. de Planej. Ciência e Tecnol.., Salvador. 1980 — Potencial de utilização do Além-São Francisco. — Diagnóstico. — CPB —Secr. de Planej. Ciência e Tecnol., Salvador.
1980 — Mapa geomorfológico do Estado da Bahia. — Escala: 1:1.000.000. Série Recursos Naturais, n. 3, CPB, Secr. de Planej. Ciência e Tecnol., Salvador.

CIANCIULLI, P.L.
1959 — A introdução e aclimação do Pinus Elliottii e outras Coníferas no Estado de São Paulo. — Anuário Brasileiro de Economia Florestal, n. 11, pp. 66-89.

COIMBRA-Filho, A. & MAGNANINI, A.
1964 — Bibliografia Florestal Brasileira (1 ª Contribuição) — CNPq/INPA (Botany) no. 20. Manaus, AM.

CORDEIRO, C. de A. & SOARES, L. de C.
1977 — A erosão nos solos arenosos da Região Sudeste do Rio Grande do Sul. —
Revista Brasileira de Geografis (IBGE), yr. 39, no. 4, pp. 82-149.

DIAS, Sergio da Fonseca.
1988 — Considerações sobre legislação florestal e sua aplicação a Amazônia: caso particular do carvão vegetal para siderometalurgia.— Pará Desenvolvimento, n. 24 (jul./dez. De 1988), pp 50-54, IDESP-Belém, Pará.

EITEN, George.
1973 — An outline of the vegetation of South America. — Symp. Intern. Primat. Soc.

ERWIN, T.L.
1983 — Beetles and Other Insects of Tropical Forest Canopies at Manaus, Brazil. —In: "Tropical Rain Forest: Ecology and management" (Sutton).
1988 — The tropical Forest Canopy: The Hearth of Biotic Diversity. In: "Biodiversity" (Wilson, E.O. 1988), pp. 123-129. National Acad. Press., Washington.

FAO — Commitee on Forest Development in the Tropics 1985 — Tropical Forestry Action Plan. — FAO. Rome.

FAO — IBRD — WRI — UNDP.
1987 — The Tropical Forestry. Action Plan. — FAO (& others). Rome, Italy, (brochure).

FAO — Food and Agriculture Organization of the United Nations.
1988 — Forestry Action Plan for Latin America and the Caribbean. — Executive Summary, FAO-UN, ROME.

FEARNSIDE, Philip M.
1985 — Brazil's Amazon Forest and the Global Carbon Problem. — Interciência, vol. 10, n.4 (jul./-agosto de 1985), pp.179-186, (Contém bibliografia sobre o problema do Carbono Global).
1986 — Distribuição de Solos Pobres na Colonização de Rondônia. — Ciência Hoje, vol. 6, n. 33, pp. 74-78, SBPC.

FITTER, R..
1986 — Wildlife for Man. How and Why We Should Conserve Our Species. — Collins, London.

FONSECA Filho, C. de A.
1959 — Essências para reflorestamento e arborização. — Bol. de Agricultura, vol. 8, ns. 5-6, pp. 15-28, e Anais da Soc. Bot. do Brasil — XI Reunião Anual, I vol., pp. 93-111 (1962), Belo Horizonte.

FREIRE, L.C. (e outros).
1982 — Alguns aspectos econômicos sobre a implantação e utilização de capim buffel em área de caatinga. — CPATSA/EMBRAPA. Circ. Tecn. n. 9, Petrolina, PE.

FREITAS, A.R. e CHIMELO, J.P.
1984 — Utilização de madeiras amazônicas para a produção de dormentes para o Projeto Ferro — Carajás. — IPT (Publ. 1487) Inst. De Pesqs. Tecns., São Paulo.

FRIEDEL, H.
1979 — As Grandes leis da Biosfera. — In: Charbonneau, J.P. (e outros). "Enciclopédia de Ecologia", pp.9-41, Edit. Pedag. e Univers. Ltda e EDUSP, São Paulo.

GLERUM, B.B. e SMIT, G.
1962 — Combined forestry/soil survey, along road BR-14, from São Miguel to Imperatriz. — FAO/EPTA, rel. 1483. Roma.

GOLFARI, H.
1980 — Zoneamento Ecológico para Reflorestamento da Área de Influência da Serra dos Cara*. — CVRD, Revista vol. 1, n. 2, pp. 3-18, Rio de Janeiro.

GOMES, A.M.B. e CARVALHO, C.S. de.
1980 — Estudo de geomorfologia — Alegrete RS. — Instituto de Geociências, Publicação Avulsa, UFRS, Porto Alegre.

GONZAGA DE CAMPOS, Luiz Felipe.
1912 — Mapa Florestal (Brasil). — M.A.I.e C. — SGMB. Typ. da Diret. do Serviço de Estatística, São Paulo.

GRUPO DE PLANEJAMENTO ESTRATEGICO FLORESTAL
1982 — Brasil Florestal, Ano 2000: diretrizes estratégicas para o Setor Florestal Brasileiro. — Brasil/Florestal, ano XII (abril/junho de 1982), pp. 7-33, Brasília.

GUEDES, F.
1975 — Um deserto ameaça o pampa. — Revista Geográfica Universal, n. 10, pp. 6371, Rio de Janeiro.

GURGEL FILHO, C.A. e ALVARENGA, R.M.
1963 — As pináceas no reflorestamento do Estado de São Paulo. — Atlas/— Anexo do Boletim Técnico, n. 17, Secr. da Agric., IF — CPRN, São Paulo.

GURGEL FILHO, C.A.
1964 — O comportamento florestal das Coníferas. — Silvicultura 3, pp. 129-188.

HEINSDIJK, D. e BASTOS, A.de M.
1963 — Inventários florestais na Amazônia. — Setor de Inventários Florestais — Min. da Agric., Bol. n. 6 , pp.5-100, Rio de Janeiro.

HOEHNE, F.C.
1930 — Araucarilândia. — Secr. da Agric., Ind. e Corn. do Estado de São Paulo.

HUECK,K. e SEIBERT, P.
1972 — Vegetations Karte von Sudamérica. — Biogeography and Ecology in South America (Fitrkau, E.J. e outros), vol. I pp. 54-81.

HUXLEY, A.
1984 — Green Inheritance. — Gaia Books Ltda., London.

IBDF — DEPT. de Economia Florestal.
1983 — Inventário Florestal Nacional (Síntese dos Resultados). — IBDF, DEF., Brasília, DF.

IBGE.
1988 — Mapa da vegetação do Brasil. — Escala 1:5.000.000, Secr. de Planej. e Coord. da Pres. da República., FIBGE/MA/IBDF, Rio de Janeiro.

INDA, H.A.V. e BARBOSA, J.F.
1978 — Mapa geológico do Estado da Bahia e Texto explicativo para o mapa geológico do Estado da Bahia. — Escala 1:1.000.000. Secr. das Minas e Energia. Coord. da Prod. Mineral, Salvador.

INSTITUTO FLORESTAL — Coord. da Pesqs. de Recs. Nats.
1975 — Atlas do Zoneamento Econômico Florestal do Estado de São Paulo. — Atlas/
Anexo do Bol. Téc., n. 17, Secr. da Agric., IF/CPRN, São Paulo.

IPEF — ESALQ/USP.
1987 — Revista IPEF — Número Especial sobre "Conservação dos Recursos Genéticos de Plantas" — Simpósio organ. por Paulo Y'Kageyama — Abril de 1986. — IPEF-ESALQ/USP. Piracicaba,SP

JORDAN, C.F. e RUSSEL, C.E.
1983 — Jari: productividad de las plantaciones y perdida de nutrientes debido al torte u la quema. — Interciência, vol. 8, n. 6, pp. 294-297.

KAYSER, Bernard.
1966 — Les divisions d'espaces géographiques dans les pays sous-devetlopés. Annales de Geographie, ano LXXV, n. 412 (nov./dez. de 1966), Paris, Publ. em trad. portug. In: Orientação (IGEOG — USP), n. 4, julho de 1969, pp. 25-30, São Paulo.

KERR, Warwick Estevam.
1979 — A Amazônia: sua floresta e sua ocupação. — Anais do simpósio sobre Ciência- as Básicas e Aplicadas, Publ. ACIESP, n. 19. pp: 85-100, São Paulo

KLEIN, R.M.
1969 — Arvores nativas na Ilha de Santa Catarina. — Insula, n. 3, pp. 3-93.

KRUG, H.P.
1964 — O plantio de Pinus em São Paulo. — Anuário Brasileiro de Economia Florestal, n. 16, pp. 259-295.

LAMEGO, A. Ribeiro.
1960 — Mapa Geológico do Brasil. — Escala: 1:5.000.000, D.G.M. — DNPM, Rio de Janeiro.

LUCIETO, D.A.
1969 — Identificação e Utilidades das espécies do gênero "EUCALYPTUS" em São Leopoldo. — Univ. do Vale do Rio dos Sinos.

MAACK, Reinhard.
1947 — Breves notícias sobre a geologia dos Estados do Paraná e Santa Catarina. —
Arquivos de Biologia e Tecnologia (PR), vol. 2, pp. 63-154, Curitiba

MAGALHAES, L.M.S. e POSEY, D.A.
1987 — Reflorestamento indígena. — Ciência Hoje, vol. 6 n. 31 (maio 1987), pp. 44-50, SBPC.

MAINIERE, Calvino.
1958 — Madeiras do Brasil (II). — Anuário Brasileiro de Economia Florestal, n. 10, pp. 5-108.

MAINIERE, C. e CHIMELO, J.P.
1989 — Fichas de características das Madeiras Brasileiras. — 2ed., IPT, Div. de Madeiras, São Paulo.

MAINIERE, C. e PEREIRA, J.A.
1965 — Madeiras do Brasil Anuário Brasileiro de Economia Florestal, n. 17, pp. 135416.

MALTBY, E.
1986 — Waterlogged Wealth. — International Institute for Environment and Development, London e Washington.

MARTIUS, EICHLER E URBAN. 1840-1906 — Flora Brasilienses.— 40 vols.

MORS, W.B. e RIZZINI, C.T.
1966 — Useful Plants of Brazil. — Holden Day, Inc. San Francisco.

MUTHOO, M.K.
1977 — Perspectivas e tendências do setor florestal brasileiro, 1975 a 2000. — IBDF, 2 vols. Serv. Tecn. 8, Brasília.

MYERS, Norman.
1980 — Conversion of Tropical Moist Forests. — National Acad. Science, Washington.

MYERS, Norman.
1983 — A Wealth of Wild Species. — Westview Press. Boulder, Colorado.
1984 — The Primary Source: Tropical Forests and Our Future. — W.W. Norton & Co., New York.

1986 — Tropical deforestation and a Mega-extinction Spasm. — In: "Conservation Biology: The Science of Scarcity and Diversity", (Solué, Ed. 1986), Sinauer Assoc. Mass.
1988 — Tropical Forests and Their Species, Going. — In: "Biodiversity" (Wilson, E.O. Ed.) pp. 28-35, National Acad. Press, Washington.

NAHUZ, M.A.R.
1989 — Deforestation and development: a compound issue for Brazil. — IPT (Publ. 1789) Inst. de Pesqs. Tecns., SP

NAVARRO DE ANDRADE, E.
1961 — 0 Eucalipto. — 2 ed., Comp. Paul. de Estradas de Ferro, São Paulo.
1941 — The Eucalyptus in Brazil. — Journ. of Heredity, vol. 32, n. 7, pp. 215-220.

NAVARRO SAMPAIO, A.
1951 — Aplicações da madeira de eucalipto. — Anuário Brasileiro de Economia Florestal, n. 4, pp. 79-94.

NEW SCIENTIST.
1988 — Herb to Fight Malaria. — New Scientist, 15 de set. de 1988.

NOGUEIRA, J.C.B.
1977 — Reflorestamento heterogêneo com essências indígenas. — Instituto Florestal, bol. tecn. n. 24, São Paulo.

OLIVEIRA, L.A.,BRITO Neto, O. e CALADO, M.A.L.
1984 — Preparação de dormentes de madeira para o Projeto Ferro — Carajás. — IPT (Publ. 1513), Inst. de Pegs. Tecns., São Paulo.

PAIN, S.
1988 — No Escape from the Global Greenhouse. — New Scientist (12 de nov. De 1986), pp. 38-43.

PARENTE, E.
1966 — Plantas de valor econômico no Ceará. — Fortaleza (12 pags.)

PEIXOTO, Rodrigo, C.D.
1987 — 0 carvão parece ser o centro do problema, mas os camponeses querem atenção para a agricultura. — Pará Desenvolvimento, n. 22 (jul/dez 1987), pp. 80-82, IDESP, Belém, Pará

PEREIRA, J.A. e MAINIERI, C.
1957 — MaDeiras do Brasil. — 2 ed., Anuário Brasileiro de Economia Florestal, n. 9, pp 5-170.

PICCOLO, A.L.G. (e outros).
1972 — Plants invading plantation of eucalyptus robusta. — Revista de Agricultura, vol. 47, n. 2, pp. 81-85.

QUERALT, Maria Amélia.
1987 — A polêmica questão do carvoejamento no Programa Grande Carajás. — Pará Desenvolvimento, n. 22, jul./dez de 1987, pp. 16-22, IDESP, Belém, Pará

RANKIM, Judy M.
1979 — A floresta tropical como modelo para desenvolvimento ecológico na Amazônia. — Anais do Simpósio sobre Ciências Básicas e Aplicadas. Publ. da ACIESP„ n.19, pp. 112-121, São Paulo.

RAVEN, Peter H.
undated — Our Vanishing Rain Forests.

RECORD, S.J.
1925 — Schizolobium: a promising source of pulpwood. — Tropical Woods, vol. 2, pp. 2-5

RECORD, S.J.E HESS,R.W.
1943 — Timbers of the New World. — Yale Univ. Press.

REINOLD E QUEEN (Eds.).
1974 — Ecology of Halophytes. — Academic Press, New York.

REIS, Mauro Silva.
1983 — Recursos Florestais no Brasil. — Revista do Serviço Piiblico (FUNSEP), ano 40, vol. III, n. 4 (out./dez. de 1983), pp. 7-16, FUNSEP, Brasília.

REITZ, R., KLEIN, R. E REIS, A.
1978— Projeto madeira de Santa Catarina. — SUDESUL/IBDF, Itajaí.

RIZZINI, Carlos Toledo.
1971 — Arvores e Madeiras üteis do Brasil — Manual de Dendrologia Brasileira. Ed. Edgar Blucher e EDUSP, São Paulo, (inclui bibliografia selecionada, pp. 279286).
1977 — Arvores e madeiras do Brasil. — SUPREN. IBGE, Rio de Janeiro.

RIZZINI,C.T.e COIMBRA Filho, A.F.
1988 — Ecossistemas brasileiros — Brazilian Ecosystems. — (Texts). Editora Index, Rio de Janeiro.

ROSILLO-CALLE, F. e HALL, D.
1988 — Brazil Finds a Sweet Solution to Fuel Shortages. — New Scientist (19 de maio de 1988), pp 41-44.

SEPLAN-CODEBAR-SUDAM.
1986 — Problemática do carvão vegetal na área do Programa Grande Carajás. — CODEBAR/SUDAM, Belém, Pará.

SERRA FILHO, Renato (e outros).
1974 — Levantamento da Cobertura Vegetal Natural e de Reflorestamento no Estado de São Paulo. — Instituto Florestal, Boletim Técnico IF, n. 11, São Paulo.

SIMMONS,N.W. (Ed.).
1976 — Evolution of Crop Plants. Longman, New York.

SIMPÓSIO FLORESTAL DA BAHIA.
1973 — Anais do I Simpósio Florestal da Bahia. IBDF/CELAC/ANCARBA, Secretaria de Agricultura, Bahia, Salvador.

SOCIEDADE BRASILEIRA DE SILVICULTURA.
1990 — A Sociedade Brasileira e seu Patrimônio Florestal. — SBS, São Paulo.

SOCIETÉ ENCYCLOPEDIQUE UNIVERSELLE.
1977 — L'Encyclopédie de l'Ecologie. Soc. Encyclop. Univers. (S.E.U.). Librairie Larousse, Paris.

SOULÉ, M.E. (Ed.).
1986 — Conservation Biology: The Science of Scarcity and Diversity. — Sinauer Assoc. Inc. Publ., Massachussetts.

SOUTO, João José P.
1985 — Deserto, uma ameaça. — Secretaria da Agricultura (Estado do Rio Grande do Sul), Porto Alegre.

SUTTON E CHADWICK (Ed.).
1983 — Tropical Rain Forest: Ecology and Management.

TAVARES, Sérgio.
1959 — Madeiras do Nordeste do Brasil. — Univ. Rural de Pernambuco. monogr. n. 5, pp. 9-171, Recife, PE.

THIBAU, C.E.
1986 — Manejo da floresta tropical — I Simpósio do Trópico úmido, vol. II, pp. 237-244, EMBRAPA/CPATU, Belém/Pará.

TIGRE, Carlos de Bastos.
1964 — Guia para o reflorestamento do Polígono das Secas. — Ed. Tip. Minerva. Fortaleza, CE.
1972 — Pesquisa e experimentação florestal para a Zona seca. — Minter-Dnocs. Fortaleza, CE.

TRICART, Jean.
undated — Problemas de conservação de terras e de águas nos municípios de Alegrete e São Francisco de Assis. — SUDESUL, Relatório de Viagem, Porto Alegre.
1959 — Division morphoclimatique du Brésil atlantique central. — Rev. de Géomorph. Dynamique, vol. 9, n. 1-2, pp. 1-22, Paris.

UHL,C. e Vieira, I.G.
1988 — A Extração seletiva de madeiras: impactos ecológicos em Paragominas. — Pará Desenvolvimento, n. 23, pp. 46-52, Belém, Pará

UNIVERSITY OF AMAZONAS.
1979 — Propostas de política florestal para a Amazônia Brasileira. — Ed. Metro Cúbico, Manaus.

U.S.CONGRESS — Office of Technology Assessment.
1987 — Technologies to Maintain Biological Diversity. — OTA -F.-330. U.S. Gov. Printing Office. Washington.

VANGOOR, C.P.
1965 — Reflorestamento com coníferas no Brasil. — Setor de Invents. Florestais, Minist. de Agricultura (BR), bol. n.9, pp. 5-58, Rio de Janeiro.

VELOSO, H.P. e Goes Filho, L.
undated — Fitogeografia Brasileira, classificação fisionômico-ecológica da vegetação neotropical. — Boletim Técnico, n. 1, pp. 237-.244, EMBRAPA/CPATU, Belém, Pará.

VERGUEIRO, Sérgio.
1988 — Roça florestal de castanha. Plano para cultura de castanha do Brasil em pequenas propriedades. — São Paulo, (xerox).

VICTOR, Mauro Antonio de Moraes (e outros).
1981 — Elenco de Medidas para Promover o Reflorestamento e a Conservação dos Recursos Florestais em São Paulo. — Parte I — Diagnose. Instituto Florestal, São Paulo (mimeogr.)

VICTOR, Mauro Antonio de Morais.
1987 — E Hora de Avaliar o Reflorestamento. Silvicultura, ano I, maio-junho de 1987.

VICTOR, M.A.M., KRONZA, F.J.N., TIMONI,J.L. e YAMASOE, G.
1986 — Land classification for industrial afforestation in the State of São Paulo, Brazil. — In: "Forest site and productivity," GESSEL, pp. 69-91, Martinus Nijhoff. Publ. Dordrecht.

VOLPATO,E., BARBOSA,A.F. e DALL'AGNOL, R. e SEABRA, E.J.
1987 — As consequências sociais, econômicas e ambientais da siderurgia a carvão vegetal na Amazônia Oriental. — Path Desenvolvimento, n. 22 (jul./dez de 1987), pp. 25-30 (c/subtítulos específicos) Painel IDESP, Belém, Pará.

VOLZ, Richard.
1990 — Le Bilan de CO_2 des Forests Suisses et de leur Exploitation — Bull. de l'Off. Fed. del'Environment, des Forêst et du Paysage, n. 1 (1990), pp. 16-19.

WILCOX, B.A., BEUCHER, M. e EHRLICH, P.H.
1988 — Tropical Deforestation and Species Extinction: An Assessment of the State of Our Knowledge and Scientifique Needs. — (Documento preparado para a W.W.F.).

WILSON, E.O. (Ed.).
1988 — Biodiversity — National Academic Press, Washington.

WORLD WIDE FUND FOR NATURE.
1990 — The importance of Biological Diversity. — A Statement by WWF, Yale Press.

WYATT-SMITH, J.
1987 — The Management of Tropical Moist Forest for the Sustained Production of Timber. — WWF/IUCN/IIED, London.

YAMAZOE, Guenji (& others).
1988 — Avaliação do Programa de Reflorestamento de Pequenos e Médios. Secr. de Estado do Meio Ambiente — CPRN. (Trab. apres. no I Encontro Brasileiro de Economia Florestal — Curitiba, maio de 1988). Instituto Florestal, SP.