

Challenges to cattle ranching in the Brazilian Amazon



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Foreword

Cattle ranching emerges as one of the main activities in the Brazilian Amazon. In the last decades, this activity expanded strongly in that region, a growth that should continue in the future.

This manuscript summarizes the challenges and evolution of cattle ranching in the Brazilian Amazon, including their historical beginning. Emphasis is placed on the past 40 years of research experience accumulated by Embrapa on management and reclamation of degraded pasture areas in the Amazon.

This document represents an important contribution by Embrapa in this strategic area for food security, environmental preservation and economic growth in the Amazon region.

The expectation is that this paper might provide a new view on this often-misunderstood area of knowledge, influencing research investment decisions and public policies in the Brazilian Amazon.

Adriano Venturieri

Head of Embrapa Amazônia Oriental

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Introduction

Cattle ranching in the Brazilian Amazon¹ has its origins in the mid-17th century. During this period, the first heads of *Bos taurus* entered the Amazon valley, introduced by the Portuguese colonizer, through the city of Belém, at the mouth of the Amazon River. This pioneer introduction of Creole cattle, originally brought from the Iberian Peninsula, was first raised in sown pasture areas, opened around Belém (Reis, 1960). These animals were later taken to Marajó Island, and then, to other locations in the Brazilian Amazon, where cattle ranching expanded in different proportions (Dias-Filho, 2019).

During the past 400 years, multiple predisposing conditions converge to account for the expansion of beef production in the Amazon region. Over this period, cattle ranching in the Brazilian Amazon has gone through an evolutionary process, described by stages of efficiency and productivity (Figure 1)

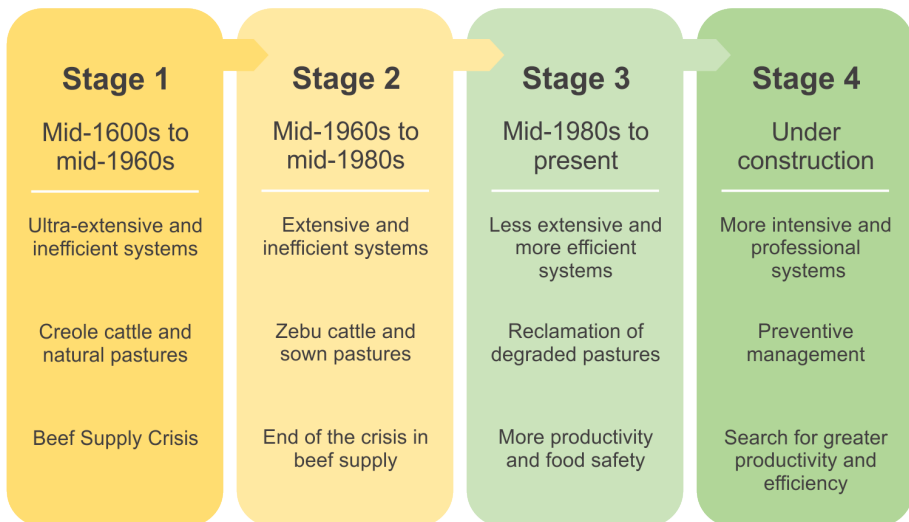


Figure 1. Evolution of cattle ranching in the Brazilian Amazon.

¹ In Brazil, two geographical concepts of Amazonia are used: Classical Amazonia and Legal Amazonia. Classical Amazonia corresponds to the northern region of Brazil and includes seven states (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins). Legal Amazonia corresponds to a region legally defined for purposes of regional planning and public policy. It includes the northern region and parts of the center-west and northeastern regions of Brazil.

The purpose of this paper is to summarize the challenges and evolution of cattle ranching in the Brazilian Amazon, including their historical beginning. Emphasis is placed on the role of Embrapa in generating improved pasture technology and fostering its adoption by ranchers.

The expectation is that this paper might provide a fresh view on this often-misunderstood area of knowledge, being a valuable asset to influence research investment decisions and public policies in the Brazilian Amazon.

First stage of cattle ranching in the Amazon: inefficiency and low productivity

For over three centuries, that is, from mid-1600s to mid-1960s, Marajó Island was the major cattle ranching center in the Brazilian Amazon. Also important were the marginal stretches of the Lower and Middle Amazon Region, the Rio Branco Valley (east of the present state of Roraima) and the coast of the current state of Amapá (Dias-Filho, 2019).

During this period, which characterized the first stage (Stage 1) of cattle ranching in the Amazon, most beef production was dependent on Creole cattle (“common”, “curraleiro” or “pé-duro” cattle) reared on natural pastures (Figure 2). These cattle were degenerate descendants of the cattle introduced by the Portuguese at the beginning of colonization.



Figure 2. Creole cattle introduced by the Portuguese colonizers in the Amazon. Photo taken at Marajó Island, in the early 1900s.

Source: Pará (1908).

During Stage 1, most pastures presented low productivity and poor nutritional value and, in some places, were subject to periodic floodings of the Amazon River and its tributaries. These floodings hindered pasture use for a few months every year, causing the loss of thousands of cattle. Coupled with this, the transportation infrastructure for fresh beef supply to the population of major cities, heavily dependent on waterways, was precarious and ineffective.

The crisis in beef supply

The high regional demand for fresh beef, driven by growing population centers experiencing chronic supply deficits in city markets throughout Amazonia, created a recurrent beef crisis. This crisis in beef supply, which began in the colonial era (early 19th century), lasted until the mid-1960s, affecting particularly low-income families, that is, the vast majority of the inhabitants of the Amazon (Dias-Filho, 2019).

Such a condition of food insecurity, characterized by scarcity and, consequently, the high price of the little available beef, was, for over a century, one of the main causes of the low consumption of animal protein in the Amazon, especially in the largest urban centers.

In this regard, the then director of the Northern Agronomic Institute [now Embrapa Amazônia Oriental] Felisberto Cardoso de Camargo (1896–1977) stated that the Brazilian Amazon had endemic hunger for centuries, considered by the “decrease of one’s own size and weight” (Camargo, 1948). In addition, in the end of 1940, the nutrologist physician Josué Apolônio de Castro (1908–1973) made a similar statement in his classic book *Geography of hunger: hunger in Brazil*. According to Castro, in the Amazon, protein deficiency in food “is immediately revealed by insufficient growth, due to the below average height of the components of the Amazonian population that are among the lowest in the South American continent [...]” (Castro, 1948, p. 69).

Similarly, an article published in the early 1960s explains that low human life expectancy in the Amazon (39 years) would be mainly a consequence of the undernourishment of the population than of the typical endemics of the Amazon region (Gomes, 1960). The same article cites, as the basis of this statement, a declaration contained in a report from the forestry mission of

Food and Agriculture Organization (FAO) to the Brazilian government, written in the 1950s. This report states that “The three and a half million square kilometers of the Amazon produce less than half of the food needed by just two million people who are so malnourished that malnutrition and inadequate nutrition – not endemic diseases – are the main problem from the medical point of view” (Gomes, 1960).

Indeed, in a study conducted in 1966 on the economic development of the Amazon, it was claimed that malnutrition of the Amazonian population took on “extremely dramatic” proportions and that the lack of animal protein in the diet was a problem that could not be solved while cattle ranching was “inadequate and deficient” (Desenvolvimento..., 1966).

Air shipments of beef in the Brazilian Amazon

The large unmet demand for fresh beef in the Amazon region forced the importation of this commodity. This importation came from places within the Amazon Region itself, from other regions within Brazil, or even from abroad (Dias-Filho, 2013).

From the end of 1947, the supply of part of the fresh beef, consumed in Belém, PA (the largest city in the Brazilian Amazon), was air-shipped by the so-called “butcher airplanes” (“aviões carneiros”). In the following years, the air transport of fresh beef was also extended to other cities within the Amazon region, such as Manaus, AM, and Rio Branco, AC (Ferreira Filho, 1961; Borges, 1986).

Beef shipments air-transported by the butcher planes originated from slaughterhouses, then called “charqueadas”, located mainly to the north of the present state of Tocantins (then called Goiás), where the cattle were slaughtered, butchered and boarded into the airplane (Valverde; Dias, 1967). Marabá, Santarém and Marajó Island, in Pará, and Carolina, in Maranhão, were also places where the butcher airplanes were supplied with beef (Dias-Filho, 2013).

At least until 1965, about 40% of the beef consumed in Belém was air-transported, resulting in prices “prohibitively expensive for most of the

population” (Penteado, 1968). Further illustrating this food security crisis, beef in Belém, during the mid-1960s, was also heavily dependent on a “precarious and costly” market supply that depended heavily on animals reared on natural pastures in the Marajó archipelago (Penteado, 1968). An acknowledged cause of this beef supply shortfall was the low productivity potential of the region’s natural pasturelands.

Reversing the crisis in beef production and supply

Aiming to reverse this bleak regional situation, in which food insecurity was one of the main impediments, the federal government launched in 1966 the so-called “Operation Amazonia” (Banco da Amazônia, 1969; Brasil, 1969). This government action aimed, in theory, to reverse the situation of misery of the Amazon and abandonment of the region, establishing, among other benefits, a policy of granting tax incentives, encouraging private investment to integrate this region into the national productive economic process. The mechanism of fiscal incentives sought to supply what would be the greatest need for the economic development of the Amazon at that time – capital.

Because of this incentive policy, investors flocked to the Amazon. Many early investors came from the ranching sectors of Goiás, Minas Gerais and São Paulo. Therefore, for reasons of heritage and economic rationale, investors acquiring these forested lands used low-risk, extensive production methods, which required little labor, little infrastructure and low-cost pastures. In addition, cattle ranching was the only economic activity receiving public financing (transfers) to rapidly colonize the Amazon and with high earnings potential. Thus, the cattle industry historically constituted the prime use of land on the agricultural frontier (Dias-Filho, 2014a).

Beginning in the early 1960s, that is, just before the “Operation Amazonia” was launched, a gradual expansion of the existing sown pasture areas started to take place in the Amazon region. These pastures were established, with some initial success, mainly along the newly opened Belém-Brasília highway (BR-010), particularly in the current municipality of Paragominas, PA (Penteado, 1968).

Belém-Brasília and other transregional routes allowed access to forested lands for pasture formation and herd expansion. These roadways also facilitated the needed flow of beef to population centers and boosted the genetic improvement of the regional cattle herd. This was accomplished with the intensification of imports of Zebu breeding stocks from Triangulo Mineiro, MG (Valverde, 1967; Valverde; Dias, 1967).

Prior to the opening of these integration highways, Zebu cattle imports (as well as other cattle breeds) were sporadically made through Belém sea port, or other places in the Amazon by river, or airplane, at a very high cost (Dias-Filho, 2019).

The initial success achieved by cattle ranching in the Paragominas region (Valverde; Dias 1967; Valverde 1968) was an incentive for the continued expansion of cattle ranching in that municipality, as well as in other locations in the Amazon Region (Dias-Filho, 2019). This expansion was subsidized by the liberal policy of tax breaks from “Operation Amazonia” and facilitated by the opening of new regional integration roads. These events established the end of Stage 1 and the beginning of Stage 2 of the Amazonian cattle ranching activity (Figure 1).

The second stage of cattle ranching in the Amazon: the end of the beef supply crisis

The second stage of cattle ranching in the Brazilian Amazon was built upon the expansion of sown pasture areas, the ease of production flow and the gradual increase in the level of Zebu blood in the regional herd. These events greatly expanded the supply of beef, thereby lowering the price of this good to the population. Such a scenario had a profound impact on improving regional food security, radically changing the recurrent beef crisis and, as a consequence, food insecurity in much of the Amazon region. A direct effect of this new stage of Amazonian cattle ranching was the extinction of air transportation of fresh beef, initially in Belém and later, in other cities within the Amazon region. This made the price of beef even more affordable for the population (Dias-Filho, 2013).

Until the late 1970s, there were strong barriers of knowledge and technology for the effective establishment and management of sown pastures in the Brazilian Amazon. Therefore, the cattle sector operated mostly in a technological vacuum. This knowledge favored land use for extensive systems of cattle ranching.

These predominantly extensive systems of the so-called Stage 2 of Amazonian cattle ranching took its toll. As a result, the initial euphoria over the successful formation of sown pastures in the late 1960s gradually gave way to a growing concern about the failure of this enterprise. These resulted from poor pasture management, spittlebug attacks in *Brachiaria* grass species, and low adaptation of the few forage germplasm options borrowed from different ecosystems. These failures fostered crash-and-burn outcomes from soil nutrient depletion, forage species losses resulting in less ground cover and weed invasions (i.e., degradations), and low pasture longevity.

In this scenario, productivity shortfalls to achieve ranch and market supply targets generally led to the abandonment of these degraded pastures and opening of newly sown areas, on lands previously covered by natural vegetation (mainly primary forest or Cerrado) (Dias-Filho, 2014a). This land conversion dynamic increased the size of the stock of degraded pastures by stimulating land substitutions via increased deforestation (Dias-Filho, 2014a). This land use model, which prevailed from 1970s to the mid- 1980s, contributed to the expansion of degraded pasture areas and deforestation in the Amazon and helped stigmatize ranching in the Amazon as an unsustainable and environmentally destructive food production system (Dias-Filho, 2013).

The first research actions to recover degraded pastures in the Amazon

Under this generally inefficient cattle production scenario, initial research projects targeted increasing longevity of pasturelands.

In 1975, a five-year agreement was signed between Superintendência do Desenvolvimento da Amazônia (Sudam) and the Ibec Research Institute (IRI) (Agreement 061/75 IRI-Sudam). This agreement focused on land reclamation and the performance of forage grasses in the Paragominas region and northeastern Mato Grosso (Koster et al., 1977; Rolim et al., 1979).

Following this restoration strategy in private ranches, the Centro de Pesquisa Agroflorestal da Amazônia Oriental (CPATU), now Embrapa Amazônia Oriental launched Propasto Legal Amazonia, in 1976. Financial support for this project was from Banco da Amazônia (Basa) and Polamazônia (Program of Agricultural, Livestock and Mineral Poles in Amazonia) mediated by Sudam. Objectives were to determine the fundamental causes of low pastureland longevity by alleviating them to increase animal product offtake and the sustainability of beef production systems in the Amazon (Embrapa, 1979, 1980; Serrão et al., 1979; Dias-Filho; Serrão, 1982; Dias-Filho, 2019).

Although officially Propasto had an ephemeral duration (1976-1979), this initiative by several Embrapa research centers in the Amazon had a profound impact on knowledge generation, enabling the development of technologies for proper management and recovery of pastures in the region (Figure 3).

Photo: Moacyr Bernardino Dias-Filho



Figure 3. Field day about the results of the Propasto project, carried out at Embrapa's Experimental Field, in Paragominas, PA, on June 12, 1980.

Even after the official closure of this project, in December, 1979, a number of experimental activities, initiated during the lifetime of Propasto, continued

to be conducted and improved, radically changing the situation of strong technology shortage for the correct management of pastures in the region. Also, since the mid- 1980s, Embrapa has intensified the release of well-adapted, high-yielding grass cultivars. These grasses more than doubled the previously existing forage options adapted for pasture formation in the Amazon, greatly contributing to the increase of regional pasture productivity. Under this successive increase in productivity and growing availability and adoption of technology started the Stage 3 in ranching in Amazonia (Figure 1).

The third stage of cattle ranching in the Amazon: increasing productivity with technology – Embrapa’s role

Improved pasture technology in this new stage of Amazonian cattle ranching can be measured by the estimated evolution, over 200%, in the stocking rate (head of cattle per hectare of pasture), calculated for the northern region of Brazil, between 1975 and 2006 (Dias-Filho, 2014a). Similarly, there was an intense slowdown in the expansion of new sown pasture areas in this region, despite the strong growth of the cattle herd for this same period (Dias-Filho, 2014b). Such a slowdown in land sown to pasture, which continues to the present (Figure 4), suggests a substantial increase in the pasture productivity, as well as the recovery of abandoned pasturelands.

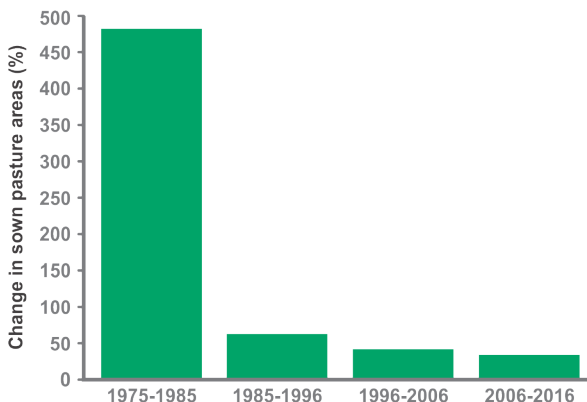


Figure 4. Relative percent change over time (10-year intervals) in sown pasture areas in northern Brazil between 1975 and 2016. Source: IBGE (2018a).

This third stage of Amazonian cattle ranching, which began in the mid-1980s (Figure 1), highlighted the increase in productivity, that is, the pursuit of a higher level of technology adoption and the reduction of speculative bias in its management. If the basis for this new stage of regional cattle ranching in the Amazon was a more extensive portfolio of technologies, adoption of technology in cattle ranching activities, several were the reasons for this change of direction in pasture-based cattle production systems. Among these reasons, it was particularly important the increasing environmental restrictions against deforestation in Amazonia and the growing valuation of land prices. Also influential were relative decrease in land availability in the Amazon. The advance of high-tech agriculture in pasture-occupied areas and the demographic expansion of arable land motivated this phenomenon. In addition, Amazon ranch managers have learned through experience and by testing alternative management strategies.

Therefore, Embrapa played a key role in the construction of the so-called third stage of cattle ranching in the Amazon. The reason for this was Embrapa's performance, as one of the main providers of the technological base that allowed the greater refinement of livestock activity by local ranchers (Figure 5).



Photo: Moacyr Bernardino Dias-Filho

Figure 5. Partial view of the first field experiment carried out in the Amazon (1981 to 1982) to assess the adaptation of marandu-grass (*Brachiaria brizantha* 'Marandu', at the time identified as *Brachiaria* sp. CPATU 20) (Dias-Filho, 1982). Photo taken at Embrapa's Experimental Field, in Paragominas, PA, in June 1983. Released by Embrapa, in 1984, marandu-grass, a few years later, became the most planted forage grass in the Amazon region, greatly improving the productivity of local pastures.

Challenges for the future of Amazonian cattle ranching: the search for greater productivity and efficiency

Amazonian² cattle ranching, with an existing pasture area of 36 million hectares (Pastagem.org, 2020) and a herd of about 50 million heads of cattle (IBGE, 2018b), currently confronts major challenges for maintaining its key role in providing food security. The greatest of these challenges is to become yet even more productive, under a very restrictive regional scenario for conducting this enterprise. Composing this restrictive scenario, the current environmental legislation, which prevents the use of 50% to 80% of the total area in rural properties in the Legal Amazon region, is a major limitation. Another significant limitation is the labor legislation, which imposes regulations of more difficult practical application in places with the lack of infrastructure and skilled labor, as much of the Amazon region.

This search for increasing productivity is further required by the growing interest of local producers in employing industrial crossbreeding of beef cattle as a tool for the exploitation of heterosis, aiming at precocity. This crossbreeding leads to an animal whose nutritional requirement exceeds that of pure zebu breeds, thus requiring pastures with higher productivity and nutritional value.

In this restrictive and challenging environment, the proper development of pasture-based livestock activities in the Amazon requires an even greater pursuit of increased productivity through rational intensification. That is, the goal will be to produce more in smaller areas, in harmony with agronomic, economic, environmental and social principles as well as animal welfare. Therefore, the negligent management that persists in many cattle ranches across the Amazon will have to move over to a more professional conduct.

The professionalization of cattle ranching is one of the biggest challenges for a considerable portion of Brazilian ranchers. This is even more laborious, in its full application, for producers in agricultural frontier areas, such as the Amazon region. In these places, access to technical assistance services, inputs and mechanization, essential tools for rational intensification, are often more difficult and costly.

² Classical Amazonia.

The full professionalization of cattle ranching requires the breaking of models, or pasture mismanagement practices inherited from the past, and still commonly carried out and accepted. Perhaps the most damaging of these mismanagements is not to treat sown pastures as a crop, assuming that pastures can be kept productive without the use of inputs to improve or maintain soil fertility or without compliance of the basic principles of grazing management.

Therefore, although the progress achieved by livestock-raising systems in the Amazon, which allowed the shift from essentially unproductive (“Stage 1”) and extensive (“Stage 2”) systems to a comparatively more technical model (“Stage 3”) could not be disputed, the average efficiency of regional cattle ranching is still relatively low. This low efficiency translates into the amount of degraded pasture areas that still exist in the Amazon region and the use, far below their actual potential, of a considerable portion of the still productive pastures. The main reason for this relatively low efficiency is the unprofessional management of these areas, where, among other limitations, the stocking rate is not adjusted, there is no adequate pasture rest periods and the pasture area is not regularly fertilized to maintain or increase productivity.

Thus, to be more competitive and ensure its persistence in a limiting regional scenario and in a global setting of increasing attention to environmental impacts, but demanding in food production, the Amazonian cattle ranching has to become even more efficient. Full access to this efficiency will be granted by managing cattle ranches, regardless of the size, as a business enterprise. That is, cattle ranches in the Amazon must have a professional management.

For this, it is necessary that the Amazonian cattle ranching evolves to a new stage in search of its full professionalization, making this activity even more efficient, dynamic and socially responsible.

The professionalization of cattle ranching can be achieved in two steps (Dias-Filho, 2017a). The first is that cattle production in the Amazon must be built on the recuperation of already-cleared lands. Thus, the reclamation of degraded lands plays decisively in a modernized livestock strategy, where production goals are obtained with reduced deforestation pressure as a key condition. Within this focus, the improved management of the still productive pastures must also have a professional treatment. In other words, the second and final

step in the professionalization of regional cattle ranching is to stimulate the producer's managerial capacity to maintain pastures productive, since their establishment, through the so-called "preventive management" (Dias-Filho, 2017b). For this, the producer must have a constant control of how much the pasture produces in forage and beef or milk.

Thus, the reclamation of degraded pastures, as well as the responsible (i.e., professional) management of still productive pastures and those already reclaimed, should play a decisive role in the process of professionalization of the Amazonian cattle ranching. This process will allow continued production growth without further substitutions of natural vegetation for new pasturelands or increasing degraded areas, but rather through skilled applications of efficacious technologies. Increased productivity and environmental preservation should be the basis of this professionalization, reconciling improved food security with reduced deforestation pressure as a key condition. That is, cattle production in the Amazon must be built on the recuperation of already-cleared lands and improved pasture management.

The construction of the fourth stage of Amazonian cattle ranching: professionalization

This full professionalization of cattle ranching in the Amazon would usher in a new stage of this enterprise, the Stage 4 (Figure 1). This new stage would suit the challenges imposed by the Brazilian environmental and labor laws in sown pasture development for the Brazilian Amazon and would comply with the Brazilian goals in the Paris Agreement. More specifically, in the goals of zeroing illegal deforestation in the Amazon, intensifying livestock activity, reclaiming degraded pastures, reducing greenhouse gas emissions and restoring forest vegetation, while increasing beef (and milk) production capacity in sown pasturelands in the Amazon.

As with the transition from the so-called "Stage 2" to "Stage 3" (Figure 1), the continued technology adoption by local producers will be critical for cattle ranching in the Brazilian Amazon to enter definitely in this new stage of development (Stage 4).

In the Brazilian Amazon region, the adoption of technology in pasture recovery and management issues has to overcome difficulties that go beyond the barriers created by infrastructural bottlenecks and the weakening of public technical assistance services. Thus, the high cost and its usual need for immediate disbursement are important economic barriers to the adoption of pasture management technologies. This is particularly true for more remote locations with poor infrastructure, where land prices are still relatively low, as it is the case in many places in the Amazon. In these locations, the financial benefit to high investments in technology adoption tends to be smaller.

In this situation, intensification would be primarily driven by an attractive cost-financing policy, in addition to strengthening public technical assistance. At the same time, it would be useful to include Embrapa's own technical staff, as well as other research and higher education institutions, to assist in the process of technology diffusion, as it has already been happening in the region.

Therefore, Embrapa, as a key governmental institution in generating and fostering the adoption of agricultural technology, will play a critical role in leading cattle ranching in the Amazon to this new stage of development, here called Stage 4. So, the strengthening of pasture research activities in the Brazilian Amazon should be a priority. For Embrapa to fulfill this role, some fundamental actions will be required.

Thus, the territorial greatness of the Amazon region, its infrastructural bottlenecks and the biological singularities of this ecosystem lead to attributes inherent to pasture research activities in this region. One of these attributes is that these research activities deserve a relatively high financial, academic and institutional support, when compared to similar activities taking place elsewhere in Brazil. In addition, an essential requirement to address efficiently pasture research needs in the Amazon is a relatively large staff of researchers (agronomists and animal scientists) with academic background in forage crops and pasture management and with knowledge of and, above all, commitment to the Amazon region (Dias-Filho, 2019).

Unfortunately, however, the reality of some strategically important Embrapa research centers in the Amazon has been the non-replacement of pasture research staff, or the evasion of those still active to other locations in Brazil. This reality means that there is currently an insufficient workforce conducting

pasture research in the region. Therefore, the urgent replacement of these staff is fundamental, which should preferably be formed by professionals with “roots” in the Amazon region. Alternatively, mechanisms should be created to encourage a long lasting stay of the non-local professional.

Therefore, the continuous generation and adoption of technology will support the desired technical evolution of the cattle ranching activity currently practiced in the Amazon region to a more professional level. This transition will require the fundamental support of Embrapa, as well as of private and public institutions of higher education and of other research and extension institution, based in the region. To achieve this objective, some actions are necessary (Dias-Filho, 2014a):

- a) Continuous generation of technology aiming at the development of new forage plant cultivars, efficacious technologies for degraded pastureland reclamation and pasture management.
- b) Constant flow of public and private investment in pasture management research and development and in strategies that encourage technology adoption and productive intensification among Amazonian farmers.
- c) Recruitment of pasture scientists and technicians by local public and private institutions.
- d) Improvement or creation of technical and undergraduate courses intended for training professionals to promote more intensive and sustainable livestock-raising systems in the Amazon.
- e) Strengthening of public technical assistance services in the Amazon.

Final considerations

Rational intensification is the right alternative to overcome current challenges and legitimize the sustainability of the Amazonian cattle ranching of the future. For this purpose, the fundamental requirement will be producing more in smaller pasture areas, consistent with agronomic, economic, environmental, social and animal welfare principles. In this scenario, nonprofessional management of Amazonian pastures should definitely shift to professional

management, regardless of the size of the cattle ranching enterprise. For the complete structuring of this new stage of cattle ranching in the Amazon Region, Embrapa should play an essential role, optimizing the success of this transition, providing technology and fostering its adoption by ranchers.

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