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## DEVELOPMENT AND CONSERVATION\*)

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*Zusammenfassung:* Entwicklungspolitik und Umweltschutz. In der vorliegenden Arbeit werden drei umfassende, zusammenhängende Themen anhand von Beispielen aus den tropischen Entwicklungsgebieten Brasiliens behandelt.

Der erste Teil befaßt sich hauptsächlich mit der übermäßigen Ausbreitung einer unrationellen Landwirtschaft auf Kosten bisher weitgehend unberührter Naturräume. Tropische Ökosysteme, seit langem unter dem Druck kleiner landhungriger Pioniere, werden nunmehr einem beispiellosen Angriff ausgesetzt, für den alle technologischen Erfindungen und große finanzielle Mittel bereit gestellt werden – für den aber praktisch keinerlei Kenntnisse der gegebenen Umweltbedingungen verfügbar sind. Wenn Neuland im Hinblick auf den hohen ökologischen Preis, den spätere Generationen dafür werden zahlen müssen, als ein in der Tat knapper und nicht als billiger Produktionsfaktor angesehen würde, dann müßte eine einsichtige Leitung vielmehr bestrebt sein, die Erschließung weiter Ländereien relativ geringen Potentials zu verhindern anstatt sie zu fördern.

Der zweite Teil erörtert einige Anreize, die dazu führen sollten, manche noch nicht erschlossene Ländereien bewußt von jeder Nutzung auszuschließen. Der begrenzte Erdrum macht eine Planung für Koexistenz mit der Natur notwendig, die unter anderem zum Ziele hat, Vorgänge in der Natur vor ihrer Vernichtung durch den Menschen ebenso zu schützen wie den Menschen vor Bedrohungen durch die Natur. Wenn die Unversehrtheit der Umwelt mit all ihren

potentiellen Hilfsquellen erhalten werden soll, so müssen die als Reserven vorgesehenen und von einer Nutzung ausgeklammerten Flächen groß genug sein, um alle pflanzlichen und tierischen Mitglieder des betreffenden Ökosystems zu enthalten.

Der dritte Teil betrifft Wertmaßstäbe, besonders für weniger entwickelte Länder, die für die Erhaltung der Naturräume von Belang sind. Angenommen, daß Alternativen zur westlichen Konsum-Gesellschaft gesucht werden sollten, so werden solche Länder, welche die genetischen Bestände, ökologische Mannigfaltigkeit und den kulturellen Pluralismus nicht zerstört haben, jenen gegenüber im Vorteil sein, die das zur Zeit beliebte, homogenisierte Industrie-Modell bis zu seinen letzten Konsequenzen verfolgt und durchgeführt haben.

Wenn es auch zuviel sein sollte, eine strikte „Hände-weg“-Politik für die noch verbliebenen Gebiete ursprünglicher Natur zu erwarten, so müssen doch zumindest ausgedehnte Räume von stückweiser Degradierung und Zerstörung gerettet werden, damit die natürlichen Prozesse weiterhin ablaufen können.

“For love of an insignificant profit the population destroys one of the greatest resources that could assure its subsistence and the well-being of its children, as well as the good fortune of coming generations. Unfortunately, it is not only the ignorant class that acts in this manner. The highest ranking persons do the same, as well as almost all the foreigners established in the country.”

João Martins da Silva Coutinho, military engineer and explorer, writing of the Amazon turtle-and of human improvidence, 1868.

\*) This article is, with minor modifications, the text of a paper presented under the title “The Need for New Concepts in Land Evaluation”, at the Twelfth Technical Meeting of the International Union for Conservation of Nature and Natural Resources, held in Banff, Canada, 12–15 September 1972.

“... everything indicates that future generations will have the right to criticize us severely if we sacrifice the per capita income growth for other priorities.”

Mario Henrique Simonsen, economist, writing on development, 1972.

There are two principal levels of land evaluation and management. The more general one concerns the processes that result in portions of a given territory remaining rural and non-agricultural. The other level, not touched upon here, concerns the specific ways in which these portions are utilized: e.g. wilderness tracts, game sanctuaries, parks.

On both levels, decisions should be based on adequate information and oriented toward goals that reflect the values of the communities concerned. In short, a chain: information-evaluation-decision-planning-implementation. It has more than one weak link. Thus, information is usually inadequate or nonexistent—especially in the case of developing tropical areas, upon whose New World expression this paper lays emphasis. And people are unclear, frequently ambivalent, about the value they attach to their resources—known, suspected or imagined. Indeed, even basic decisions are often lacking and the community drifts into haphazard dilapidation of assets, prompted by different interest groups.

Information about “land” bears upon all the elements that make the “personality” of a place: rocks, relief features, soils, macro- and micro-climates, plant and animal communities, water (increasingly, a limiting factor in the use of the oikumene)—and, of course, man himself and his works.

The gathering of some of this intelligence can be greatly expedited by new techniques of remote sensing, which make use of high-flying aircraft and, where views of large areas and time-series are required, satellites. The new sensors are particularly useful in overcoming some of the specific problems posed by tropical environments. Probably the most ambitious project thus far attempted to obtain *à pas de géant* an overview of the natural resources of a vast inter-tropical region, is Project RADAM (RADar in AMazonia). Airborne in 1971 and destined to cover some four million square kilometers of Amazonia and contiguous areas in Brazil, it uses sidelooking airborne radar (SLAR) to punch through the equatorial cloud cover that reduces the efficiency of conventional air photography. The equivalence of signals and “ground truth” having been established in all haste, the radar images are now being analyzed in terms of geology, geomorphology, hydrology, pedology and phytogeography (MOURA, 1971).

Even before the latest advances in scanning devices and the advent of spacecraft, a huge backlog of aerial photographs had been accumulated in many parts of the developing tropical world, e.g. Latin America and

Africa, and never seriously analysed (SCHWEITZER, 1972). Among the reasons for this waste of informational resources is lack of properly trained manpower, compounded by the short-sighted tendency of some governments to slap the “classified” stamp on all air photographs indiscriminately, making it extremely difficult for scientists, foreign and national, to study them.

Despite the assistance from new land inventory techniques, full understanding of ecosystems requires the detailed *in situ* study of interrelationships, at successive notches of integration. For instance, the plant-/animal coevolutionary syntheses carried out by HERBERT G. BAKER (Berkeley) or DAVID H. JANZEN (Chicago). For this kind of investigation, close-up, not remote sensing is required; there is no substitute for slugging over the ground.

Information gathering is influenced by and, in turn, influences the evaluation process. An important by-product of holistic thinking in relation to the environment is the better appreciation of the fact that the *mise en valeur* of any one of its elements will affect the others. One resource may be destroyed if another is exploited. Now, some value systems may be quite permissive when the inevitable “trade-off” involves surrendering a non-tangible benefit. But value systems change, especially after basic needs have been provided for. Greater store may be set on the environment’s capacity to provide for amenities—if that capacity is still there. Value may be discovered in what appeared valueless. The ongoing reappraisal of goals by the developed countries (DC’s) suggests that the less developed ones (LDC’s) should not make decisions that irreversibly impoverish or destroy the ecologic base, thus rendering futile a later reassessment of priorities. This is especially true where information is so incomplete that many undertakings can properly be considered a sort of “ecological roulette.”

Within the assigned frame of reference of this paper, I have picked three broad, interconnecting themes, to be treated in as many sections and only as examples. The first section deals with the complex, often unmediated interplay of forces that controls the existence, as well as the expansion and contraction, of non-agricultural rural lands. The second explores some of the many possible inducements for a deliberate setting aside of open lands. The third touches upon value systems, particularly those prevailing in the LDC’s, that condition receptivity to the ideals of quality growth and thus bear upon the chances for preservation of significant expanses of non-agricultural rural lands.

#### *Stress on Non-Agricultural Rural Lands*

In addition to the rural-non-farm domain, this discussion will refer to two other major functional land categories: urban and rural agricultural. Within

a particular territory, the lands thus classified, whose boundaries may be transitional or diffuse and are commonly unstable, are part of a physico-biotic as well as socio-economic-political fabric. These lands, by which I mean all the complex processes associated with them, interact with each other and with other non-coextensive subsystems—some chorological, some systematic or sectoral—woven into the fabric. They are also linked to systems of a higher order of magnitude; market prices and political or other world events may ultimately influence the destiny of the most remote parts of the earth. For instance, in the Peruvian rain forest, where during the rubber boom Indians were enslaved to work as tappers, profound cultural and biological repercussions resulted: eighty percent of the indigenous population of the Putumayo River were annihilated during the first decade of the century (VARESE, 1971).

Of the land in the three major categories mentioned, two kinds, urban and agricultural, are, in terms of prevailing values, obviously "productive." Excluding some deliberately protected areas, those in the third category, rural non-agricultural lands, constitute no more than a residue after urban and farm areas have been subtracted from the total space considered. If endowed with any potential at all, so goes the reasoning, the leftovers will eventually be used. Since the space preempted by urban and agricultural milieux defines by exclusion the extent of rural non-farm lands, much of this review, including the present section, deals with the subtrahends.

I shall address myself primarily to the category of agricultural lands. This choice is not meant to play down the phenomenon remarked by JEAN BRUNHES sixty years ago, which is even more striking today: "no human fact . . . has more quickly and powerfully changed 'the face of the earth' than the recent and prodigious growth of the cities" (BRUNHES, 1910). But these nerve centers, which radiate into all parts of the geographic body, are, in terms of direct competition for space, less significant than the agricultural lands. In the US, for instance, urban space, including airports, railroads, highways and places with more than 1,000 population, occupies only 2½ per cent of the territory (KRAUSE, 1971). Of course, through the urban field of which it is the core, the city projects its influence far into the surrounding countryside.

Given the extraordinary urban growth in the LDC's, the question as to whether the future increases in urban population will be entirely absorbed by existing communities or partly accommodated in new towns is of considerable interest to the fate of the rural non-farm lands. In the case of Latin America, for instance, guesstimating ninety million additional urbanites by 1990, some experts are talking of the need for ninety new million cities—or forty-five two-million agglomerates. Far-fetched, perhaps, but with a solid tradition of building cities from scratch, it will

not be a surprise to see quite a few new ones added to the ranks of Belo Horizonte, Brasilia, Ciudad Guayana and others. The implantation of a series of new towns is likely to produce a considerable impact on the environment, not only directly but also through the establishment of new urban fields and the building of a network of highways that will make isolated areas accessible. Opening up of "new" lands is precisely one of the main purposes of pre-planned towns in emerging nations. Accessibility, *per se*, is bound to affect the environment, whatever the stage of a country's development. But the closer a community is to the profit end (or the further from the aesthetic end) of the spectrum of environmental values at the time the lands are opened up, the greater the impact is likely to be.

#### Expansion and Retreat of Agricultural Land

The time dimension also is basic in the case of agriculture's impact on the rural non-farm lands. Much forest and woodland, wide stretches of grass in what is now the United States, were broken to the plow or modified by introduced livestock. For centuries, farms encroached on wilderness. Lately, however, gains have been more than offset by losses to agricultural land: the net retreat of cropland has proceeded at a rate of some ¾ million hectares *per annum* (ABEL and McARDLE, 1971). Many areas on which cropping is being discontinued are ill-suited for modern machinery and agricultural technology. Cleared land, over which farmers at one time walked their horse-drawn implements, have been abandoned or deliberately planted to trees. Similarly, extensive grasslands, once cultivated, have reverted to a herbaceous cover. The overextension and subsequent retreat of farming is not limited to lands of modern colonization. Witness, for example, the recent desertion of rural settlement in Norrland, where, for economic, political, and military reasons, the Swedish government encouraged farming in the late nineteenth and early twentieth centuries (STONE, 1971).

Social and economic costs of agricultural retrenchment are high, and original ecosystems have been grievously damaged, in some cases beyond recovery. One wonders if an assessment of agricultural potentials, incorporated into an overall plan for settling might have spared some of the lands that time was to prove marginal and dispensable.

Is it an equally vain exercise to speculate that the attack now being carried out against the remaining wilderness areas of the world, especially those in the tropical LDC's, might be tempered by greater foresight? The times are certainly different. There are now more environmental awareness and an increased potential for overall assessment of resources. And although the individual pioneer still threads his way

into the forest to hack out an ephemeral *roca*, large-scale enterprises, spurred by official incentives, and outright government colonization schemes are responsible for most of the ongoing clearing. Enlightened leadership might therefore use more integrated planning and appropriate manipulation of incentives to avoid rather than stimulate the opening up of much land of relatively low potential. In this connection, the fact that the decrease of agricultural land in the US has been possible despite a growing population should be duly evaluated by the peoples of the LDC's. That a reduction of more than ten percent in area of cropland occurred in the last two decades (KRAUSE, 1971), while the population increased by a third to pass the 200 million mark is due to a hefty increase in farm productivity. So great an increase, in fact, that it has created problems of overabundance, and extensive tracts of farmland have been taken out of production temporarily: in 1970, the total cropland diverted under specific government programs amounted to an estimated twenty-four million hectares (USDA, 1970).

Greatly increased efficiency that boosted the production per hectare by half since mid-century is due in part to the shift from marginal to better soil, in part to a more intensive use of the land, achieved by several means: increased use of power, better farm management and increased credit, as well as considerable inputs from scientific research, e.g. new fertilizers, pesticides, improved plant and livestock varieties (KRAUSE, 1971).

Concerning these inputs, the rather sudden realization that misuse of fertilizers and indiscriminate "overkill" with persistent synthetic pesticides has created serious environmental problems will slow down the rate at which farm productivity has been increasing in the US. The current ecological crisis should be a warning against uncritical transfer of "advanced" agricultural technology to the LDC's. However, these countries still have immense scope for improving the productivity of farming and stock raising, in ways that do not threaten the environment.

#### In-Depth Growth of Tropical Agriculture

In the emerging countries of the tropics, rapidly growing populations traditionally have been fed by advancing an inefficient agriculture into "new" lands. With a few notable exceptions, efforts to intensify and rationalize food production have been minor; more has been done for commercial export crops. However, if the encroachment upon wilderness areas is to be curtailed, and at the same time food demands met, there must be an increase in productivity. A policy destined to promote such growth in depth sets itself somewhat antithetical goals: on the one hand, to

maximize the output per hectare; on the other, to ensure the integrity of as much of the environment as possible. And all this, without increasing the vulnerability of tropical agriculture to pests and diseases. Alternatives to horizontal expansion must do more than adapt imported technology; they should explore a wide and varied range of measures that include, for instance, utilization of native resources as well as institutional reforms.

Efforts to produce high-yield cereal varieties suitable for the tropics, notably wheat and rice, culminated in the late sixties in what has been heralded as the "green revolution." It is no aspersion on the undeniable merits of the agricultural scientists involved to see in their achievements something less than the ultimate solution to the food problems of the tropics. The very success of the "miracle" grains, leading to their widespread adoption and the displacement of low-yielding indigenous varieties, carries the danger of providing a more favorable environment for pests and diseases. There also may be less tolerance to peaks of climatic or hydrological stress. That there is a very real basis for fearing that the food production of a region could be wiped out in one fell swoop was confirmed in 1971, when considerable areas in the Philippines, planted to high-yielding varieties of rice, including IR22, IR8 and IR5, were stricken by a severe outbreak of disease (*tungro*) or subjected to critical flooding.

It seems that, if agricultural productivity is to be effectively increased in the low latitudes so as to restrain undesirable expansion into wilderness areas, long-range solutions should be sought that are capable of exploring the rich diversity of tropical crops as well as peasant systems of agriculture of which they are a part. Witness, for instance, how inter-cropping or the value of native root crops have been generally ignored in the thrust for large-scale operations, partly as the result of the not always appropriate transfer to agriculture of "economy of scale" thinking.

Where, as in many tropical developing countries, the land tenure situation is characterized, on one hand, by the generally inefficient *latifundium* and, on the other, by the non-viable *minifundium*, increased productivity in the agricultural sector cannot be achieved without institutional changes. The objective of such changes: a social and economic environment conducive to the elaboration of a tropical-specific type of agriculture that seeks maximum sustained yield and fully utilizes resources native to the environment.

Unless one is dealing with a problem of the kind derived from indiscriminate use of pesticides or pollution by fertilizer run-off, it is the *latifundium*, with its extensive use of land, that is most detrimental to the overall environment. An use that is sufficient to destroy the ecosystem, yet not intensive enough to produce abundantly, to provide land for those that would till it, and to render unnecessary the advance of the frontier of settlement.

Need one say that powerful interests align themselves against a deep-cutting solution of the land tenure problem? Such interests are likely to feel more comfortable with an application of the venerable "safety valve" theory: surplus populations are drawn off and left to gnaw away at the rapidly retreating edge of the remaining wilderness.

### The Age of Large-Scale Clearance

Tropical ecosystems have long been under pressure from these small land-hungry pioneers, pushed by the socio-economic malaise of distant source areas. Now they are threatened by a massive assault mounted by groups armed with technological hardware, commanding great financial resources—and guided by a frighteningly inadequate understanding of the tropics. Certainly no period in history has witnessed a more extensive and rapid transformation in the planet's vegetation cover than that under way in the tropical lowlands of Latin America. It surpasses by far even such major episodes of land clearance as occurred during what the historian MARC BLOCH described as "l'âge des grands défrichements." The medieval clearings, which produced what appears to have been the greatest increment to the farmland of France since prehistoric times, ran their course over a period of two to three centuries (BLOCH, 1952). The ones now in progress are compressed into a few decades: to strip vast areas, tractors are deployed alongside the axe-wielding woodsman, and, it is said, even defoliantes have been used (FRISCH, 1970).

Consider, for instance, the case of Brazil, where recently there has been a great increase in the total amount of land in farms, mostly in the Central-West and Amazonia. Although statistical data are not at hand at the time of this writing, it is safe to say, on the basis of field observations, that cattle ranches occupy an overwhelming proportion of the land opened up since 1960. The pursestrings of the funds used in the vast campaign of clearing and grassification are held by the Superintendence for the Development of Amazonia (SUDAM). Resources derive from a highly ingenious scheme that allows substantial tax deductions, provided funds are put up for investment in approved development projects. The bulk of the tax moneys allocated as of 1971 went to agro-pastoral (*i.e.* livestock) projects (43.5 percent), followed by industry and services (39.9 and 16.6 percent, respectively). Major beneficiaries have been wealthy entrepreneurs working out of São Paulo and engaged in carving immense cattle spreads out of the forests and savannas of Mato Grosso, northern Goiás and southern Pará.

Several factors contribute to the expansion of pasturelands in Brazil, part of the ongoing grassification of the New World tropics (WILHELMY, 1954; STERNBERG, 1968; PARSONS, 1970). But other stimuli

would not be effective if operators did not foresee expanding markets and favorable beef prices. Even if the figures for world-wide growth in population that serve as a basis for projecting future protein requirements should fall short of expectations, medium term prospects for beef are, indeed, very good (FAO, 1971). The producers' position seems assured by growing internal consumption in Latin American countries and a substantial demand on the part of some developed importing countries.

Nevertheless, to the conservation-conscious observer, the ongoing "grass rush," carried out at the expense of existing ecosystems, appears a shortsighted dilapidation of irreplaceable resources, an elimination of future options.

### Better Use of Existing Pastures

First and foremost, this expansion of grassland seems unwise because foreseeable demand for beef probably can be satisfied with existing pastures. Livestock production in the developing countries is among the world's most inefficient industries (FAO, 1969); in addition to poor grazing conditions, the prevalence of epizootics and the generally inadequate levels of husbandry as well as adverse institutional factors contribute to low productivity. To bring to fruition the potentialities of existing pastures there is often no need for very sophisticated or costly technology. The harvest and storage of forage, for instance, can cushion the adverse effects of seasonal fluctuations on the condition of pastures (BEHAR and BRESSANI, 1971). A second example is the identification of trace-element deficiencies: small investments in corrective measures can contribute greatly to the productivity of the herds. A final example is the suggested "integration of animal and plant agriculture" in order to improve soil fertility (FAO, 1969). The extent to which some experts believe the Latin American livestock industry can be upgraded is reflected in a recent report dealing with the Beef Program of CIAT (Centro Internacional de Agricultura Tropical):

"The present beef cattle population of tropical grassland areas of Latin America could probably be increased four to five times, and total marketable beef production increased up to ten-fold through application of available knowledge to existing pasture and animal resources, proper seeding of improved pasture, population with beef cattle of now idle grassland and development of improved breeding systems, particularly thorough selection and crossbreeding" (CIAT, 1969).

In brief, the "deplorable level" (BEHAR and BRESSANI, 1971) of the cattle industry in Latin America and other tropical areas, with beef production at a fraction of capacity, constitutes in itself the best assurance that an ample margin exists for greatly expanding the output of beef without expanding the area of grass-

lands. The keynote: intensified use of existing pastures.

The scarcity and plenty of resources implied here does not conform to traditional cost-benefit analyses. Where land is treated as a "cheap" factor, extensive grazing with perhaps some supplemental feeding might produce the most profitable economic combination. But if one were to inject econometrics into econometrics, wild lands would be treated as a scarce resource, not because of their cash value but because the ecological price of their conversion to pasture is judged too high for future generations to pay. Production processes would have to adjust to this shift in the weighting of factors; the trend would be toward more intensive cattle-feeding systems, with reduced amounts of land and greater inputs of capital and management. Even if one does not envisage the ultimate in confined livestock systems—which have their own problems (MUELLER, 1971)—, much land now in pasture might be put to alternate uses, including food and feed crops, thus permitting a remeshing of crops and stock production, where appropriate, and halting the escalation of wilderness-taming.

#### Possible Changes in Food Intake Patterns

A kindred argument for curbing imprudent expansion of grazing areas is the possibility of a change in patterns of meat intake. In the LDC's, bovine and sheep meats—mostly beef in Latin America—account for nearly seventy per cent of the meat consumption, against fifty per cent in the DC's (FAO, 1971). With adequate precautions, a great amount of domestic fowl and pork meat can be produced in the LDC's, with relatively minor demands on space, as has been established in some areas of the Far East, where land is in short supply. Yet poultry in many countries remains a luxury. Thus, in Cuba, according to an account recently quoted by DUMONT (1970), "chicken is reserved for the sick and women with child." In Brazil, despite a rapid increase in poultry production around major urban centers, a considerable segment of the population understands only too well the grim humor of the old saying: "when a poor person eats chicken, one of the two must be sick."

The expansion of grazing areas for domesticated livestock goes hand in hand with a widespread disregard for native animals as a source of protein. These were utilized by aborigines such as the natives of Brazil, who at the time of discovery had "bodies so clean, so well-fed and handsome, that they could not be more so" (CAMINHA, 1500). Some of the wild species that provided the Amerinds with a bountiful and palatable source of protein now hover on the brink of extinction through overkill and destruction of their habitats. Yet they are probably more efficient converters of native vegetation than the introduced live-

stock. Some form of rational cropping of wildlife, perhaps as a supplement to more conventional ranching (including the raising of water buffalo), seems particularly promising in riverine environments, the habitat of such significant meat-producers as the capybara (*Hydrochoerus hydrochoeris*), the largest rodent living, or the tapir (*Tapirus terrestris*). The streams themselves provided, along with the coastal waters, a substantial portion of the protein used by the aborigines, and might again play an important role if their biological integrity can be saved. The South American river turtles (*Podocnemis expansa*), once described as the cattle of the Amazon, were kept in corrals by the Indians; recent experiments have demonstrated the possibility of raising *tartaruga* (SMITH, N. J. H., 1972), as had been suggested over a century ago by COUTINHO (1868).

Among the many alternatives the future may hold, whose effect would be to dampen the drive for more man-made grasslands, is a partial turning away from animal protein itself. The efficiency of cattle as converters of nutrients into high quality food for human consumption is relatively low, and there are situations where the more intensive use of land to produce crops directly ingested by man may be more expedient. Prospects for increasing the amount or improving the quality of vegetal protein are significant. There is even the possibility that plant-derived substitutes will make appreciable inroads on the meat market, as in the past they have partly displaced other farm products, such as butter. According to projections made by the Economic Research Service, USDA, if conditions most favorable to market penetration obtain, replacement of beef by soy substitutes in 1980 might represent as much as 8½ per cent of the U.S. beef output; this switch would liberate 1.4 million hectares otherwise used for livestock production (USDA, 1972).

The statement that direct chemical synthesis may in the future replace the biochemical processes of nature in the elaboration of some basic foods currently shipped in from the farm, smacks of science fiction. Yet know-how is available for production in factories of food commodities or their components, in which vitamins and synthetic amino acids have been fore-runners (PYKE, 1970). Whether or not one shares futurologists' enthusiasm for this kind of prospect, it does represent a maximum concentration of food production per unit area (with all attendant problems), and should be taken into account when reflecting on how tomorrow's spatial organization may affect the present urge to encroach upon rural non-agricultural areas.

#### The "Frontier Vision"

This section has dealt with the expansion of urban and farm lands, discussing it in terms of the need to

accommodate a growing population or to increase agricultural output. A brief mention should be made of an entirely different type of motivation for advance upon the wild lands, one that is not always explicit and has somewhat elusive psychological dimensions. I refer to the "frontier vision," a vision that takes hold of some people and inspires them to open up wild lands simply because it is the "right thing" to do. One could easily point to many adverse effects the application of this concept is having in the less developed tropics. But perhaps it is better to demonstrate the latitudinal range of the vision by drawing attention to such plans as the "Mid-Canada Development Corridor" that aims at the enhancement of an area lying roughly between the 50th parallel and the northern tree line from Newfoundland to the Yukon (ROHMER, 1970). Sovereignty over resources is among its objectives. Also national pride: "Canadians will cease to live as colonials, imitating the cities and economic life of Great Britain or the United States and . . . live as a northern people like Siberians or Scandinavians." (CONWAY, 1969).

#### *The time of the finite world*

PAUL VALÉRY said it almost three decades ago: "the time of the finite world commences" (VALÉRY, 1945). At the root of the frontier vision and of the related theme of pioneer conquest has been the idea of colonization of "new" or, what has been regarded as the same thing, "empty" lands. With the unprecedented territorial windfall of the Age of Discovery, Europeans and their descendants got into the habit of regarding space for settling almost as if it were an infinite or renewable resource. Now, however, it is finitude, emphasized dramatically by the image of our planet as seen from outer space, that lends urgency to the need for a rational organization of earth-space, for a *géographie-volontaire* (LABASSE, 1966), to save at least some significant ecosystems from urban and rural sprawl.

This earth-space of ours is not merely a geometric, nor even an economic space, but a highly diversified, multidimensional pulsating tissue. Its place-to-place variations must be auscultated, if a delicate attunement is to be achieved between, on the one hand, the heartbeat of the land, with its message of opportunities and constraints, and, on the other, human design.

A design for coexistence should have among its objectives that of protecting natural processes from disruption by man and man from the insults of nature. Out of enlightened self-interest if not on aesthetic or moral grounds.

It is essentially on a moral plane, however, that one particular issue needs to be situated, when discussing the kind of spatial organization that is germane to the objectives of this session. The issue I refer to arises

from the fact that the notion of the emptiness of "new" lands—with its corollary urge to hasten clearing, taming, peopling—is often unfounded. Pioneer colonization can be less a conquest of emptiness than the triumph of a modern civilization, commercial and technological, the civilization, over backward groups condemned to submit or perish (RAISON, 1968). It is a tragic fact that, in the white man's dealings with the aborigines, "physical, spiritual or cultural imperialism of one kind or another" (BISKUP, 1968), has its analogues in almost every newly colonized country.

Areas reluctantly and ungenerously set aside for aboriginal reservations have subsequently been reduced, intruded upon or exchanged for less valuable land. Recently, the approach seems to be to "integrate" the aboriginal populations in the national society. Ignoring completely their mobile way of life, some proposals in New World areas would "grant" plots of farm land to the Amerinds, on a parity with civilized settlers. In relation to the Australian aborigines, once "the idea was to kill them off," it has been admitted, "then the more humane programme was to let them die peacefully and meanwhile to smooth the dying pillow, now the policy is to assimilate them" (COLEMAN, 1959).

Point-blank: lands that are occupied by indigenes, no matter how sparsely, cannot ethically be dealt with as a *res nullius*, to be developed or assigned to any other use.

Proceeding now to a brief commentary on the matter of a design for coexistence from the viewpoint of the place for non-agricultural rural lands, with uses that range all the way from recreational purposes to complete interdiction, this section will take up first some aspects of the endangered environment; then, a few thoughts on natural hazards to man, concluding with a meshing of the two concerns.

#### Roots of Change

In reviewing some ecological aspects that might lend support to a policy of deliberately setting aside sizable rural non-farm areas, I shall limit myself to a few that seem appropriately "developmentist." Exemplification comes from a part of the world where technological man is thrusting violently into areas that are unique, virtually unresearched and presumed to be highly vulnerable: the sparsely settled parts of the lowland tropics, especially in the Americas. They have already made major contributions to the world economy.

An outstanding example of the lowland tropical elements borrowed from the Amerind's cultural heritage is manioc (*Manihot esculenta*), which has become a major food staple. The Indians handed on, not only the ancient cultigen itself, but also the rather complex techniques for preparing flour and for eliminating the

poison from the roots of those cultivars that have a high concentration of a cyanogenetic glycoside. Some techniques, incidentally, appear to boost the concentration of protein in the finished product (ROGERS, 1972).

Manioc outranks all other food crops in the production of energy per unit area. As raw material for compound animal feeds and industrial starch, it is an increasingly important international trade item (*International Trade Center*, 1968; AYRES, 1972). In line with the preceding section of this paper, it might be pointed out that a wider use of manioc as cattle feed in some of the countries producing this crop could supply a valuable supplement to grazing, thus reducing the area required for pasture. Furthermore, several researchers have pointed out that, even when people enjoy an adequate intake of protein, symptoms of its deficiency may still occur if the proper calorie levels are not met, since protein will be utilized for energy purposes (GOPALAN, 1968; MILLER and PAYNE, 1969; SUKHATME 1969, 1970a and 1970b). Indeed, it has been stated that in areas such as India, "widespread incidence of protein deficiency . . . is mostly the result of an inadequate quantity of food" (SUKHATME, 1970b) and, in fact that "the main bottleneck in the current dietary situation is caloric inadequacy" (GOPALAN, 1968). If such is the case, extraordinary energy-producers like manioc should have an important role in the composition of a balanced diet in the tropics.

The vegetation of the New World may still have a valuable contribution to give in respect to manioc. Experts believe there is considerable margin for improvement of this already precious root crop, in inter-specific hybridization between *Manihot esculenta* and several other species (ROGERS and APPAN, 1970). It is significant for what will come later in this section that "species of manihot are seldom widely distributed and occur mostly as very local populations" (ROGERS and APPAN, 1970; my italics).

The case of manioc illustrates only one of many practical reasons for guaranteeing the diversity of the biosphere. In addition to the possible use of gene pools for the improvement of known crops, the tropics abound with wild, unrealized provender that needs to be explored before the wreckers with their bulldozers bring the storehouse tumbling down. Many such provisions were known to the aborigines who, over the millenia, by trial and sometimes costly error, learned to use available food resources, preparing them in a palatable manner, and freeing them of toxins when necessary. Some foodstuffs, in fact, did come down to us, only to be disdained as poor man's fare, low in status, even when high in nutritive value. It will be necessary to discover or rediscover the potential use for many food resources of forest and savanna: most of the Indians are no longer with us, and their lore is beyond recall.

One is reminded of episodes such as that narrated by Dr. EMILIA SNETHLAGE, at the time Head of the Zoology section of the Museu Goeldi in Belém. In 1909, this extraordinary woman set out to cross the divide between the Xingu and Tapajós rivers. At the end of a four-week march in the company of a band of Kuruáya Indians, provisions were exhausted and nourishment consisted largely of roots or tubers gathered by the Tupi. One, of the arrowroot family (*Marantaceae*), named "hothin-á" by the Kuruáya was a whitish, grape-sized tuber, pulled in bunches from shallow soil between the rocks at water's edge. It had a potato-like taste and could be eaten raw or roasted, but generally was prepared as a mush by the Indian women who accompanied the expedition. Another tuber, "hamai-pin," also provided a pap, especially savory when mixed with honey; Miss SNETHLAGE described it as irregularly bulbiform, black-skinned, with white, extremely juicy flesh (SNETHLAGE, 1913).

How many other edible roots and tubers like the Kuruáya's "hothin-á" and "hamai-pin" may remain unknown, while constituting perhaps important potentials for food production in the tropics? Some will never be identified. It is not possible, for instance, to ask the descendants of her Indian companions to retrace Dr. SNETHLAGE's steps and identify the plants mentioned by her. These are still there, and geologists, helicoptered in to reconnoiter the area's mineral resources (Anon., 1970), may be inadvertently stubbing some of the tubers, as they scuff around the stream banks. But the Kuruáya, who had intermittent contact with the national society at the turn of the century, are now extinct (RIBEIRO, 1967).

A recent guest editorial in *Science* starts out with the whimsy that roots and their activities have been kept very much in the dark. The author, a plant physiologist, concludes with a plea for the closure of the information gap concerning the processes that are "literally at the root of life on Earth" (EPSTEIN, 1972). The gap is far wider in respect to the related nutritional aspects of tropical roots and tubers, often disposed of in a cavalier fashion because they are primarily carbohydrate. It is perhaps not without significance that a book extolling the "green revolution" should be entitled "Seeds of Change" (BROWN, 1970). One hopes that new attention to the potentials of tropical roots and tubers may soon bring forth a "Roots of Change".

#### Survival of Unperceived Resources

Theoretical efforts to estimate the agricultural potential of the tropics often are so loaded with temperate zone biases that their purpose is defeated, as, for instance, when the light-response curves of middle latitude crops are used to establish indices of productivity for the low latitudes. Even from a practical



point of view, rather than trying to transplant temperate crops to the tropics, more effort should be made to develop plants indigenous to the low latitudes. The reopening of the entire field of photosynthetic metabolism since the mid-sixties, with the discovery of an alternate pathway of CO<sub>2</sub> fixation, has demonstrated the existence of a group of higher plants that have important adaptive advantages in high-temperature environments (HATCH and SLACK, 1970; HATCH, OSMOND and SLATYER, 1971). It has also shown how little is known, as man discriminates between high-efficiency plants, to be improved and propagated, and weeds or useless plants, to be eliminated. Today's weed just might be tomorrow's staple—if it survives. Although emphasis in this paper has been on the food-producing potential of the tropical plants, there are many other possibilities; e.g., natural replacements for synthetic pesticides. Again, if the potentially useful plants survive to be discovered. In many tropical areas, the "rate of forest destruction exceeds the rate of screening for untapped but useful phytochemical compounds" (LOWRY, 1971). The question arises as to the minimum size which continuous areas of natural reserves must have if they are indeed to include all potential resources. Consider, for instance, the Amazonian *Hyloea*. The fact that this rain forest stretches for thousands of kilometers, relatively unbroken and with no marked discontinuities, and the recurrence of certain plants almost throughout the length and breadth of the Amazon valley might suggest that it is enough to set aside certain discrete forest reserves in order to ensure a complete spectrum of genetic resources. Not so. Richard Spruce, who spent years in the Amazon valley during the mid-19th century, describes the *Hyloea* as "wonderfully rich," despite an appearance of uniformity: "by moving a degree of either latitude or longitude I found half of the species different" (SPRUCE, 1908). An example is the woody climber guaraná (*Paulinia cupana*) of the Maué, Mundurucu and Apicá Indians, which grows in the Tapajós-Madeira region and is cultivated mostly around Maués, being used as the basis for a popular soft drink sold all over Brazil—and now exalted by an imitation bottled in Montreal. The astonishment caused a few years ago, during an FAO forestry survey, by the discovery of a conifer of the genus *Podocarpus* in the region between the rivers Caité and Maracassumé, in Pará (HEINSDIJK and BASTOS, 1965), is an indication of the degree to which the Amazon rain forest is unknown—it also confirms the rather localized occurrence of some species.

The smallest effective dimensions of wild areas, as related to the preservation of plant diversity, cannot be appreciated without the growing recognition that plants and animals have evolved as members of ecosystems (BAKER, 1970); resulting mutualistic bonds are essential to the equilibrium among plants species of the tropical forest. The identification of minimum

ecological modules thus requires a thorough understanding of the biosystematics of the tropical forest, if truly functional assemblages are to be preserved. Among many plant-animal relationships that need to be investigated are those concerning plant reproduction (pollination, dispersal of seeds and improved germination by their passage through the gut). Consideration must be given to the possibility that some animals affecting the equilibrium of the forest may be transients, who carry out their assigned roles and move on, perhaps out of the module—if Noah's Park is not big enough for the system.

#### Natural Hazards and Open Space Programs

That the whole earth soon will not be big enough for mankind is a hotly debated proposition. That parts of it are inhospitable to humans is beyond dispute. Avoidance of "high-risk" areas by permanent, especially urban, settlements would reduce the stress of environmental insults upon a segment of the population and, therefore, must be considered by a "volitional geography."

Different natural hazards tend to fall into regional patterns; detailed maps showing their distribution and severity should constitute a fundamental requirement for land-use planning at all levels. There is, however, a considerable range in the extent to which the spatial arrangement of risk can be brought to bear upon open-space programs. Applicability varies, not only with the type of hazard, but also with the human factors involved.

The possibility of setting aside hazardous areas for non-agricultural rural use will depend on the options offered to the population involved. Contrast, for instance, the impact of hurricanes along the shores of the northern Bay of Bengal (where in November 1970 a killer storm lashed the coast and offshore islands of what is now Bangladesh and caused some 300,000 fatalities) and on the Gulf and Atlantic coastlands of the US (where the most deadly hurricane on record produced the 1900 Galveston surge, responsible for 6,000 deaths). Not only are the physical conditions very dissimilar, but the demographic, social and economic components in these two coastscapes are worlds apart. Whereas one would be at a loss to suggest alternatives for the poor farm- and fisherfolk who occupy the littoral of the Bay of Bengal, the same does not apply, for instance, to the well-to-do population that is now creating "another of America's megalopolises" along the Florida coast, north and south of Miami: "men and machines . . . gobbling up sandy pineland and hardwood hammocks, filling the bay bottoms." The aggression against nature continues through the Florida Keys (WILSON and EISNER, 1968), and an ecosystem rich in plant and animal life is being destroyed. The crowding of residential resorts into

this hurricane-prone coast seems to be inviting retribution. A Hurricane Preparedness Conference for the Southeast recently brought out the fact that it will be virtually impossible to evacuate Greater Miami, where a hurricane of major proportions is overdue. The director of the National Hurricane Center at Coral Gables, referring to the possible impact of a major hurricane on prestigious Key Biscayne, is quoted as saying that "it could turn into a nightmare": the low-lying island commands only one exit route to the mainland and does not have enough high-rises to hold all residents who might seek shelter there (BRANDT, 1972).

In some of the world's disaster-prone areas, major agglomerations already have mushroomed and, even with a well-devised policy of disincentives, it would be utopian to expect more than to bring growth to a stop and, ever so slowly perhaps, reverse the trend. However, there are many open areas, high-risk areas, that at this very moment are being viewed with a speculative eye by real estate "developers." It is here that a master design for coexistence can have the greatest impact. There is much scope for ecological studies to play a supporting role in this approach to spatial organization, which derives quite properly from an overriding concern with hazards to man, but can advantageously be linked to effective programs for open space preservation, so as to reduce the hazards to nature. Such an approach requires that the prevailing growth model be replaced by one that gives due consideration to non-profit values. The people involved must be willing to forego certain "development" values—and to pay the price. Persons ready to adopt such a position have increased in numbers and militancy in developed areas. They are still an almost invisible and not very vocal minority in the emerging countries.

#### "Underpolluted" Countries?

Considerable expectation exists among peoples in the LDC's that science and technology will provide a cornucopia of goods and services. Often there is an underlying confidence in great, untapped resources and in the discovery of a simple way to unlock treasures hoarded by nature, coveted by foreigners.

Many recent converts to ecology find it difficult to comprehend that people in the LDC's should be eager to have belching smokestacks and other visible symbols of development—and of pollution. A look at some infant mortality figures might help. In some state capitals of Brazil, for instance, this rate lies between 150 and 200 per thousand live births (Brasil, 1970). In limited extreme-poverty districts, it may well be twice as high. That this, probably the best single index for gauging the general health and welfare of a population (SMITH, T. L., 1972), should be so staggering is tragic evidence of the extent to which

human resources are being wasted. For people whose main concern is survival, it is hard to understand, much less care about the deleterious effects of pollutants on morbidity and mortality: however undesirable, these are certainly minor in the short run, when compared with those of utter, catastrophic poverty. As a spokesman from India put it: "The wealthy countries worry about car fumes. We worry about starvation" (*New York Times*, 1970).

Governments at all levels tend to assume—often with faultless motivations and usually with widespread support—that leadership carries a mandate for promoting economic growth, regardless of long-term effects on the environment. The problems of "pollution havens" (RUSSELL and LANDSBERG, 1971) is a case in point. Consider the statement for which the Planning Minister of Brazil was recently taken to task by editorials in the world press. Discussing ongoing negotiations for the establishment of a highly polluting wood-pulp plant for Japanese paper manufacturers (who are facing pressure from domestic anti-pollution legislation), the Minister was quoted: "Why not, we have a lot left to pollute. They don't." (*New York Times*, 1972). A subsequent clarification, while recognizing the need to reduce the effects of certain industries on the deterioration of the environment, reasserts the basic premise that "countries like Brazil, having ample reserves of unutilized land, can be much more flexible than, for instance, Japan, in the choice of sectors with major pollution potential." (*Estado de São Paulo*, 1972). An administration that has led the economy "from mess to miracle," as headlined in the *Wall Street Journal* (1972), breaking every record of economic development in 1971 with an 11.3 per cent increase in GNP, is not likely to admit that its "flexibility" in dealing with environmental degradation could be disastrous.

As to pollution exporters: to obtain and sustain a high standard of living at the cost of one's neighbor's environment is colonialism of a particularly insidious kind. Presented to the LDC's under the magic cloak of one more opportunity to industrialize, it seems to raise few nationalistic hackles. Yet that is what it is: ecolonialism.

As a matter of fact, quite a lot is being published nowadays in the LDC's about ecology. But generally the rules of the game are that environmental concern should never impede development. Those who know better often maintain a low profile. An example comes from a country that hardly can be included among the least developed. One of the editors of the first report by the Israel National Committee on the Biosphere and Environment is quoted: "We must not sound as if we're against progress, or that would be the end of us." (MILLER, 1972).

Entrepreneurs—a flourishing class in many LDC's—are actually getting in each others way, as devoted to the progress ethic, they discover new possi-

bilities in the environment. With little or no value attached to natural processes, with interrelationships de-emphasized, it is not surprising that certain money-making activities should impinge upon others. Consider, for instance, the tourism business, which is expanding rapidly in the tropics and, in some places, is or may become the major source of revenue. If scenic beauty, variety of game animals, cultural diversity, and similar assets are adversely affected by other uses of the environment, the flow of visitors may easily be turned. Where massive funds are invested in tourist services, it is "only good business" to protect such resources, not merely for their intrinsic value—reason enough—but because they represent the prime input of an industry capable of contributing substantially and on a sustained yield basis to the national income. Conversely, in the words of a recent plan for Hawaii, "the needs of the tourism industry must be adapted to—and not detract from—the indigenous amenities." (*Overview*, 1972).

While belief in indefinite economic progress is quite generalized, for the LDC's it holds out the much decried, but no less desired, material well-being of their rich, spendthrift cousins. Yet it is pretty obvious that a US-style throw-away economy will never be ecumenical. If the contrast in living standards of "have" and "have-not" countries is to be abated, some of the "necessities" of the consumer society may have to be renounced by all, and, in fact, alternate styles of development sought. In the search, countries that have not destroyed genetic pools, ecological diversity, and cultural pluralism will have the edge on those that have carried to its ultimate consequences the pursuit of a homogenized, industrial model. Such a course may lead a society to dangerous overspecialization, leaving it with less adaptive resources than one which endeavors to mesh the new with the old, without destroying its heritage—and options.

The transference of technology to LDC's as it has been made, has run counter to diversity. And yet, that which has been judged good for, say, the United States may not be good for a tropical developing country; in fact, as is now becoming evident, it sometimes is not good even for the prototype. One course of action that might favor a better adjustment of technology to the conditions prevailing in the LDC's is to encourage the transfer of technical knowledge among developing countries, so that native ingenuity may be better combined with imported expertise (TARAPORE, 1972).

A drive for "status" technology may bring few advantages and many disadvantages to the countries importing know-how. A Brazilian newsweekly not long ago displayed on its cover a full-color photograph of a beer can; the corresponding story announced the entry of the country's brewery industry into the canned beer market (*Visão*, 1970). The impact of strip-mining iron, tin and bauxite, the expenditure of

electricity—about 17,000 kilowatt hours to convert five tons of bauxite to one ton of aluminum (YOCHELSON, 1972), and other ecological costs might seem more acceptable if the end product were to contribute, effectively, to the quality of life. But the last link in the chain of insults to the environment: a throwaway container! This, at a time when conservationists in the United States are demanding that strong measures be taken against the manufacture of beer cans and that all facilities under control of federal and state governments discontinue the purchase and sale of non-returnable beverage containers.

There is no need for the LDC's to adopt a twentieth-century version of Rousseau's theory of the "happy savage," nor to turn their backs on science and technology and revert to romantic primitivism. But whenever some form of "hard" technology is adopted it should be capable of contributing to the general welfare without the ill effects that are so obvious in the production of, say, steel beverage cans with aluminum flitops. Escape from hunger and poverty should not be made even more difficult by environmental degradation. Today's problems must be solved without creating super-problems for tomorrow.

Realistically, however, no LDC is willing to fall behind in the race to adopt sophisticated rather than "soft," ecologically-adjusted technology. In the perspective of an one world system, the DC's contribute in several ways to foment this race. One inducement is the "under-remuneration by the industrialized countries for agricultural and animal produce," as pointed out by the Group of African Experts (1972), which met last April at the Institute of Economic Development and Planning (Dakar), and demanded upgrading and stabilization of the prices of their products. If, on the one hand, it behooves the leaders of emerging nations, in the best interest of their own people, to set their sights on qualitative, rather than on quantitative growth, the wealthier countries, on the other hand, must do their bit to create global conditions where such a plank becomes clearly desirable and politically feasible.

### Conclusion

It is too much to expect that mankind would or even, at this point, could adopt a strict "hands-off" policy in relation to the remaining non-agricultural rural lands. But if the earth space is holistically viewed, researched, organized—managed if you accept the paradox—at least some extensive tracts may be saved from piecemeal degradation. From management itself. From development. From man's busyness, his urge to assert himself, to cut and fill and straighten. Some tracts where it may be possible, actually, to "laissez faire la Nature."

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## DIE ÖKONOMISCHE BEREICHSGLIEDERUNG IM MITTELASIATISCH-KAZACHSTANISCHEN RAUM DER SOWJET-UNION

6 Abbildungen und 9 Tabellen

ERNST GIESE

*Summary:* The economic regionalization in the Central Asian/Kazakhstan rayon of the Soviet Union. According to the present economic regionalization (ekonomicheskoye rayonirovaniye) of the Soviet Union, Kazakhstan and the Central Asian republics of Turkmenistan, Uzbekistan, Tadzhikistan and Kirgizistan form two economic rayons. Although South Kazakhstan has a stronger similarity to the Central Asian republics of Turkmenistan, Uzbekistan, economic structure and maintains close economic relations with that region, South Kazakhstan does not belong to the economic rayon of Central Asia but to the economic rayon of Kazakhstan. In this paper, the reasons for this allocation are examined. Apart from purely economic factors, politico-economic, national-political and administrative aspects are taken into consideration. Primary consideration is given to the question of what status and position Central Asia and Kazakhstan hold within the Soviet Union and what economic policy is pursued by Russia in relation to this former colonial region and development area of today.

Nach der gegenwärtigen ökonomischen Bereichsgliederung (*ekonomičeskie rajonirovanie*) der Sowjet-Union bilden Kazakhstan sowie die vier mittelasiatischen Republiken Turkmenistan, Uzbekistan, Tadzhikistan und Kirgizistan zwei ökonomische Großräume (Abb. 1). Obwohl Südkazachstan nach seiner physiogeographischen Ausstattung und wirtschaftlichen Struktur mehr dem mittelasiatischen Raum ähnelt und mit diesem enge wirtschaftliche Verbindungen unterhält, gehört Südkazachstan nicht zum ökonomischen Großraum Mittelasien, sondern zum ökonomischen Großraum Kazakhstan.

Im folgenden sollen die Ursachen dieser Zuordnung untersucht werden, wobei vor allem der Frage nachzugehen sein wird, welche Stellung und Position der mittelasiatische und kazachstanische Raum im Verband der Sowjet-Union einnehmen und welche Wirtschaftspolitik von russischer Seite diesem ehemaligen