

Alternative models for sustainable cattle ranching on already deforested lands in the Amazon

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ABSTRACT

Based on the conclusions that ranching is a very important activity in the context of agricultural development in the Amazon, this paper describes the stigmas of cattle ranching on deforested lands, such as forests sacrificed to create pastures, pastures as fire-prone ecosystems, desertification, low productivity and socioeconomic efficiency, climate changes and agronomic instabilities. It examines more sustainable alternatives models as semi-intensive beef cattle, intensive ranching for dairy-beef cattle and integrate animal-pasture-crop/tree and make recommendations for government policy actions after raising questions about future developments, as “how much ranching is really necessary”, “how should it be organized” and “how should improvements be implemented”.

Key words: agroforestry, sustainable pastures, land recuperation in Amazon region

INTRODUCTION

Within the context of agricultural development in the Brazilian Amazon, cattle raising activities undoubtedly play a role of extreme relevance. But the expansion of cattle raising replacing forests in the last three decades has been the motive for serious questioning due to low levels of sustainability from a technological, socioeconomic and, mainly, ecological point of view.

Large scale deforestation in favor of agricultural development in the region has been the result of poorly conceived development policies which have encouraged extensive ranching, threatening the fragility of the environment (Serrão & Toledo, in press).

The dominant feature of cattle production systems replacing large tracts of forest in the Amazon has been pasture degradation, the main

factor contributing to the low biological and economic efficiency of this type of activity.

The majority of the analyses on ranching have been tempered, in general, with a certain degree of emotion and partiality, depending on the academic and ideological inclination and of other diverse interests of the analysts. On one extreme, cattle raising has been accused by environmentalists of being the principal cause of the Amazonian ecosystem's degradation – mainly the forest ecosystem – and tagged as unfeasible from an agronomical and socioeconomic point of view. On the other extreme, developmentalists consider cattle raising to be capable of opening development frontiers and of making good use of land, capital, and labor resources. In addition, the great majority of these analyses which condemn ranching are based largely on what occurred during the 1960s and 1970s when the opening of the frontier via cattle raising presented, moreso than now, all of the problems typical of frontier activities such

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as: reduced knowledge about the environment and, consequently, insufficient scientific and technological support; logistical difficulties; land speculation; inefficient monitoring of credits and incentives, among others.

Controversies aside, cattle raising replacing forests in the region is a reality today and – although at a slower speed than in past years – ranching continues to expand because of increasing population density and the consequent demand for cattle products.

In this paper, a brief analysis of cattle ranching on deforested lands is made and, based on experience accumulated in the past two decades, alternative models are proposed which should propitiate higher levels of sustainability within the environmental and socioeconomic conditions of the Amazon.

THE SIX STIGMAS OF CATTLE RANCHING ON DEFORESTED LAND

Cattle raising activities developed in the process of opening Amazon frontier have been stigmatized in various aspects.

STIGMA 1 — FORESTS ARE SACRIFICED TO CREATE PASTURES

According to recent estimates from INPE (1990) put into effect by the Senate committee (Senado Federal, 1990) established to evaluate the extent of deforestation and its consequences in the so-called Legal Amazon, during the 1970s and 1980s alone, some 25 million hectares of forest were cut down and burned for various agricultural purposes. If one estimates that at least 70% of this area was used for cattle raising purposes, at least 17 million hectares of forest were cleared to form pastures for cattle raising in this period. And, supposing that, on the average, each hectare of forest contains about 300 tons of biomass, there would be a loss of about 5 billion tons of plant biomass, in addition to the immediate genetic losses of the macro and micro flora and fauna.

Moreover, considering that about 50% of the forest biomass is liberated as carbon in the form of CO₂ during combustion and decomposition,

very gross estimates suggest that as much as 2.5 billion tons of carbon have been liberated into the atmosphere as a result of fires in the pasture formation and management process during the 70s and 80s. These fires release “greenhouse gases” that affect climate (Salati, 1990). According to recent estimates (Woodwell, 1988) the total global emission of carbon resulting from the conversion of tropical forests in the last two decades was about 40 billion tons. Thus, the conversion of forests into pastures in the Amazon would have contributed to at least 6% of that total (Serrão, 1990), which should not be so alarming, unless the process continues to accelerate unnecessarily as has been occurring over the last three decades.

STIGMA 2 — PASTURES ARE FIRE-PRONE ECOSYSTEMS

Recent research (Uhl & Kauffman, 1990a,b) scientifically proves that open pastures are very susceptible to burning, followed, in descending order, by forest vegetation in areas where there has been recent logging, and by secondary forest vegetation, in descending order, the primary forest being practically immune to burning. Fires set in pastures for management purposes frequently escape into surrounding logged forests and second-growth forests and may cause incalculable damage to the ecosystem. For example, when a 20-yr old capoeira burns, it loses 20 years of forest succession with its ecological and economic values.

STIGMA 3 — DESERTIFICATION

It has been argued that large scale deforestation and burning for pasture formation and management could lead to “desertification” of large tracts of the Amazon (Goodland & Erwin, 1975). This stigma lacks scientific support. Recent research carried out in the Eastern Amazon (Uhl *et al.*, 1988) shows that forest regeneration in degraded and abandoned pasturelands depends on its previous management and fire control. In spite of some difficulties of a physical and biotic order, forest regeneration in abandoned pasturelands can

be quite satisfactory, with an accumulation of forest biomass which varies between 5 and 10 tons per hectare per year.

STIGMA 4 — LOW PRODUCTIVITY AND SOCIOECONOMIC EFFICIENCY

It is estimated that first-cycle pastures (pastures formed after clearing and burning the primary forest), in their 5 to 7 year average lifetime, have produced between 500 and 600 kg of liveweight (between 250 and 300 kg of meat or about 50 kg of meat per hectare per year), which is very low in terms of food energy, protein productivity, and monetary value per unit of land, mainly when compared with other products such as cassava, rice, corn, beans, cocoa, and Brazil-nuts (Uhl & Gonçalves, in preparation).

Recent surveys (Mattos *et al.*, in press) indicate that extensive ranching replacing forests yields very low net income per hectare of active pasture and per hectare of cleared forest, profits being satisfactory only on very large ranches (probably larger than 3,000 ha). In addition, extensive ranching provides few employment opportunities. According to Uzeda (unpublished) cited by Mattos *et al.* (in press), not more than one full-time person is employed for about every 500 hectares of clearing for pasture. Besides, extensive ranching is frequently associated with land ownership problems (land speculation and conflicts of diverse natures) (Hecht, 1982).

STIGMA 5 — CLIMATE CHANGE

Climatic change has been one other stigma associated with deforestation for cattle ranching in the Amazon. Deep roots in the forest (Nepstad *et al.*, 1991) provides access to water deep in the soil and maintain the forest ecosystem in an evergreen state, which contrasts with the pasture ecosystem that has more superficial root systems and, consequently, seems to have lower annual evapotranspiration than the forest ecosystem (Skula *et al.*, 1990; Nepstad & Jipp, unpublished). According to Salati (1990), that situation may lead to decline in regional rainfall because a sig-

nificant quantity of rainfall in the Amazon is derived from local evapotranspiration.

STIGMA 6 — AGRONOMIC INSTABILITY

During the first 3 to 4 years after first-cycle pasture establishment, forage production is relatively high, supporting stocking rates of up to two 300kg – liveweight heads of cattle per hectare. After that period, a fairly fast decline in productivity takes place, accompanied by weed encroachment, resulting in advanced stages of degradation which occur, in general, between 5 and 7 years after pasture establishment (Serrão *et al.*, 1979; Serrão & Toledo, 1990). It is estimated that, to date, at least 50% (about 10 million hectares) of the total 1st-cycle pastures formed in the past 25 years have reached advanced stages of degradation (Serrão, 1990).

In general, these stigmas of clearing forest for ranching in the Amazon have been associated with the *first-cycle pasture based extensive ranching model* for beef production which were prevalent mainly until the mid 80s and are typical of frontier conquests in other humid tropical regions (Serrão & Toledo, in press).

Besides that, at the outset of the 80s, more progressive ranchers began to adopt technological innovations in search of greater sustainability in their ranching activities. Pastures established in the beginning of the 80s – with the availability of more adaptable forages (e.g. *Brachiaria brizantha* cv. Marandu and *Andropogon gayanus* cv. Plantalina) – already show a promissory level of agronomic sustainability in comparison with pastures established in the two previous decades.

MORE SUSTAINABLE ALTERNATIVE MODELS

From the outset of the 1980s – due to reductions in tax incentives and subsidized credit, increase in the area of degraded pastures, beginning of pressures directed at environmental preservation, greater availability of technical/scientific knowledge and pasture technology, decrease in available forest areas for additional clearing on already existing ranches, increase in the price of

land – a greater intensification in the use of land already explored by cattle raising came into effect, with the use of technology more compatible with greater agronomic/economic sustainability (Serrão, 1989).

Following are models that have higher levels of sustainability and should be implemented in *already deforested lands in the Amazon*.

SEMI-INTENSIVE BEEF CATTLE RANCHING MODEL

These more intensive (in relation to the extensive pioneer model) beef cattle ranching models began to be implemented in the 80s, and should continue to be implemented on already degraded pasturelands. It involves more modern agricultural and technological methods such as mechanization, soil fertilization, forages better adapted to environmental conditions, better quality forage seeds, greater care with pasture management, among other production factors (Serrão, 1989).

Restoration of degraded pastures resulting from the extensive model and improved pasture stability are the main features of the semi-intensive model. Pasture restoration typically involves: 1) clearing the site of debris, old trunks and boles left in degraded first-cycle pasture areas and burning the accumulated debris; 2) tilling; and 3) fertilizing and seeding forage seed by tractor.

The performance of these semi-intensive reformed pasture-based models has been satisfactory to date. According to Serrão (1989), the cost to make this shift from extensive to semi-intensive ranching vary between US\$ 200 and US\$ 250 per hectare; that capital for pasture restoration has come, to a large extent, from logging of still forested portions of the ranch holdings; and that, depending on how forests are logged for that purpose, between 1 and 2 hectares of forest are needed to finance the restoration of 1 hectare of pasture. Recent surveys (Mattos *et al.*, in press) show that profits of these semi-intensive ranching systems are at least four times greater than in the extensive pioneer model.

According to Serrão (1989), based on informal evaluation, the improved economic performance of cattle raising on restored pastures in relation to extensive ranching is due to: 1) reduced maintenance costs involved with keeping the pasture weeded (weeding is considerably less frequent); 2) improved carrying capacity of at least 200%; 3) increased daily cattle liveweight gain varies between 400 and 500 grams; and 4) longer productive life.

This model has been undergoing development in medium and mainly, in large-size ranches in an area presently estimated at, at least, 1 million hectares.

INTENSIVE MODEL: RANCHING FOR DAIRY-BEEF CATTLE

The consolidation of some poles of development started in the 60s and the population's need for dairy products have more recently led to still more intensive approaches to ranching by small-property holders with dual-purpose (dairy-beef) cattle ranching in formerly deforested lands for extensive cattle ranching in the vicinities of more recently developed rural cities.

This model differs from the typically more intensive dairy cattle ranching which is being developed in areas near the capital cities of the region (example: the Castanhal region in Bragançana Zone, State of Pará) (Simão Neto *et al.*, 1989) and which involves, in large measure, specialized dairy cattle breeds, improved installations and the use of diverse kinds of rations, characterized as being a high investment and low economic feasibility model.

The intensive dual-purpose model is characterized by milk and beef production on small holdings using bovine cross breeds (for example, "gir-holando") with a reduced number of cows fed mainly on pasture with average carrying capacity of about one cow per hectare, using some supplemental rations of cassava tubers and other products grown on the property.

In general, in this model, the cattle ranching activity is associated with some kind of agricultural activity involving perennial crops (black

pepper, citrus, rubber trees), semi-perennial crops (passion fruit, pineapple, papaya) or annual crops (cassava, corn).

A typical dual-purpose cattle ranching model is one described by Mattos *et al.* (in press) which is being carried out in the municipality of Paragominas, State of Pará. In this model, farmers have cows of different ages. The oldest animals are sold for slaughter while the weaned males are sold for fattening to neighboring ranches who use the extensive or semi-intensive beef cattle models.

In these more intensive ranching models, capital investments are relatively high, but so are the net profits (Mattos *et al.*, in press).

These models have the great advantage of higher levels of socioeconomic and ecological sustainability than the extensive and semi-intensive beef cattle models discussed above.

THE ANIMAL-PASTURE-CROP/TREE INTEGRATED MODEL

In spite of the present and potential possibilities of improved technical and socioeconomic sustainability in cattle raising on already deforested lands, as discussed above, one question is appropriate here: would it be correct to continue in the search for improved ranching sustainability based merely on traditional pasture systems (monoculture open pasture) as has happened, in general, in the region? This question deserves attention for, in general, perennial monocultures which have replaced the forest ecosystem without taking into account the peculiarities of environmental factors (climatic, edaphic, biotic) and the forest vocation (great biological diversity) of the region have had serious limitations in regard to agronomic sustainability, as has been frequently observed in crops such as rubber tree, cocoa, black pepper and African oil palm, to name the most important ones.

As for cattle ranching, it is probable that the dissemination of pasture spittle but (a pasture pest which has caused great economic damage to the cattle raising sector) is the result of the ecological imbalance resulting from deforestation of large areas for pasture monoculture establishment of

Brachiaria spp (the spittle bug's most preferred substrate) in the region (Serrão, 1989).

In view of the above, and in spite of the advances in improved sustainability of Amazonian pastures, environmental and socioeconomic peculiarities of the region require that alternative models of pasture-based cattle raising production systems be found, whether they be agronomical, ecological and socioeconomically more sustainable than the present ones in use.

The agro-silvo-pastoral systems (agricultural systems where annual and perennial crops and trees are explored in planned associated with pasture for animal production in a simultaneous or sequential manner), which in recent years have deserved the growing attention of research and the productive sector, should be inserted within the context.

The existence of agro-silvo-pastoral systems on a commercial scale in areas of more recent agricultural development is still incipient due to the model of extensive exploration in effect and to the still low demographic density of the rural sector and the great availability of land in the greater part of the region (Veiga & Serrão, 1990).

However, it can be visualized that, on the short and medium term, with increased demographic density in the existing poles of development and pressures for more food, fibers and other agricultural products (and the consequent increase in land value and land use intensity) and with the increase of pressures in favor of the environment, a good portion of the present extensive cattle raising models may be progressively modified to give way to more intensive integrated systems of the agro-pastoral or agro-silvo-pastoral types which have been beginning to take place in agricultural regions of higher demographic density such as, for example, the Bragantina Zone of the State of Pará, in the eastern Amazon.

Although not a panacea, by way of their positive bioeconomic and ecological characteristics, these integrated models can propitiate higher levels of *agronomic sustainability* (reduction of risk due to pests and diseases; improved cycling and, consequently, better utilization of soil nutrients), *economic sustainability* (diverse sour-

ces of income), *social sustainability* (supply of diverse agricultural products, greater job offer, greater labor specialization) and *ecological sustainability* (biomass accumulation; improved hydrological relations; soil protection; improved environment for macro and micro fauna and flora) (Serrão & Toledo, in press).

In the 1990s, the Amazon should begin to see some development of these integrated systems in the process of recuperation/renovation of degraded pasture ecosystems in lands already deforested for cattle raising and, within the first decades of the next century, agro-silvo-pastoral models should be an important asset in sustained regional agricultural development.

This model should be developed in medium- (mainly) and large- sized ranches.

FUTURE DEVELOPMENTS

Three questions should be asked in relation to the future of cattle ranching in deforested lands in the Amazon. How much cattle raising is really necessary? How should it be organized? How should improvements be implemented?

HOW MUCH RANCHING IS NECESSARY?

Although the possibility of exportation of cattle products (mainly beef) produced in the Amazon should not be entirely discarded, there is no doubt that at least ranching should supply the meat and dairy needs of the region's inhabitants.

Mattos *et al.* (in press) have suggested, for example, that the present herd size (6 million head of cattle) for the State of Pará is sufficient to supply the protein needs of its present population (6 million people). These estimates and the most recent technological improvements in cattle ranching in already deforested areas make it possible to infer that, in about 50% of these areas, it is possible to produce cattle products for the region's population at least until the year 2000 (Serrão, 1989; Serrão, 1991; Mattos *et al.*, in press). The remaining 50% should be utilized for promoting forest regeneration and agricultural and forestry development (Serrão & Homma, in press; Nepstad *et al.*, 1991), that could bring greater

economic and social benefits for the region's population.

HOW SHOULD RANCHING DEVELOPMENT BE ORIENTED?

In order to meet future regional population demands with conservation of natural resources, ranching will have to increase its productivity. Consequently, it will have to be intensified, which seems to be the present tendency.

In this context, there should be some expansion of the semi-intensive ranching model as discussed above, in degraded first-cycle pasture areas. Presently, implementation of this model is being supported by the Government through official financial mechanisms, such as the FNO (Constitutional Fund) with the support of regional research and technical assistance institutions. This model's implementation assures improved levels of sustainability in relation to the extensive model. However, in view of their present and potential socioeconomic and ecological sustainability, emphasis should be placed on the development of intensive dual-purpose ranching and agro-silvo-pastoral models.

HOW SHOULD SUSTAINABLE RANCHING DEVELOPMENT BE IMPLEMENTED?

Improvement of cattle raising sustainability in already deforested lands requires changes in attitude and appropriate policies (Serrão, 1989).

The production sector is beginning to assimilate the philosophy and importance of intensification of already explored lands and the need to search for more sustainable agriculture and ranching models "compatible" with the present stage of regional development. This change in attitude is of paramount importance and must be stimulated, supported and accompanied by a corresponding change of attitude in the public sector.

The public sector's change in attitude has to be translated into policies which favor less predatory agricultural, forest and ranching activities and are more oriented towards the exploration of already explored lands. On a short term

basis, a moratorium on further deforestation for ranching should encourage more sustainable agricultural and pasture-based ranching on the presently explored lands.

In order to promote implementation of these proposed more sustainable models, larger investments must be injected into research and technical assistance. Only the generation of scientific knowledge and the development and adoption of appropriate technology will make possible the necessary compromise of production with conservation in sustainable development.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on what has been discussed in this paper, the following conclusions can be drawn:

— Ranching is a very important economic activity in the context of agricultural development in the Amazon.

— Ranching in deforested lands has been seriously questioned due to its negative socioeconomic and ecological implications.

— Questioning of ranching's low sustainability in deforested areas is related mostly to pioneer extensive cattle raising development models used in the frontier development process, mainly in the 60s and 70s.

— Starting in the mid 80s, ranching in deforested lands experienced increasing sustainable development, where restoration of already deforested lands with improved pastures and management has played a significant role.

— With the existing and developing knowledge and technology, it is possible to produce cattle products to meet the demand of the regional population, at least until the year 2000, in about 50% of the land already explored for that purpose. In this process, intensification of land use is of utmost importance.

— In already deforested lands, on a medium- and long-term basis, that the unsustainable *extensive ranching model* should gradually be transformed into more sustainable *semi-intensive beef cattle*

models, intensive dual-purpose cattle ranching models and agro-silvo-pastoral models.

— In order to make those changes possible, very important changes in attitude and policies are required from the productive and the policy-making sectors.

RECOMMENDATIONS

In order to encourage and promote more sustainable cattle raising development in the Amazon, the following recommendations are appropriate:

— It seems appropriate for the Federal and State governments to establish a short-term moratorium on further deforestation for ranching and carefully evaluate the real need for further expansion of ranching replacing forests in the region.

— Governments should give emphasis to promote the development of socioeconomically and ecologically sustainable models such as the intensive dual-purpose cattle and the agro-silvo-pastoral model in already developed areas.

— Governments should give increasingly decisive support to research and technical assistance institutions in the region so that they can effectively perform their role in the search and development of more sustainable agricultural models.

— Governmental and non-governmental research and technical assistance institutions must review their portfolio and, in a joint effort, search and implement sustainable agriculture and forestry development alternatives for the Amazon.

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