

THE DEVELOPMENT OF THE AMAZON RAIN FOREST: PRIORITY PROBLEMS FOR THE FORMULATION OF GUIDELINES

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SUMMARY Priority areas of research for the formulation of guidelines for development of the Amazon rain forest, especially as related to the Brazilian government's current effort to delineate a forest policy, are divided into six categories. Carrying capacity and colonization must be studied to avoid failures of development projects from the point of view of sustaining the human population at an adequate standard without environmental degradation.

Information on the extent of deforestation is woefully inadequate. Known effects of deforestation are mostly deleterious, especially effects on climate and biota. Causes of deforestation include: fiscal incentives, availability of alternative investments yielding higher returns than sustainable management in Amazonia, a land tenure system based on deforestation, low price of land, and the demand of the

exponentially increasing population for agricultural land. Problems complicating the control of deforestation, in addition to the force of these motivations for continuing felling, include: a traditional disregard for conservation laws, a flexible legal system with selective enforcement, inadequate resources for enforcement, and over-centralization of the enforcement bureaucracy.

Planned uses of the forest include: uses of the forest after clearing, uses of managed forests, and reserves or parks. Reliability of yields and sustainability of systems should be high priorities in planning economic uses of the forest. The contribution of ecologists is essential, but the inadequacies in present knowledge do not justify procrastination of effective containment of deforestation.

The Brazilian government has mobilized much of the Amazon region's scientific and development communities in a special effort to chart the future course of man's use of the region's most unique natural resource: the Amazon rain forest. I will attempt to identify some of the principal areas in which ecologists can and should contribute to this effort. I divide these priority areas for the formulation of guidelines for development into six categories: 1) carrying capacity and colonization, 2) extent of deforestation, 3) effects of deforestation, 4) causes of deforestation, 5) control of deforestation, and 6) planned uses of the forest.

Carrying Capacity and Colonization

I put this consideration at the head of the list due to its enormous importance and its effect on all other possible considerations related to the development of Amazonia. Each type of development implies the sustaining of a human population. The number of persons that can be supported by the different projects depends on the type

of colonization, the type of productive technology employed, the standard of living to be enjoyed by the population, and the probabilities of failure, as defined by a variety of criteria, which are considered acceptable to planners (Fearnside, 1978, 1979). The fact that planners do not have (and do not demand) concrete information on this type of consideration for the formulation of development plans for the Amazon leads to a great danger of these schemes failing, both from the point of view of sustaining the human population at an adequate standard, and from the point of view of avoiding degradation of the environment in these areas. The contribution of ecologists to the design of studies of carrying capacity under different types of exploitation being considered is essential.

The Extent of Deforestation

Considering the importance of information on the extent of the areas which have already been deforested, and the present accelerated rate of deforestation, the level of knowledge on this subject is shamefully poor. The literature and the popular press contain

a wide range of estimates and opinions on the subject based on very few data. The best substantiated estimate, which was made using LANDSAT images, confounds the situation by including a large area of *cerrado* (Central Brazilian scrubland) in the sample area, even including parts of the State of Goiás at the latitude of the Federal District of Brasília in the sample (Tardin *et al.*, 1978: 19), the data specific to the Amazon forest not being interpretable in terms of percentage of deforestation. This study of the National Institute of Space Research (INPE) is aimed at demonstrating the applicability of remote sensing technology to the quantification of deforestation, and this objective is certainly attained.

Close accompaniment of forest clearing in Amazonia should be a high priority, with adequate ground reconnaissance to complement data from remote sensing. The development of the capability to carry out studies based on remote sensing in Amazonia itself should be an important objective in order to guarantee that the benefits of such studies will be as relevant as possible to complementary field studies. Facilities are needed for interpretation of aerial

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photographs, LANDSAT images, and the side-looking radar mosaics of Brazil's RADAM Project.

It should be emphasized that the lack of detailed information on the extent of deforestation should not be used as an excuse for procrastination on taking immediate and effective measures to slow this process in Amazonia.

Effects of Deforestation

The importance of this problem is already widely recognized. Studies of the effects of deforestation on global and local climate, especially in terms of rainfall and temperature, give good cause for worry and should be continued at an accelerated pace. Studies of the effects on soil fertility, erosion, and the cycles of various elements also merit priority studies. The obvious connection of deforestation with the extinction of many species, communities, and ecosystems justifies continued study, publicity, and debate of these unfortunate effects. The effect of deforestation on human populations which depend on the forest for a livelihood, principally indigenous populations but also including populations of rubber tappers, Brazil-nut gatherers, and other groups, clearly falls in this category as well. Despite the continuing need for studies of deforestation effects, enough is already known indicating that most of the changes are undesirable to warrant immediate and concerted efforts to contain this process.

Causes of Deforestation

Any development policy which includes an effective containment of deforestation will have to be based on knowledge of the underlying causes which motivate this process. Any program of regulations, even if designed with the most rational and desirable of purposes, will end in failure if it does not address these fundamental causes of deforestation.

A review of all of the government fiscal and tax incentive programs, and their effects on deforestation is urgently needed. For example, cattle ranching projects have been enjoying enormous incentives: interest-free loans (but with inflation adjustments) with two year grace periods and a loan term which in the beginning of the program was seven years and now is five years. These ranching projects also have the privilege of applying a part of the income tax owed by the companies, undertaking the projects towards capitaliz-

ing the ranching enterprises. In addition to this, there is a program which gives the rancher the use of money which is collected as income tax from other taxpayers. Ranching enterprises aided by the Superintendency for Development of the Amazon (SUDAM) follow a "chronogram" for deforestation which assures that this is done as rapidly as possible, although not all of the enterprises are able to keep up with this accelerated schedule for clearing. The appeal of these offers of money clearly constitutes a great motivation for deforestation. There is even the danger that incentives as generous as these can make operations profitable which, if based only on their own merits, would be anti-economic. Even in cases where the rancher knows full well that the system of exploitation to be installed after the deforestation will not be profitable or competitive with alternative investments due to insufficient yields or sustainability, the economic picture is altered by the existence of the incentives to the point where this path of development is followed in spite of ecological, agronomic, and economic problems.

Any type of development aided by incentives runs the risk of prolonged detours in unwise directions. Incentives act to remove one natural control against errors in development strategies which is present in a free market situation: without incentives, projects which are not justifiable on strictly economic terms quickly go bankrupt before deforesting large areas. This is not to say that any and all incentives are wrong, but that such incentives should be much more restricted than the present ones, should be much better understood in terms of their impacts on deforestation, and should be reevaluated continually so as not to remain in effect after indications appear that the policy is in error. In the case of incentives for the establishment of cattle ranching projects, there is sufficient indication that the incentives program should not continue due to doubts concerning the sustainability of the system (Fearnside, 1978, 1979b). Incentives presently being offered for fertilizing pastures, which undoubtedly prolongs the productivity of degraded pastures (Serrão *et al.*, 1978), should be examined to verify that a system is not being encouraged through incentives which would not be advisable in terms of its own economic merits, apart from other worries concerning deforestation in general. If this should be the case, it would constitute an additional motivation for the continuation of large scale clearings of doubtful wisdom.

In addition to cattle ranching, various other types of development are aided by incentives. The silvicultural and rice plantations of Jari Florestal e Agropecuária Ltda., for example, enjoy a number of key incentives, including exemptions both from income tax and from duty on the importation of foreign equipment (Fearnside and Rankin, in preparation). Other projects for encouraging commercial plantations of rubber trees, and other crops, are incentivated as well, along with a long list of non-agricultural types of development (see de Almeida, 1978). Probably schemes for exploiting the forest by means of "forest utilization contracts" would also be aided by incentives such as these.

Financial incentives constitute one of the great causes of deforestation in Amazonia, although they only influence a part of the area being exploited. It can be calculated from the data of Tardin *et al.* (1978: 19), who surveyed 445,843 hectares of clearing in rain forest areas, that 54.6% of this area belong to projects with SUDAM incentives.

A second motivation for deforestation is a consequence of the availability of alternative investments, which makes the individual entrepreneurs in Amazonia uninterested in using land in ways which would be sustainable over the long term. The discount rate used in calculating the present value of future monetary returns (after correction for inflation) doesn't have the slightest connection with the rates of exploitation which would be sustainable, which are determined by biological processes such as the time needed for a tree to grow. In cases where the discount rate is higher than the regeneration rate of a potentially renewable resource, it is in the economic interest of the individual to destroy the resource as quickly as possible and reinvest the resulting profits in some other project, often in a different location (Clark, 1973, 1976). This logic applies to many situations in Amazonia with regard to deforestation for the purpose of obtaining profits on the short term, without worrying about sustainability on the long term. The applicability of this sad logic should also be studied with urgency with respect to proposals to utilize the forest for large scale lumbering operations. New economic mechanisms are needed which will make the monetary compensations reflect better the requirements of sustainable systems designed for Amazonia: mechanisms which would make these systems economic and the

present destructive systems anti-economic.

A third great motive for deforestation is the present system of land tenure in Amazonia. There is a very old tradition in the Amazon according to which it is the act of deforesting an area which gives a person the right of possession. The function of the legal system has been, to a large extent, the subsequent legalization of these *faits accomplis*. Clearly this system gives everyone a tremendous motivation to deforest as large an area as possible, whether the "squatter" is a poor *caboclo* or a big enterprise. Any attempt to limit deforestation while this system prevails will end in failure even with a full complement of regulations, inspectors, etc. The situation as to who is the owner of each piece of land must be clarified, and the custom of legitimizing the possession of the deforester, or else compensating him for having deforested an area (which is even called *benfeitoria*—"betterment") must end. The problem is that this traditional system of land tenure has been serving for centuries as a kind of escape valve for injustices and extreme inequalities in the land ownership situation throughout Brazil, especially in the more heavily populated areas. Without the option of the poor for acquiring land in this manner, their situation would become intolerable. Because of this, any effort aimed at regularizing the land tenure situation in Amazonia, which is an urgent priority for any plan to control deforestation in the area, must be linked with measures to alleviate the inequalities which presently are being moderated by the squatter system.

A fourth underlying cause of deforestation in Amazonia is the extremely low price of land. Land sold by the National Institute for Colonization and Agrarian Reform (INCRA) for cattle ranches in the area of Altamira, Pará, for example, is sold at 2% of the minimum monthly wage per hectare (about US\$ 1.18/hectare), with financing terms which are highly favorable to the buyer. Under these conditions, there is little motivation for the rancher to exploit small areas of land using techniques which demand high inputs of labor and/or capital. Ranchers opt instead for extensive exploitation, thus felling vast areas regardless of whether or not this type of exploitation is sustainable. Government efforts to encourage more expensive techniques, including the intensive management of pasture, have met with little success under these economic conditions. Eco-

nomie measures are needed to maintain the price of land at a sufficiently high level to motivate owners to employ sustainable production techniques rather than felling ever-larger areas.

A fifth motive for deforestation is the simple necessity of agricultural land to sustain the growing human population. This is complicated by the use of land for agricultural production not only to attend to minimal necessities for food, but also to satisfy the farmers' natural desires for a better material life, which have a tendency to grow without limit. This makes areas cleared for agricultural purposes determined, not by the limited capacity of the stomachs of the farmer and his family to use the production directly, but rather by the limitation of the farmer's capability as determined by his supplies of labor, capital, and land. The relationship between the size of the population and living standards is a basic question in connection with deforestation, which serves to emphasize even more the importance of carrying capacity studies.

These five causes of deforestation must be dealt with in any forest development policy in Amazonia which involves controlling the process of deforestation in the region.

Control of Deforestation

How to control deforestation is one of the most important and most difficult problems for any development policy. In the Brazilian Amazon there is a tradition which is over 400 years old of complete disregard for any law designed to preserve the flora and fauna of the area (Sternberg, 1973). In all of Brazil there is also the problem of a system where the law is considered to be something which is only to be applied to "enemies", and which can always be avoided by means of the omnipresent *jeito* (Rosenn, 1971). There is a tradition dating from colonial times of maintaining thousands of laws technically in force, and only applying a few of them. These problems make it difficult to formulate effective laws to control deforestation, and it is not reasonable to expect that this context of the problem will change in the near future.

The present laws regarding deforestation are interpreted in this context, and are not enforced. For example, the law requiring that 50% of each lot be left in forest was first reinterpreted by the officials in the Altamira Colonization Area of the Transamazon Highway to allow the replac-

ment of the forest by "permanent crops" (an extremely misleading term which can include, in addition to tree crops, such crops as black pepper, and even sugar cane and pasture). In the end, these reinterpretations of the law did not matter since no enforcement of this law was attempted. There are a number of colonists in the Altamira Colonization Area within full view of the highway who have had all 100 hectares of their lots cleared since 1974 without any legal consequences. In other areas where the subdivision of holdings is more common, the separate sale of these 50% reserves is an obvious possibility for avoiding the limitations of this law should enforcement be attempted.

In Altamira the situation illustrates the problem of inadequate enforcement of forest laws. The area under the responsibility of the Brazilian Institute for Forest Development (IBDF) in Altamira extends approximately 500 km along the Transamazon Highway in a strip 200 km wide, or approximately 20 million square kilometers. Within this area is located the largest planned colonization project of the Transamazon Highway, with some 3,800 families of government-settled colonists (Brasil, INCRA, 1974), extensive areas being colonized as *glebas* (ranches of 500 or 2000 hectares), an older area of colonization with river access, and the city of Altamira. The entire IBDF team responsible for this area consists of three people: one forest officer and two guards. This team is charged not only with enforcing the laws related to deforestation, but also with inspection to control the export of skins and forest animals, and the selling of licenses to sawmills and timber extractors. It was recently announced that beginning with the 1979/80 agricultural year there will be a new requirement: colonists will need to obtain a license to be able to fell in their lots. It appears that there is no plan to increase the IBDF team in the area in view of this additional requirement. The effectiveness of IBDF in enforcing the forest laws is obviously limited by the endemic problem of government organs concentrating the majority of their resources in the central administration, and very few resources in the far away places where law enforcement actually occurs or not. The lack of enforcement can also be interpreted as an indication that the government considers the enforcement of these laws to be of less importance than the many other activities for which government funding is more generous, for example for fiscal incentives for cattle ranching.

The formulation of adequate forest laws has a series of complicating factors. For example, in the case of the law requiring that 50% of each property be left in forest there is a certain injustice: the demand that a poor colonist on the Transamazon Highway reserve half of his resources to protect the environment is considered reasonable, while a parallel demand in the case of, say, an industrial firm in São Paulo, would be unthinkable. There is also the problem of small reserves of this type not serving the function of maintaining natural populations (Goodland and Irwin, 1975: 30). In addition to this, adequate inspection of these reserves is already very difficult. On the positive side, there is a greater probability of the owners of these private reserves defending them against squatters than would be the case with government-owned reserves.

Generally, laws attempting to motivate behavior through incentives are more effective than those which depend on the application of fines or other forms of punishment for transgressors. The complicated process of locating and prosecuting these persons is a major reason for this. Laws linking compliance with forest regulations to opportunities for bank loans and other benefits would be expected to have most effect.

Ecologists need to give all help possible to the effort to design laws which will be practical to enforce, which will result in effective control of deforestation, and which will best serve the laws's various purposes in terms of maintaining the environment. Studies on what the needs are for the enforcement of forest laws in terms of numbers of inspectors, remote sensing, funds, etc., are urgently needed.

Planned uses of the Forest

The planned uses of the forest are an integral part of forest development policy. Three types of uses are relevant: uses of the forest after clearing, uses of managed forests, and reserves or parks.

Research in the area of uses of deforested land is generally aimed at the improvement of crops and agricultural systems. Normally the highest priority is placed on obtaining higher yields. I would suggest that two other priorities should be given greater emphasis that the problem of maximization of yields: the improvement of reliability in yields and the sustainability of the systems. Reliability is very im-

portant in order for the farmer not to run a high risk of crop failures from year to year; diversification of crops and varieties is the classic technique for increasing reliability (Kass, 1978). The emphasis on perennial crops, such as plantations of cacao, rubber, oil palm, fruit trees, or silvicultural plantations is another tendency which gives more reliability than annual crops. One should remember that the dangers of crop diseases, pests, etc. which threaten monocultures, both annual and perennial, create even heavier losses when they attack arborescent monocultures (Janzen, 1973).

The sustainability of systems becomes very important when one considers the future generations of Brazilians which will live in Amazonia, which should be the highest priority for the Brazilian government in the formulation of its policy for development in the region. Sustainability is also linked to the problem of deforestation, the continuing deforestation of ever more forest being the inevitable consequence of systems which are not sustainable.

The uses of managed forest offer the hope of being a means of obtaining a sustained yield in the vast areas of *terra firme* (high ground) in Amazonia, and at the same time of avoiding many of the undesirable effects on the climate, soil, biota, etc. associated with clearcutting. A detailed examination is needed of the present proposals for projects of this type, and accelerated programs of basic research on the ecology of tropical forests, the effects of different levels of perturbation, and the behavior of managed forest systems. Examination of the proposals for "Forest Utilization Contracts" (Schmitz, 1978) should include knowledge of the proposed regulations, the plans for replanting seedlings, for leaving seed trees, for enriching the forest with valuable species, and for inspection and enforcement of these regulations. The sad history of enforcement of forest laws gives cause for caution, even if the plans are adequate given the assumption of perfect enforcement. The cost effectiveness of programs of inspection and enforcement should be estimated to allow prediction of the results of more realistic levels of enforcement—in other words, imperfect enforcement. In addition to ecological investigations, economic data are needed, especially on the costs of extraction, replanting, inspection, and defense against squatters. So far the costs and techniques for extraction (Brasil, SUDAM, 1978) are much better known than the other items,

especially the problem of replanting. Care should be taken that the costs and income from the schemes do not become disconnected, such that the beneficiaries of the income do not pursue a project which would not be attractive if the full cost had to be weighed against this income. A plan proposed by SUDAM would relieve the firms of the expensive and onerous task of replanting logged areas, making this the responsibility of the government (Pandolfo, 1978). The levels of income to be expected need to be better known, and consideration must be given to how this income will be distributed to sustain the population in the area. The enormous scale of the proposed projects, totalling 39,504,000 hectares (Pandolfo, 1978: 21) indicates the necessity of much more experimentation, including experiments installed in areas outside of the few areas which have been studied so far in the Curuá-Una Experimental Station and the Tapajós National Forest, as has always been noted by the proponents of this type of management (Reis, 1978: 16). Even in areas where studies are already in progress, the situation is described by Reis (1978: 14) thus: "In truth, a self-sustained system of production for dense tropical forest for industrial ends, based on the model considered here, has not yet been developed." In other words, much more research is needed. This should be given very high priority, especially by ecologists with an interest in development.

Reserves and parks, including national parks, national forests, "forest" (timber) reserves, ecological reserves, Indian reserves, biological reserves, etc., constitute a planned use of the forest on which the input of ecologists is indispensable. Arguments based on data are needed to justify the number, size, location, and restriction against perturbations of these reserves and parks. The taking of adequate measures to safeguard these areas against invasion is essential. The opinion that these reserves and parks are not adequate and are not sufficiently protected against invasion is the general opinion among researchers in this line of work.

Conclusions

Carrying capacity and colonization, extent of deforestation, effects of deforestation, causes of deforestation, control of deforestation, and planned uses of the forest are six general areas of research in which ecologists can contribute to the formulation of guidelines for development in Amazo-

nia. In addition to these six areas, there are many others which are important as well, such as energy policy, policy on transportation, mining, development of reservoirs, fisheries, pollution, and the effects of urbanization and industrialization which are increasing in the Amazon area. The need for further study should never be used as an excuse for putting off the implementation of effective measures to contain the process of deforestation and other irreversible and potentially deleterious processes affecting large areas of the Amazon Rain Forest.

REFERENCES

- Brasil. Ministério da Agricultura. Instituto Nacional de Colonização e Reforma Agrária (INCRA). Coordenaria Regional do Norte CR-01. (1974): *Relatório de Atividades 1974*. (Belém, INCRA).
- Brasil. Ministério da Agricultura. Superintendência de Desenvolvimento da Amazônia (SUDAM). (1978): *Exploração Mecanizada de Floresta em Terra Firme*. (PNUD/FAO/IBDF/BRA-76/027). (Belém, SUDAM). 133 pp.
- Clark, C. W. (1973): The economics of over-exploitation. *Science*, 181: 630-634.
- Clark, C. W. (1976): *Mathematical Bioeconomics: the Optimal Management of Renewable Resources*. (New York, Wiley-Interscience). 352 pp.
- de Almeida, H. (1978): *O Desenvolvimento da Amazônia e a Política de Incentivos Fiscais*. (Belém, Superintendência de Desenvolvimento da Amazônia - SUDAM). 32 pp.
- Fearnside, P. M. (1978): *Estimation of Carrying Capacity for Human Populations in a part of the Transamazon Highway Colonization Area of Brasil*. Ph.D. Dissertation in Biological Sciences, University of Michigan, Ann Arbor, Michigan (Ann Arbor, University Microfilms International). 624 pp.
- Fearnside, P. M. (1979a): *The Simulation of Carrying Capacity for Human Agricultural Populations in the Humid Tropics: Program and Documentation*. (In press, Manaus, Instituto Nacional de Pesquisas da Amazônia - INPA).
- Fearnside, P. M. (1979b): Cattle yield prediction for the Transamazon Highway of Brasil. *Interciencia*, 4: 220-226.
- Goodland, R. J. A. and Irwin, H. S. (1975): *Amazon Jungle: Green Hell to Red Desert? an Ecological Discussion of the Environmental Impact of the Highway Construction Program in the Amazon Basin*. (New York, Elsevier). 155 pp.
- Janzen, D. H. (1973): Tropical agroecosystems: habitats misunderstood by the temperate zones, mismanaged by the tropics. *Science*, 182: 1212-1219.
- Kass, D. C. L. (1978): Polyculture cropping systems: review and analysis. *Cornell International Agriculture Bulletin* Nº 32 (Ithaca, N. Y., Cornell University). 69 pp.
- Pandolfo, C. (1978): *A Floresta Amazônica Brasileira: Enfoque Econômico-Ecológico*. (Belém, Superintendência de Desenvolvimento da Amazônia - SUDAM). 118 pp.
- Reis, M. S. (1978): Uma definição técnico-política para o aproveitamento racional dos recursos florestais da Amazônia brasileira. (Conferência proferida durante o 3º Congresso Florestal Brasileiro, Manaus, Amazonas, 04-07 de dezembro de 1978). (Brasília, Projeto de Desenvolvimento e Pesquisa Florestal - PRODEPEF / Instituto Brasileiro de Desenvolvimento Florestal - IBDF). 21 pp.
- Rosenn, K. S. (1971): The jeito: Brazil's institutional bypass of the formal legal system and its development implications. *The American Journal of Comparative Law*, 19: 514-549.
- Schmithüsen, F. (1978): *Contratos de Utilização Florestal com Referência Especial a Amazônia Brasileira*. (PNUD/FAO/IBDF/BRA/76/027 Série Técnica Nº 12). (Brasília, Projeto de Desenvolvimento e Pesquisa Florestal - PRODEPEF). 35 pp.
- Serrão, E. A. S., Falesi, I. C., da Viegas, J. B., and Neto, J. F. T. (1978): *Produtividade de Pastagens Cultivadas em Solos de Baixa Fertilidade das Áreas de Floresta do Trópico Úmido Brasileiro*. (Belém, Empresa Brasileira de Pesquisa Agropecuária - Centro de Pesquisa Agropecuária do Trópico Úmido - EMBRAPA-CPATU). 73 pp.
- Sternberg, H. O'R. (1973): Development and conservation. *Erdkunde, Archiv für wissenschaftliche Geographie*, Band 27, lfg. 4 Bonn. pp. 263-265. (re-published as: Center for Latin American Studies, University of California, Berkeley, Reprint Nº 447).
- Tardin, A. T., dos Santos, A. P., de Moraes Novo, E. M. L., and Toledo, F. L. (1978): Projetos agropecuários da Amazônia: desmatamento e fiscalização - relatório. *A Amazônia Brasileira em Foco*, (12): 7-45.
- Tardin, A. T., dos Santos, A. P., Lee, D. C. L., Maia, F. C. S., Mendonça, F. J. Assunção, G. V., Rodrigues, J. E., de Moura Abdon, M., Novaes, R. A., Chen, S. C., Duarte, V., and Snimabukuro, Y. E. (1979): *Levantamento de Áreas de Desmatamento na Amazônia Legal através de Imagens do Satélite LANDSAT*. (INPE-COM.3/NTE C.D.U. 621.38SR). (São José dos Campos, São Paulo, Instituto Nacional de Pesquisas Espaciais - INPE). 9 pp.

EL DESARROLLO DE LA SELVA AMAZONICA: PROBLEMAS PRIORITARIOS PARA LA FORMULACION DE PAUTAS

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RESUMEN *Las áreas prioritarias de investigación para la formulación de pautas para el desarrollo de la selva amazónica, especialmente con relación al esfuerzo actual del gobierno brasileño para delinear una política de bosques, se dividen en seis categorías. La capacidad de sustentación y la colonización han de ser estudiadas para evitar fracasos en los proyectos de desarrollo con el objeto de sustentar la población humana a un nivel de vida adecuado sin degradación del ambiente.*

La información sobre la extensión de la deforestación es inadecuada. Los efectos conocidos de la deforestación son generalmente perjudiciales, especialmente aquellos que influyen sobre el clima y la biota. Las causas de la deforestación incluyen: incentivos fiscales, disponibilidad de inversiones alternativas que rindan más que el manejo sustentado en la Amazonia, un sistema de posesión de la tierra basado en la deforestación, el bajo precio de la tierra, y la demanda

de tierra agrícola para la población que crece exponencialmente.

Además de la fuerza de los motivos anteriores para la continuación de la tala, los problemas que complican el control de la deforestación incluyen: el desprecio tradicional de las leyes conservacionistas. Un sistema jurídico flexible con ejecución selectiva de las leyes, unos recursos inadecuados para imponer la ley, y una burocracia super-centralizada.

Los usos planificados de la selva incluyen: el uso de la selva talada, uso de selvas manejadas así como las reservas o los parques. La confiabilidad de producciones y la sustentabilidad de sistemas deben ser prioritarios en la planificación del uso económico de la selva. La contribución de ecólogos es esencial, pero la insuficiencia actual de conocimientos no justifica la tardanza en tomar medidas efectivas para contener la tala.

O DESENVOLVIMENTO DA FLORESTA AMAZÔNICA: PROBLEMAS PRIORITÁRIOS PARA A FORMULAÇÃO DE PAUTAS

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RESUMO *No sentido de formular pautas para o desenvolvimento da Floresta Amazônica, especialmente em relação ao esforço atual do governo brasileiro para delinear uma política florestal, as áreas prioritárias de pesquisa foram divididas em seis categorias. A capacidade de suporte e colonização devem ser estudadas para evitar fracassos nos projetos de desenvolvimento, do ponto de vista da sustentação da população humana em um padrão de vida adequado, sem a degradação do meio ambiente.*

A informação sobre a extensão do desmatamento é inadequada. Os efeitos conhecidos do desmatamento são geralmente prejudiciais, especialmente aqueles que influem sobre o clima e a biota. As causas do desmatamento incluem: incentivos fiscais, disponibilidade de investimentos alternativos que rendam mais do que o manejo sustentável na Amazônia, um sistema de posse da terra baseado no des-

matamento, preço baixo da terra e a demanda de terra agrícola para a população que cresce exponencialmente.

Além da força dos anteriores motivos para a continuação das derrubadas, os problemas que complicam o controle do desmatamento incluem: o desprezo tradicional às leis conservacionistas, um sistema jurídico flexível com cumprimento seletivo das leis, recursos inadequados para fazer cumprir a lei e a burocracia super-centralizada.

Os usos planejados da floresta incluem: o uso da floresta derrubada, o uso de florestas manejadas e reservas florestais ou parques. Confiabilidade de produção e sustentabilidade de sistemas que devem merecer alta prioridade no planejamento dos usos econômicos da floresta. A contribuição de ecólogos é indispensável, mas a insuficiência de conhecimentos atuais não justifica a protelação de medidas efetivas para conter os desmatamentos.