4. Private colonisation in Mato Grosso and expansion of agribusiness into the *cerradão* and tropical forest ecosystems

4.1. Migration flows and private colonisation from 1970 onwards

In the humid savannah (*campos cerrados*) of Mato Grosso, large-scale extensive livestock farming was traditionally the predominant form of economy. Subsistence-oriented peasant agriculture or – since the 18th century – artisanal gold and diamond mining (*garimpagem*) existed in niches or extremely peripheral areas. Mato Grosso was a very isolated part of the Brazilian Midwest (Centro Oeste) due to the lack of transport links with only a few roads passable all year round and the enormous distances to the urban centres. The only railway connection from the Southeast ended in Anápolis in the state of Goiás.

In the decades after World War II, this changed fundamentally. The new capital Brasília, inaugurated in 1960, contributed to the development of Central Brazil and set strong impulses towards the incorporation (Kleinpenning 1986; 1991) of the "interior" with a functional orientation of the periphery towards the centre of national markets or the world market, as the later soybean boom clearly showed.

Initial attempts by a group of entrepreneurs from Rio Grande do Sul (Mayer brothers from Santa Rosa) to buy land without state support and start private agricultural colonisation in the mid-1950s met with almost insurmountable difficulties in developing land (eventually 220 000 ha) on the Rio Arinos, 700 km north of Cuiabá in the rain forests of northern Mato Grosso. The plots of 25–50 ha were mainly bought by Brazilian settlers of German origin from southern Brazil, who were forced to migrate to new pioneer fronts due to increasing population pressure in the old colonisation areas of Rio Grande do Sul and the impossibility to continue the traditional inheritance sharing in small properties in their home region. The colonisation company Conomali as well as the investments of the rubber planter groups from Germany operating in the neighbourhood had very little success (Kohlhepp and Dutra e Silva 2022; Pfeifer 1966).

For the development of private colonisation in North Mato Grosso, the *Estatuto da Terra*, adopted in 1964, was important, which for the first time officially provided the possibility of private initiatives for land development. Although state colonisation by INCRA had reached a peak in the early 1970s with its agrarian colonisation projects

along the eastern section of the Transamazônica,[225] low-interest loans made it possible to buy private land from 1971 onwards. When state colonisation proved to be unsuccessful and the costs too high (Kohlhepp 1976a), the Polamazônia programme[226] brought special support and tax incentives for private enterprises and development projects from the mid-1970s.

In addition to the large-scale private companies strongly supported by SUDAM in the field of cattle breeding, the owners of private colonisation companies, as well as the landowners with dubious land titles, were now also active in the Association of Amazon Entrepreneurs, who promised themselves a lucrative business through the sale of land. Land acquisition in Mato Grosso was often carried out without respect for the settlement areas of Indigenous groups or traditional Brazilian smallholders, squatters (*posseiros*) who often had not achieved land titles. Land grabbing at the Amazon frontier of Mato Grosso was associated with *grilagem*, corruption, and violence (Oliveira 2016).

The absolute majority of colonisation companies came from South and Southeast Brazil. Between 1970 and 1987, 86 colonisation projects were registered with the INCRA licensing authority (Coy and Lücker 1993).

Three groups of settlers in the new private colonisation projects in Mato Grosso could be distinguished:

1. The first migrants came from North Paraná, where the coffee cultivation boom had come to a premature end. The occurring frosts in the years 1969, 1975, 1979 and 1981 – often only a single night frost, but with the consequence of up to three years of crop failure or total loss of plants – from the mid-1970s finally heralded the end of the coffee cycle and the beginning of the fundamental structural changes in agriculture in northern Paraná. Those who were involved in coffee cultivation in northern Paraná as landowners or tenants were mostly from São Paulo, sometimes also from Minas Gerais. Many of those who became owners through an activity as subcontractors (*empreiteiro*) or tenants were descendants of Italian coffee plantation workers from São Paulo.

However, the structural changes in agriculture had serious social consequences for small farmers and tenants as well as for the rural workforce. In contrast to coffee cultivation, highly mechanised agriculture with rapidly increasing soybean cultivation and even more so expansion of extensive stock raising had only a very low labour requirement. In the 1970s and 1980s, there were numerous operational closures of small holdings and dismissal of farm workers, especially in north-western Paraná, and catastrophic rural unemployment. In the decade 1970–1980, the rural population in North Paraná declined by almost one million people (Kohlhepp 2014; 1991b; 2020b).

Since the pioneer front in North Paraná had reached the national and ecological borders, a first migration of new land seekers and agricultural workers occurred to the neighbouring areas of the state of Mato Grosso do Sul, which had been created in 1977 by separation from Mato Grosso, as well as to the subtropical rain forests of eastern Paraguay. From the beginning of the 1970s, rural exodus took aim at new pioneer fronts, in particular the new colonisation projects in Amazonian Rondônia and in the

225 Cf. Kleinpenning, vol. 1 of this publication.

226 Cf. chapter I.1.1.

cerradão[227] and the rain forests of North Mato Grosso, where private colonisation companies from Paraná initiated a dynamic development.

For this purpose, after the end of coffee cultivation, especially in the Norte Novissimo of Paraná, numerous former owners of small farms or tenants were recruited via real-estate offices as settlers, attracted by very low land prices and the prospect of much larger land holdings. Among them, many so-called *empreiteiros*, a special form of subcontractor in the rural social scheme, which was important in coffee cultivation. They were specialised in the initial planting of larger coffee plantations for landowners. They brought the coffee planting to production maturity and were also called *formadores*. By selling the small first and second coffee harvests – determined by the 4 to 6 year contract – and selling the one-year harvests that were allowed as intermediate plantings, they came to capital and were then able to acquire land in Mato Grosso themselves (Kohlhepp 2014, Fig. 3a, Table 11).

In the initial phase, know how from Paraná was used to promote coffee cultivation (*coffea robusta*), which was soon abandoned due to low soil fertility and high transport costs (Coy and Lücker 1993). However, capital, colonisation model and pioneering spirit of leaders and settlers from North Paraná found new perspectives in Mato Grosso. For the colonisation companies, the sale of urban land in the fast-growing pioneer towns proved to be an additional lucrative business (Coy 1992).

2. The second group of migrants to the colonisation areas of Mato Grosso came from Rio Grande do Sul, Santa Catarina and West Paraná. These southern Brazilian migrants were mostly descendants of 19th century German and Italian immigrants, peasants from the land-deprived colonisation areas. They had nothing to do with coffee cultivation in North Paraná. Since the 1960s, a first wave had bought land in the subtropical forests south of the Rio Piquirí, which formed a border in western Paraná for the expansion of coffee cultivation due to the risk of frost. In West Paraná, they first continued their traditional agricultural system, an "improved land-rotation system" (Waibel 1950, 533) with the cultivation of staple foods and maize refinement by pig fattening in mostly 25 ha farms. Due to traditional inheritance sharing of the small plots, the sons were forced to buy land in East Paraguay and Rondônia. The emigration of young people from small and small medium-sized family farms in southern Brazil often meant a kind of "land consolidation," as the plot size of those remaining on site was expanded and thus the economic viability of the farm was ensured. For settling in North Mato Grosso, they had been successfully recruited by agents of the colonisation companies. For these land buyers, West Paraná had remained only another stage hike on the way from northern Rio Grande do Sul via the west of Santa Catarina to West Paraná and finally to Rondônia and North Mato Grosso.

A special sub-group of migrants to North Mato Grosso was the smaller part of a total of about 8000 families who lost their land because of the expropriations during the construction of the large hydroelectric power plant and the reservoir of Itaipu. They received too little compensation payments, most of them with a long delay. In Paraná, they had

227 *Cerradão* is a drought-resistant type of transition forest, with relatively sparse trees. It includes species of the humid savannah (*campos cerrados*) and others of rain forests. Tree coverage is of 50% to 90%. Waibel (1948) mentioned the *cerradão* in the Planalto Central of Goiás as a transitional forest with narrower or broader zones between forest and *campo cerrado*, based on Gonzaga de Campos: Mappa florestal do Brasil. Rio de Janeiro, 1926, 48. See footnote 229. Cf. Dutra e Silva (2020).

no chance to acquire land because of the excessive land prices. Among those affected by the relocation were also settlers without a land title (*posseiros*), who received no compensation. The power plant company Itaipu Binacional recommended to everyone the migration to North Mato Grosso. Some of the colonisation companies, in the "hunt" for land buyers, took advantage of the inexperience of the resettlers and especially of those with capital from compensation payments (Kohlhepp 1987d; Kohlhepp and Karp 1987).[228]

Later, migrants already had support of well-managed service-oriented cooperatives of West Paraná, where soybean-wheat crop rotation known from the farmers' areas of origin gained importance. Furthermore, they had experience with service-providing agricultural cooperatives, which not only provided the technological package of a production and marketing structure, but also the mediation of agricultural loans, training, consulting, medical care, agricultural broadcasting programmes and cultural offerings (Karp 1986, 1987; Kohlhepp 2020b).

3. Since the mid-1970s, migrants from Rio Grande do Sul and Santa Catarina had come directly to the *campos cerrados* and *cerradão* areas in Mato Grosso. Their land purchase was increasingly carried out without the mediation of colonisation companies. Frequently, they were well-funded investors, especially from the northern Rio Grande do Sul highland, who had experience in modernised but too small farms. They were supported by well-organised cooperatives and were characterised by a cohesion shaped by their origins, a higher level of education, neighbourly help, a willingness to experiment and a consolidated church and community life. In the following decades, they dominated the medium and large-scale soybean cultivation in Mato Grosso.

By 1987, a total of 3.1 million hectares of land had been offered by private colonisation companies and over 18 000 plots of various sizes had been sold. State controlled colonisation provided only about 20 % of this area (Coy and Lücker 1993).

Colonisation in North Mato Grosso was based on the large biomes of the region. In the northernmost rain forest in the Aripuanã region, private colonisation companies with very large estates were active. Small farmers of south Brazilian origin who traditionally cultivated basic foodstuffs in slash-and-burn agriculture without mechanisation in family farms with little starting capital have been settled on plots of mostly 25–50 ha of land in the areas of Alta Floresta, Guarantã do Norte, Colíder and others. The state colonisation company Codemat was an exception, as the state of Mato Grosso was otherwise completely restrained in colonisation, leaving surveying, road construction, spatial planning and the construction of pioneer towns to private companies. Initially, besides basic food, coffee (*coffea robusta*) was grown, later also permanent crops such as cocoa, guaraná (*Paullinia cupana*) and rubber. Gold mining also attracted thousands of *garimpeiros* in northern Mato Grosso, mostly from the Northeast and North of Brazil, to the newly opened *garimpos*.

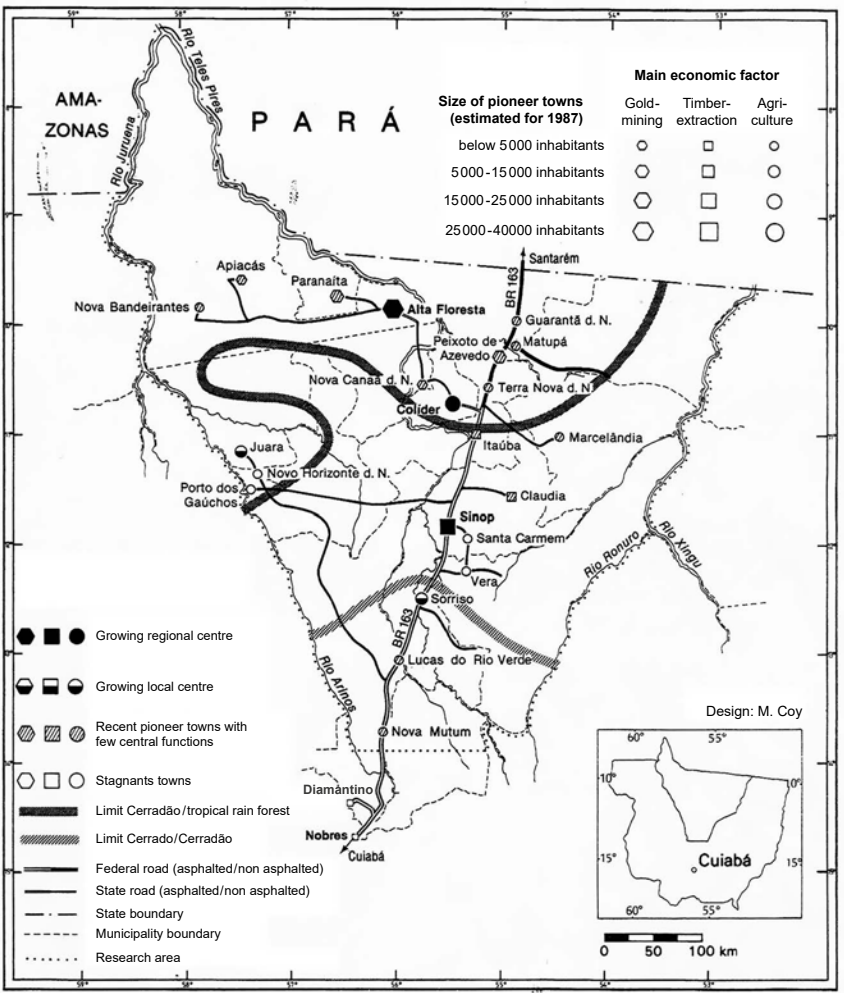
In the *cerradão* areas, colonisation began in 1972 around Sinop, which became an important pioneer town. In the second half of the 1970s, the purchase of land in this region intensified, which became an important guideline for the development of other pioneer towns through the beginning of the construction of the Cuiabá–Santarém road axis (BR-163) in Mato Grosso. Sinop (Sociedade Imobiliária Noroeste do Paraná) was one of the oldest colonisation enterprises in northern Mato Grosso which sold in the Gleba Celeste

228 Among the colonisation companies that sold land to Itaipu victims were Sinop, Colider, Brasnorte, Mutum-Eldorado, Indeco, etc.

about 650 000 ha of land in 6200 plots (25–50 ha) to settlers and tenants who previously worked on coffee cultivation in northern Paraná and who were now unemployed.

After the failure of coffee cultivation, which had almost completely disappeared by 1980, the future of colonisation was posed by major problems due to the unresolved question of land use through new cash crops. Many settlers sold their land and emigrated, partly to the surrounding pioneer towns. Against the background of the Brazilian energy crisis and the Proálcool programme since 1975/76, a major agro-industrial project in biofuel production based on manioc brought a temporary upswing in Sinop, which, however, forced the smallholder farms to grow manioc for the most part. In the 1980s, after structural changes in the rural sector with new south Brazilian actors, soybean cultivation and cattle breeding became increasingly important in the region.

Figure 28. Spatial organisation of private colonisation and pioneer towns in North Mato Grosso



Source: Coy (1992, 14, Fig. 1).

For the settlers of some colonisation regions in northern Mato Grosso, Paraná remained their place of origin and reference, with many intense family and cultural connections, finally the region of success and the "place of longing" ("local da saudade"). Bus companies like the Expresso Maringá connected the old and new pioneer fronts, whose names of the new border villages in Mato Grosso as well as in eastern Paraguay resembled the old land in Paraná (Nova Esperança, Novo Eldorado etc.) (Coy, Klingler, and Kohlhepp 2017, 14, 25, 37; cf. Coy 1992).

In the *campos cerrados*, land acquisition developed on the basis of larger plots (200–500 ha). Here, well-funded southern Brazilian farmers emerged who decisively influenced the development of soybean cultivation by agricultural modernisation. They formed a new social class of independent farmers who built new networks in the region. In Sorriso, development began in 1976/77, where over 500 000 hectares were sold to about 1000 land buyers from southern Brazil.

In the Araguaia-Xingu region of south-eastern Mato Grosso, the Lutheran pastor Norberto Schwantes, son of small farmers in Carazinho, Rio Grande do Sul, founded a new private colonisation company, but with a distinct difference to the companies that sold land for profit. He was one of the first to enter the *campos cerrados* with the aim of promoting a cooperative spirit in agricultural colonisation.[229] With about 400 members of the "Colonisation Cooperative 31 de Março" from the region of Tenente Portela, Rio Grande do Sul, he came to Barra do Garças in 1972, where the Canarana project meant an "escape gate" for landless and small farmers (Silva *et al*. 2022). The cooperative's activities against the backdrop of deliberations on agrarian reform were viewed with great scepticism during the military governments, when this issue was still sensitive (Schwantes 1989).

With 400 to 500 ha of land, the members of the cooperative had to cultivate up to 40 times as large land areas as in their areas of origin. As in the rest of Brazil, the goal of agriculture in Mato Grosso was initially discriminated against as impractical in the *campos cerrados*, where extensive cattle grazing traditionally predominated. After the granting of land titles in 1975 and the initial cultivation of rice, agricultural credits enabled the development of modernised agriculture with a high degree of mechanisation, so that soybean cultivation became prevalent in the 1980s. Farm size increased, the ownership changed and more and more land buyers from southern Brazil came to the region. This was the beginning of regional development along a new road axis from Barra do Garças to the border of Pará (BR-158). Conflicts with cattle farming and with *posseiros* occurred frequently.

The owners of the colonisation companies were decisive as leaders for the development of pioneer towns. This applies, for example, to Alta Floresta and Sinop, where

229 The German geographer Leo Waibel, scientific advisor to the Conselho Nacional de Geografia in Rio de Janeiro (1946–1950), in the second half of the 1940s was convinced during his research on the Planalto Central that in the near future, the best types of soil in the *cerrado* would be cultivated by permanent agriculture with crop rotation and the cultivation of more sophisticated plants (Waibel 1948, 373; cf. Kohlhepp 2021a). Already in the beginning of the 20th century, the *campos limpos* in South Brazil, e.g., the *Campos Gerais* in Paraná, had become innovation centres of successful agrarian colonisation in regions outside forest areas (e.g., Carambeí: Waibel 1950). The fugitive settlement Entre Rios near Guarapuava in Central Paraná, founded in 1952 with people of an ethnic German-speaking population (Danube Swabians), who lived in various countries of south-eastern Europe in the Danube river valley and had been expelled after World War II, became another highlight of the *campos* colonisation (Cf. Kohlhepp 1989d).

a personality cult developed around the local leaders Ariosto da Riva or Enio Pepino (Coy 1992). Among these personalities in Mato Grosso may also be counted the – later no longer successful – early founder of Porto dos Gaúchos, Guilherme "Willy" Mayer, and Norberto Schwantes (Canarana) (Kohlhepp and Dutra e Silva 2022). The frontier narrative of the successful conquest at the pioneer front is still existing for the "winners" who care about the myths of "unlimited" economic progress and optimistic future visions.

Southern Brazilian migrants initially remained isolated, were alien to the region and remained for a long time without contact with the traditional social groups in Mato Grosso. In some colonisation areas in northern Mato Grosso, "south Brazilian enclaves" were formed, initially almost homogeneous territories of mostly southern Brazilians of German and Italian descendance with the same regional, often even micro-regional origin and with a comparable economic starting state. Kinship networks were formed, from which a stabilising continuity between the region of origin and the target region emanated. Relations with the home region did not break off and often the migrant acted as the first outpost in the new homeland, followed by other family members. Clusters of families of common ethno-social and regional origin were often encountered (Kohlhepp and Blumenschein 2000).

In the *campos cerrados*, the farms of modernised agriculture distinguished themselves from the traditional farms of the traditional population of Mato Grosso due to their participation in specific credit and infrastructure programmes. The creation of a "South Brazilian diaspora" in the Mid-West also revealed socio-cultural differences with the traditional population, even beyond the borders of the Midwest, e.g., also in Rondônia and in East Paraguay (Kohlhepp 1984c; 1999). This could be observed in cultural conflicts with an exaggerated emphasis of one's own regional identity (traditional population versus "gaúcho"/"sulista") and in Mato Grosso also on a political level with the emancipation of newly founded municipalities with a predominant southern Brazilian population.

The narrative of a traditional settler of Barra do Garças in south-eastern Mato Grosso clearly illustrates the contemplative spirit of the "old frontier" and, at the same time, inner anger and finally acceptance in relation to the capacity of the "new frontier" "to establish itself in an arrogant and absolute way":

> The southern people arrived and dominated everything: they bought the best land, obtained the best funding from Banco do Brasil, built the best houses of the town, made noise everywhere with their trucks and stereos, are arrogant to the local people, already have the political dominance of the county and they will dominate the state as well [...].[230]

In an interview with Dom Pedro Casaldáliga, Bishop of the Prelature of São Félix do Araguaia, the same problem was mentioned:

230 Statement of Valdón Varjão, cited in: Passos (2019, 47).

> From 1960, the big landowners arrived from São Paulo and the South, arrogant people, went on acquiring land, deforesting, forming pasture areas, introducing cattle, expelling people – indians, north-eastern people – those who arrived before.[231]

In the following years, the political influence of the south Brazilian migrants also grew beyond the local municipal council (Camara Municipal) and the mayor and was also shaped by members of parliament, ministers, governor of the state and federal senators at the supra-regional level. The legacy of south Brazilian migrants is also expressed in the "centros de tradições gaúchas" (Haesbaert 1997, 1994; Kohlhepp and Blumenschein 2000, Fig. 1), the evangelical-Lutheran churches, as well as the radio stations with *gaúcho* music, which diffused with the migration of south Brazilians to the Midwest.

Like in other large colonisation projects in Brazil, e.g., the Cia. Terras Norte do Paraná project in North Paraná,[232] planned pioneer urban settlements were founded as a condition of the colonisation company or in later periods of the licensing authority INCRA. In case of a favourable development of a colonisation project, selling of urban plots was an additional lucrative business for the owners of the colonisation companies, who always reserved expansion areas in the new towns. Sinop was one of the first pioneer towns in northern Mato Grosso (1974). With more than 196 000 inhabitants today and a population increase of 73.4 % between 2010 and 2022, Sinop is the "urban centre of agribusiness" (Coy, Töpfer and Zirkl 2020; Coy *et al*. 2022; IBGE 2023).

Since the rural population had to be supplied with a variety of products, shopkeepers were often persuaded to set up shops by the allocation of free urban land. In pioneer towns in forest areas, a new urban middle class soon developed with merchants, transport companies, administrative employees of the colonisation companies and other service providers. In *cerrado* towns, the owners of larger farms became part of the urban population, where contacts with banks, insurance companies, urban commerce, trading enterprises of agricultural machinery, companies for the marketing of

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231 Interview during field work of Messias Passos (2015, 91) on September 7, 1991 with one of the best-known exponents of liberation theology.

232 The originally British private colonisation company Cia. Terras Norte do Paraná (CTNP) was nationalised in 1944 and continued under the leadership of a group of entrepreneurs from São Paulo under the name CMNP (Cia. Melhoramentos Norte do Paraná). The exemplary company envisaged the creation of town squares in the individual glebas when allocating land in North Paraná. The systematically planned urban settlements arranged along the guiding axis of the railway line were laid out at certain intervals according to criteria of central locations. This structure showed the successful coordination of colonisation model, traffic development with its own railway line and integration of urban settlement cores at the pioneer front. In the case of the towns, a rigid chessboard floor plan was only initially used in Londrina (1930). Later founded larger towns (e.g., Maringá: 1947) received very flexible floor plans according to modern town planning (cf. Kohlhepp 2014/1975). The Paraná-born owners of colonisation companies in Mato Grosso were well informed about this urban system. In São Paulo and in the colonisation areas of 19th century European immigrants in Rio Grande do Sul and Santa Catarina town squares were also founded as central places within the rural colonisation areas. From 1951 to 1955, CMNP founded 22 pioneer towns. Until 1970, a total of 62 towns had appeared on CMNP land, of which 35 were the headquarters of municipalities and 27 of district seats. The names of the urban settlements founded throughout northern Paraná emphasised the optimism and pioneering spirit of all participants: Bela Vista do Paraíso, Terra Rica, Pérola, Diamante do Norte, Bom Sucesso, Nova Esperança among others, some of these names were transferred to Mato Grosso (Kohlhepp 2020b).

agricultural products and the service sector were necessary and schools for the children and hospitals and medical care were available. These farmers left their farms in the care of administrators and a few employees.

The elevation to a municipality gave the pioneer town a special position as the seat of the municipal administration and the emergence of new local elites, who politically and economically – often both together – determined the fate of the town and the surrounding area. However, many of the former pioneer towns – as examined in detail for Sinop (Coy 1991; 1992; 1995; Coy, Töpfer and Zirkl 2020) – experienced several economic cycles that determined economic rise, immigration, temporary stagnation, and social segregation that began within a decade. But in the self-perception of its successful inhabitants, the town is one of the Brazilian "metropolises of the future" due to its "pioneering spirit" and growth dynamics. Frontier discourses in Brazil were often only related to one's own success and lack any differentiated evaluation, especially regarding social and environmental degradation.

In these towns, far-reaching changes began after only a few years through socio-spatial differentiation. This was evident in the townscape with an incipient social segregation. The successful colonisation projects have formed a new middle class and new local elites who call the shots in urban politics and economic life. In addition to the neighbourhoods of the successful, marginal areas with failed settlers, immigrants without capital and residents who fed on daily relief services increasingly appeared.

In addition to the socio-spatial changes, a fundamental functional and physiognomic structural change of towns has also taken place during the soybean boom. Large silos and industries of national and multinational corporations for the processing of agricultural products, concessionaires for agricultural machinery, trucks and off-road vehicles, shops for the sale of agrochemical products, transport and export companies, repair shops, consulting offices, banks and insurance companies characterise the townscape. A new urban attitude to life fills the middle and upper classes. School facilities and the establishment of state and private universities show the interest in a solid education, which has a special focus in the field of agricultural science.

With the urban social fragmentation dependent on the soybean boom, a verticalisation in the town centre developed and new separated "gated communities" for the urban upper class were created. This also showed that social conflicts had increased sharply. World market dependency and increasing international competition in agricultural production and the labour market dependent on commodities have a precarious potential vulnerability. These dependencies, together with the long-overlooked ecological consequences of monocultures, make it difficult to predict the future development of these towns.

Cuiabá, the capital of the state of Mato Grosso, had been an isolated stagnant provincial town with a traditional urban and economic structure until the 1960s. The population increase in Cuiabá of just over 100 000 inhabitants (1960) to more than 650 000 today (2020: Metropolitan Region Vale do Rio Cuiabá with Cuiabá/Várzea Grande: >1 million) caused almost revolutionary structural changes in functional equipment and urban physiognomy. Today, Cuiabá is an important regional metropolis in Amazônia Legal, one of the most important centres of soybean processing in the Brazilian Midwest.

In Cuiabá, uncontrolled urban expansion, land speculation in urban plots, lack of low-cost housing, invasions and illegally developing marginal quarters characterise

the urban scenery. On the other hand, the dynamic verticalisation of the new town centre, the diversification of local trade and a wide range of high-end goods, new shopping centres, imposing buildings of national and multinational agro-industrial companies, banks, transport companies and modern neighbourhoods of the middle and upper classes bear witness to the new era. All this is linked to the agribusiness boom.

A new urban lifestyle of the successful is prevailing, demonstrated in "gated communities", the most modern fleet of cars and off-road vehicles, trendy restaurants, country clubs, etc. The urban infrastructure underlines the socio-spatial fragmentation. In some areas the absence of any infrastructural installations and environmental impacts as water pollution and lacking sewage purification plants are the reason for social conflicts. The degradation of the peri-urban environment was obvious as the municipal garbage (in 1990: 250 t/day) was dumped without any control on a waste disposal (Coy 1995; Coy *et al*. 1997).

The state of Mato Grosso, which had just 600 000 people in 1970, today has a population of 3.66 million.[233] Overall, net migration of about one million families can be assumed for the period 1975–1996 alone, taking into account all southern Brazilian migrants to Mato Grosso and neighbouring states in the Midwest, from smallholder settlers to agricultural entrepreneurs.

4.2. Regional development and boom of soybean cultivation in Mato Grosso

Soybeans are used in animal feed and food. Soybeans are processed in the form of meal and pellets into the highly demanded soybean meal, which is the most common animal feed due to the combination of high protein content and relatively low prices. Soybeans are now an important product for the mass production of high priced beef, pork and chicken and one of the most successful cash crops in the agricultural world market. The smaller part of production goes into the production of soybean oil, which is used for both edible (e.g., soy sauce, tofu) and non-edible products (cosmetics, soaps and detergents) and as a base for diesel fuels.

Brazilian soybean cultivation began in southern Brazil in the northern highland of Rio Grande do Sul in smallholder farms with polyculture before 1940, expanded with wheat-soybean crop rotation in the 1960s[234] and then gradually took possession of parts of the west of Santa Catarina, of North Paraná and of Brazil's Midwest over the past 50 years.

Carriers of large-scale agricultural development of the humid savannahs (*campos cerrados*) in the central Brazilian highlands were the *sulistas*, farmers who have migrated from the southern states since the mid-1970s and who created modern land management after a difficult initial phase. With the migration of southern Brazilian actors, the plateaus (*chapadões*) of the Planalto Central, traditionally used extensively through cattle grazing and extraction economy, were for the first time fed into large-scale, modernised and export-oriented agriculture. The extensive *campos cerrados* are

233 See chapter II.7.1. Data 2022: IBGE (2023).

234 As for the development of soybean cultivation in the Alto Uruguai region cf. Pfeifer and Kohlhepp (1967); Lücker (1986).

usually endowed with infertile dark red to reddish-yellow latosols and an extended dry period exists from June to September. In contrast, in southern Brazil, on the other hand, agriculture had been carried out all year round on relatively fertile forest soils and on relatively small plots.

Not only have the migrants brought about a paradigm shift in the land use of the *campos cerrados* and carried the expansion of soybean cultivation into the humid savannahs of the Planalto Central, but – as a result of this development – in Mato Grosso, in addition to an increasing economic power in rural and urban areas, they have also considerably expanded their political influence in the region at all levels. It is precisely the socio-cultural conflict with the traditional population of the state that has contributed to a unifying identity among the south Brazilians (e.g., the Centros de tradições gaúchas), although they were of different regional and social origins.

This development, which required a capital- and energy-intensive input of external resources, would not have been possible without special state-organised programmes (Proterra: 1972–1978; Polocentro: 1975–1982; Prodecer: 1980s) for land redistribution and stimulation of agroindustry in a development process of the *campos cerrados*.

However, the dream of growing soybean on a large scale was not easy to implement, because one was neither familiar with large agricultural machinery nor with professional farm management (cultivation methods, market information, personnel management, etc.). Reproduction of practical knowledge in the target region was limited, e.g., in the case of the no-till method, since in Mato Grosso the dry "winter" did not allow crop rotation with an intercrop in a usual manner.

A south Brazilian pioneer from the *cerrado* area of Nova Mutum, who arrived in the region in the 1970s, expressed very well this situation:

> I am stressed out, I have to be a farmer, mechanic, master the computer, know how to purchase, know how to sell, know how to use chemical fertilizers… there are too many things on my mind; and, even worse, I started feeling afraid of not being able to hold my 400-hectare property that is becoming too small for all that, for the costs of the machinery, for the bargain power with the banks, for the companies that buy and sell what we need here in the crops […] (cited in Passos 2015, 87).

After dry rice cultivation in the initial phase, which suffered particularly from the rice crisis and the credit bottlenecks in the context of the world debt crisis, from 1982 soybean cultivation in particular proved to be an effective form of land use to cover the government's foreign exchange needs through export-oriented production and to counteract the current production costs through price increases, since from that time onwards the interest-subsidised loans ceased to exist. The rapid expansion of cultivation was also facilitated by the possibility of extensive mechanical clearing of the *cerrado* vegetation and highly mechanised cultivation on the plateaus. The biodiverse humid savannah ecosystem was perceived by the farmers as a worthless obstacle.

The expansion of soybean cultivation in Mato Grosso was related to the following factors (Kohlhepp and Blumenschein 2000; Coy *et al*. 2017):

- availability of large land reserves with much lower land prices compared to South Brazil,
- immigration of south Brazilian farmers, who mostly were forced leaving their home because of lack of land in traditional inheritance sharing and were able to acquire many times more land in Mato Grosso,
- favourable conditions for mechanised agriculture because of low relief energy,
- use of new varieties adapted to regional climatic conditions,
- introduction of the no-till method, based on the use of high pesticide levels (glyphosate) and genetically modified seeds.

Migration was usually accompanied by social advancement, as former tenants also became landowners. The subsidised loans of the government's special programmes and the minimum price policy of the 1980s, which favoured soybean cultivation in the Midwest, also contributed to this. But land prices, which were up to six times cheaper than in southern Brazil, also made it possible to acquire much larger agricultural areas in the Midwest, ranging from 500 to several tens of thousands of hectares. In addition to family farms with family workers living on the farm and medium-sized farms whose owners live in the municipal towns, speculation-oriented large-scale farms have also settled. The owners of large farms were absentees who lived in Rio Grande do Sul and especially in Paraná and managed larger consortia, and some were also politically active in these states.

The introduction of site-appropriate and knowledge-intensive land use procedures also required flexible farm management and a qualified workforce. It is precisely these characteristics that were seldom present in large companies, where they led to the cessation of operations to a particularly high degree. This took place regardless of the size of the farm and could also cover mega-farms, as was demonstrated by the abandonment of the 100 000-hectare Fazenda Itamaratí Norte (municipality of Campo Novo do Parecis) of the former "rei da soja" (soybean king) Olacyr de Moraes in 1996.

The unprecedented decline in government credit financing for soybean cultivation and other government interventions in the wake of agricultural policy deregulation, as well as the increasing agro-ecological degradation caused by soybean monoculture, also contributed to a severe crisis in soybean cultivation in Mato Grosso in the 1990s.

South Brazilian agricultural entrepreneurs preferred to employ rural workers from their own area of origin who already had experience in mechanised agriculture, including former small landowners and tenants. The short-term employment of unskilled workers for grubbing-up work, etc., which takes place via employment agencies (*gatos*) in a *bóia fria* system, is still characterised by daily commuting from the peripheral urban areas to the frequently changing short-term workplaces. Despite a strategy of agrarian modernisation, the agrarian social conditions in the *cerrado* region remain tied to family relationships.

Unlike the cultivation of dry rice in monoculture, which lost productivity after the third year of harvest, soybean cultivation in monoculture proved to be viable in the medium term, albeit with a considerably higher use of external inputs (artificial fertilizers, lime, pesticides, high fuel consumption). The modernised soybean production in Mato Grosso thus grew considerably, reaching 7.2 million t in 1997/98. In just a few years, Mato Grosso has thus become one of the most important soybean producers in Brazil and has been in second place after Paraná (7.3 million t) at that time.

Brazil launched its "Green Revolution" in a modernised form with the promotion of agricultural research, consulting, technical assistance, high mechanisation and a specific price and credit policy. A major factor was the process of world market integration of the periphery based on soybean monoculture and agro-industrialisation and the commissioning of the first agro-industrial complex (industrial processing, soybean oil refinery, pellet production, agricultural trade, transport and storage capacities) (Kohlhepp and Blumenschein 2000). Agribusiness is integrated into global value chains with agricultural production, marketing, logistics, financing, agricultural machinery, and trade strategies. In addition, with numerous agricultural machinery, trucks and car concessionaires, with agrochemical trade, consultancies, banks, etc., there is an ever-larger urban service sector, as an important part of a local/regional value chain (Coy *et al*. 2017; Coy, Töpfer, and Zirkl 2020).

Agricultural trading corporations (the big four: ADM, Bunge, Cargill, Dreyfuss) and the national Amaggi company,[235] one of the largest companies exporting commodities in Latin America, are controlling 75 % of the worldwide trading of grains.

Transnational input companies with about the same share on the world market were trying to introduce new technology packages and have had a targeted influence on the exchange of agricultural information. All the global players in the agricultural machinery, seeds and agrochemical sector are present in the new regional urban centres with sales offices and consulting agencies. "Agro towns" such as Sinop or Tangará da Serra exert the function of powerful multi-purpose "command centres" whereas the countryside is more and more reduced to serve as a "production machine" (Coy, Töpfer, and Zirkl 2020, 59). Networks in agricultural consulting, credit financing, supply of inputs and market relations created a new techno-economist paradigm (Blumenschein 2001).

The exponential increase in soybean production in Mato Grosso, which has amounted to up to one million tons per year in the late 1990s was mainly achieved through the development of new land in the Médio Norte of Mato Grosso (Chapada dos Parecis). This region, notably the stretch between Tangará da Serra and Sapezal on the axis of the BR-364, with huge contiguous plateaus, which were extremely good to manage with a modern machine park, developed into a large new production centre. However, the high price of soybean – partly favoured by the exchange rate – led these producers to expand soybean cultivation in the so-called "marginal areas," where the pedological and hydrological conditions are not suitable for crop cultivation. Another "producers' front" is located along the MT-242 that links the federal road axis BR-163 and 158. "250 km from 'landless men' to 'manless land' along dirty roads, where the signs indicate only names of farms and distances" (Passos 2019, 48 f.). There is a climate of social exclusion, much stronger than in the phase of the colonising companies. Today, the rural habitat in these regions is depopulated.

The later land use dynamics in the *cerrado* were characterised by the change from a soybean monoculture to a more diversified and verticalised land use pattern. New crops and forms of land use are strongly influenced by local, regional and supra-re-

235 The company of the Maggi family began in São Miguel do Iguaçu (PR) with seeds Maggi. Later, the family migrated to Mato Grosso, where the son Blairo started with large-scale soybean cultivation and is today head of the huge trading corporation and the largest private producer of soybeans in the world. He acted as federal Minister of Agriculture and Governor of Mato Grosso.

gional networks. Part of these networks are, for example, private-public research institutions with the direct participation of agricultural entrepreneurs, common silos, collective exchange of information, farm management and agricultural marketing in so-called *condomínios* and credit cooperatives. The cooperation between these networks with face-to-face contacts, e.g., in the agro town of Tangará da Serra, results in an innovative milieu (Blumenschein 2001). Some of these towns – just like Sorriso and Sinop as well – belong now to the most economically successful municipalities in Brazil.

The operational monostructure and the uniform orientation of the agricultural regions, which were geared to a specific use of resources, became a major obstacle to future regional development in the *cerrado*. While capital-weak and heavily indebted farms were forced to lease or sell their land or leave arable land open and also to strive for grassland, others were trying to counter the crisis with a diversification of land use, gentle tillage (no-till, green manure) and with the help of alternative sources of finance and sales channels.

The path of success of the south Brazilian farmers to a new rural elite in Mato Grosso in large-scale soybean cultivation was particularly favourable from 1982 to 2005, which made its extensive and rapid spread possible (Fig. 31). The specific regional fit into an export-oriented market economy has made its susceptibility to crises apparent in recent years. The presence of the southern Brazilians in the *cerrado*, which was often described in Brazil as a "model of success," must therefore be put into perspective. The comprehensive use of resources, which stood out from the traditional subsistence economy of the traditional population, enabled for the first time the formal, capitalist "valorisation" of the once extensive and earlier only sporadically used *cerrado* plateaus (Kohlhepp and Blumenschein 2000).

In Mato Grosso, only 2 % of people employed in agriculture are active in soybean cultivation, although soybean dominates 80 % of the arable area in this state. This proves the agro-social problems of the extraordinary development boom (Coy *et al*. 2017). In addition, it is precisely the low employment rate of workers and the strong division of labour among seasonal workers that have led to the short-term unqualified labour being pushed into marginalised social niches, which remained largely without trade union organisation.

The ruthless expansion of large soybean farms and the concentration of ownership led to the displacement of smallholders (mostly *posseiros*) who had been traditionally engaged in subsistence agriculture in this region. The increasing "capitalisation" of regional agriculture, with which the "family farms" – once the target group of colonisation activity – could not keep up has now been largely replaced by "agricultural entrepreneurs" as the most important group of actors.

In addition to the social consequences mentioned above, the increase in production and export success also cause severe environmental damage: compaction of the soils through the use of large machines, severe soil erosion, which could be significantly reduced by no-till, expansion of monocultures with destruction of natural biodiversity and increasing susceptibility to plant diseases, contamination of the soil and contamination of groundwater. Due to over-fertilisation and excessive application of plant protection products and, in the case of soybeans, a significant proportion of rain forest destruction was caused by farms invading the southern Amazon biome.

The reform of the Biosafety Act in 2005 led to the liberalisation of genetic engineering in the agricultural sector. A controversial emergency decree had already made it

possible in 2003 to officially release of transgenic soybean cultivation, initially planned for only one year, under pressure from the agribusiness lobby, despite the protest of the Minister of Environment (Kohlhepp 2010a).

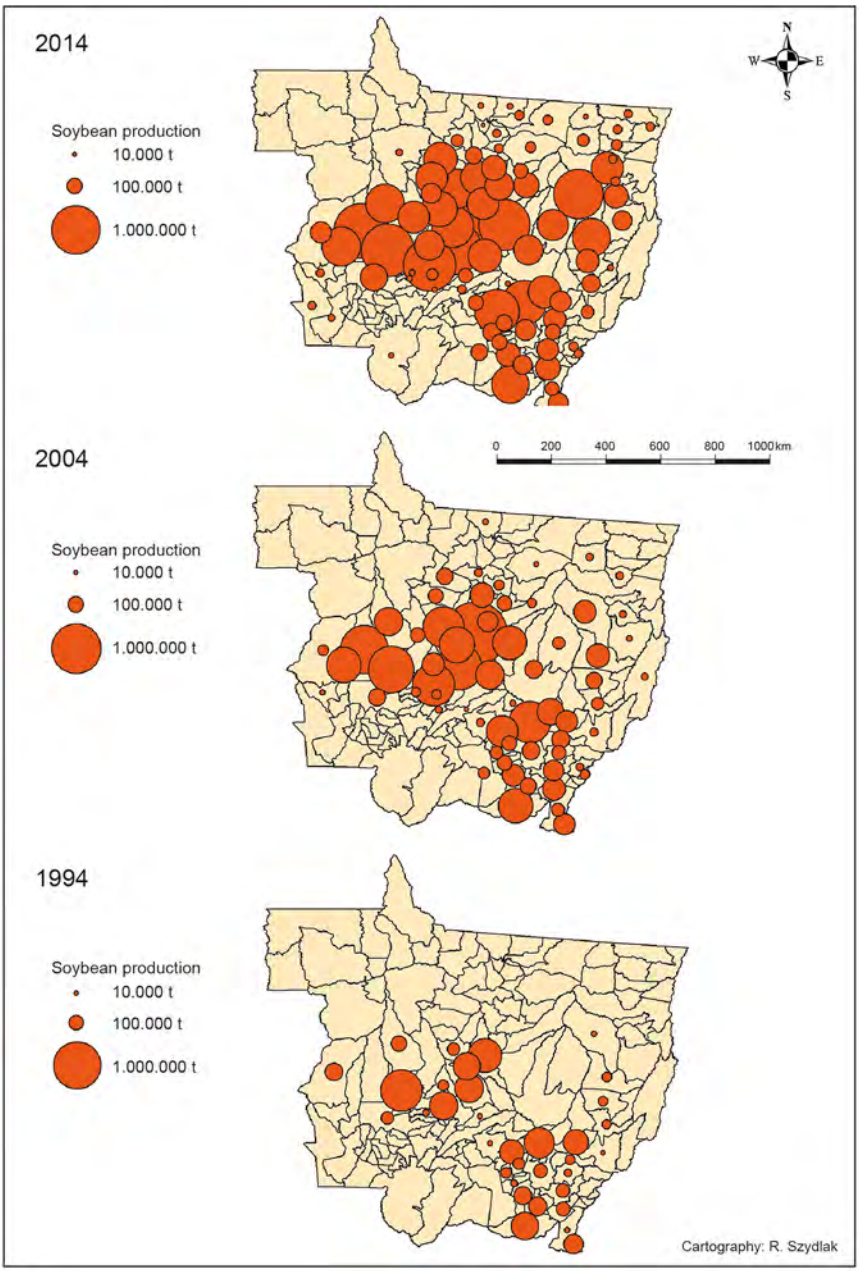
Today, multinational agricultural corporations operate with increasing supply of genetically modified seeds, such as the herbicide-tolerant Roundup Ready of the contested monopolist Monsanto, as well as coordinated agrochemicals and their own marketing strategies with high royalties. Brazil has thus lost its special position that distinguished it from the almost exclusively transgenic cultivation in the United States, Argentina and Paraguay, but it continues to dominate the world soybean market after the US.

Unstable soybean prices, deregulation of national agricultural policy and ecological degradation have led to the diversification of land use with cotton in addition to soybean-maize crop rotation. Cotton cultivation in the *cerrado* was regarded as a second economic mainstay after the first phase of decades of soybean monoculture, but initially had problems due to the regionally too high rainfall and humidity. Today, cotton is grown on large farms over 500 hectares with high mechanisation. New networks of knowledge exchange with the direct participation of farmers, credit cooperatives and agricultural innovations (e.g., no-till) as well as fruit and vegetable cultivation and poultry farming close to the market led to the above-mentioned innovative milieu (Blumenschein 2004; cf. 1995). There are efforts to "incorporate" pasture use as a third phase to combine cattle farming with modernised agriculture. In addition, there is a tendency to "refine" local feed production in large chicken farms or in large feedlots, mostly in direct connection with slaughterhouses, to further increase regional added value (Coy *et al*. 2017).

The regional economic success is highly fragile. It is determined by the price quotation of globally marketed commodities on the stock exchanges in Chicago. Furthermore, it depends on the prices of agricultural machinery, seeds, fertilisers and pesticides as well as on the all-important development of transport and export costs, because the distance factor is still the decisive location disadvantage of the Midwest. The lower limit of profitable farms is likely to be over 500 ha today. The ecological and social costs of the extraordinary soybean boom are enormous. However, a consolidation of a new social area in the Midwest in the next generation also presupposes that global market-oriented soybean cultivation in conjunction with a diversification of land use could reduce the socio-economic vulnerability and also the ecological consequences of agricultural modernisation. The dependence on multinational companies, whose rules and regulations dominate planting, fertilisation and marketing, makes it increasingly clear that the increased use of agrochemicals is destroying regional biodiversity and that at least a partial conversion to organic products should be sought, which has already begun slowly in Mato Grosso do Sul and Goiás in recent times.

The northern migration of soybean cultivation had begun in the mid-1970s and reached the state of Mato Grosso in the southeast in the Rondonópolis region. In 1994, two priority regions emerged: the *cerrado* in the southeast of the state and the *cerrado/cerradão* region around Sinop and Sorriso on the south-north road axis BR-163 and the plateaus of the Chapada dos Parecis (Médio Norte). By 2004, production activities intensified and by 2014 soybean production reached a maximum in the Médio Norte as well as an expansion in the east, even near the Xingu Indigenous Park (Fig. 29).

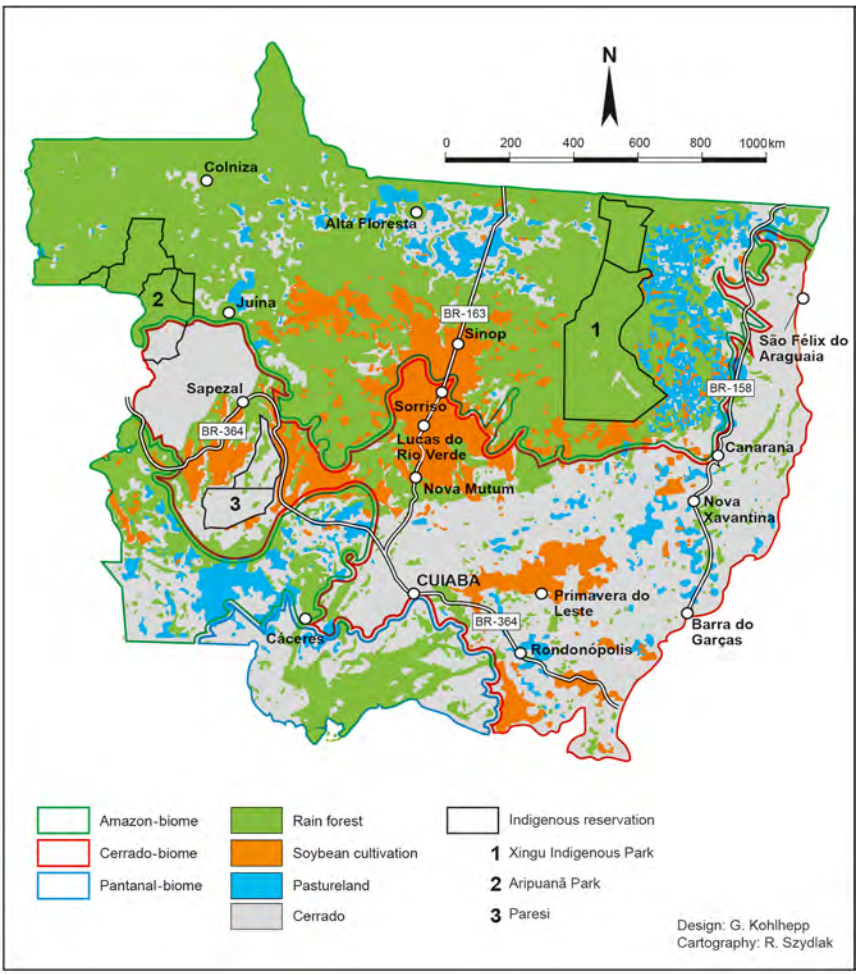
Figure 29. Municipal soybean production in Mato Grosso 1994–2004–2014



Source: Author+s design, according to: Lima and Penna (2016, Fig. 1); data from IBGE (1994; 2004); IMEA 2014.

In the last decade, further expansion of soybean cultivation and encroachment into the tropical rain forests of northern Mato Grosso has been evident. There were also former left open cleared pastures in the Amazon biome used for soybean cultivation (Fig. 30).

Figure 30. Soybean cultivation and pastureland in Mato Grosso in 2020



Source: Author's design, according to: Mapeamento SojaMaps 2019 (Universidade do Estado de Mato Grosso), pesquisa.unemat.br/gaaf/sojamaps; Cassol *et al.* (2020, Fig. 8).

In Mato Grosso, the area under soybean cultivation increased in 2018/19 by 225 400 ha, 64 % of the new areas were located in the Amazon biome. Between 1985 and 2019, a conversion of native vegetation of 22.1 million ha or 28 % loss occurred. Pasture grew 165 % with an area of 12.8 million ha. The area of agricultural crops increased by 349 % (9 million ha) (Information SEDEC-Mato Grosso in 2019; Canto *et al.* 2020). These were the driving factors of an excessive deforestation in Mato Grosso (Simões *et al.* 2020). In 2020, Mato Grosso produced not only 28.7 % of soybeans, 35 % of maize and 71 % of cotton grown in Brazil but had additionally 15 % of Brazil's large cattle herd. Very large clearings for pastures occurred until 2005, especially in North Mato Grosso (Fig. 30).

Since 2003, Brazil has been the largest beef exporter. 40 % of Brazil's cattle are kept in Amazônia Legal, where they occupy 79.5 % of the land used. Already in 2006, the

pastures in Amazonia covered 55.4 million hectares, of which 60 % are in Mato Grosso and Pará (Greenpeace 2009a).

Soybean production in Amazônia Legal is far more lucrative than cattle production, the profitability averages about US$ 300 per hectare versus roughly US$ 50 to 100 per hectare per year for cattle production (Vera-Diaz *et al.* 2009). However, it must be emphasised that the productivity of soybean cultivation in Amazonia is only around 50 % of US soybean production and only around 60 % compared to southern Brazil or Argentina. Soybean cultivation requires soil and climatic conditions, which are limited to approximately 3 % of the remaining Amazonian forest. Soybeans are expanding onto cattle pastures cleared prior to 2008.

Today, in the Amazon biome of Mato Grosso 64 % are rain forests, a large part protected by Indigenous lands (Xingu and Aripuanã Parks, Fig. 30, 1, 2), 26 % is pastureland and 3 % cropland.

The danger of the further penetration of soybean cultivation into the rain forests of the southern Amazon had already been recognised earlier and was combated with a special measure, the so-called "soy moratorium."

4.3. The soybean moratorium

High rates of deforestation in the Amazon between 2002 and 2004 and the connection between this increase and the expansion of soybean cultivation led to considerations of intervening in this development, especially in circles of the environmental movement. In 2006, public protests over the Cargill soybean terminal in Santarém and a campaign by Greenpeace called international attention to deforestation associated with soybean production in the Brazilian Amazon region. The campaign was treated as a serious crisis by the Brazilian soybean sector – under intense international scrutiny – as well as by international traders such as ADM, Bunge, Cargill, and Dreyfuss that operated in Brazil (Nepstad and Shimada 2018).

The Brazilian Soybean Moratorium (BSM) was an agreement among trading companies, national and international NGOs, retailers, and banks to not purchase or finance soybean grown in fields that were deforested after 2006, later changed to 2008, in the Brazilian Amazon biome. The BSM had been considered as the establishment of simple rules to eliminate deforestation from soybean supply chains, an agreement, easily to monitor, with a deforestation "cut-off date." 95 % of soybean production in the Amazon biome is grown in Mato Grosso. 80 % of the soybean producers participated in the moratorium (Gibbs *et al.* 2014; Nepstad and Shimada 2018).

The Brazilian Association of Vegetable Oil Industries, represented by the Amaggi group,[236] and the Association of Cereal Exporters in Brazil, which purchase 90 % of the soybean produced in the Amazon, signed the zero-deforestation soybean agreement. The moratorium operated as a "market exclusion" policy. Since soybean farmers rely on tradings to finance their production, they are complying with the moratorium. Producers violating the moratorium lose market access for their soybean production.

236 The Amaggi group had already established a monitoring system for its suppliers as a requirement for the IFC loan of 2002.

The BSM resulted in the formation of the Soybean Working Group (Grupo de Trabalho da Soja, GTS) to oversee the implementation and monitoring of the agreement. The Ministry of the Environment in 2008 officially joined the GTS and INPE was brought in to lead the monitoring efforts to identify places where soybean was being grown on land deforested after the cut-off date (Gibbs *et al.* 2014). If a violation was confirmed, the property was placed on the "black list" maintained by the GTS and checked by the soybean traders before purchase. The soybean moratorium was renewed every one or two years until 2016, when it was implemented "indefinitely." A well-controlled longer-term commitment could help maintain deforestation-free soybean supply chains.

The economic potential of soybean cultivation caused increasing deforestation rates both through the direct conversion of forests to soybean fields and through the effects of soybean on land prices. Amazon soybean expansion has not been suppressed by the BSM, because of the abundance of suitable cattle pastures for conversion to soybean. Cattle pastures that had been acquired at very low prices were now worth two or three thousand US Dollar per hectare. Cattle ranchers who decided to sell their land to soybean producers suddenly were in a strong financial position to acquire new landholdings on the rapidly advancing agricultural frontier (Nepstad and Shimada 2018).

The dynamics of soybean replacing forests are complex because soybean is often planted several years after the clearance of tree cover. During the interim period land can be used for other purposes, typically as pasture for grazing cattle.

There is a general consensus that the moratorium has been successful. Only one percent of soybean production in Brazilian Amazonia sold to participants in the BSM is associated with forest clearing after the cut-off date. In the two years preceding the agreement, nearly 30 % of soybean expansion occurred through deforestation rather than by replacement of pasture or other previously cleared lands (Gibbs *et al.* 2014).

The soybean moratorium was the world's first major regional decline in tropical deforestation, beginning in 2005. The BSM has achieved a nearly zero deforestation free soybean sector in the Amazon region. The moratorium was an initiative that complemented the Prevention and Control Programme for Deforestation in Amazonia (PPCDAm) that was launched during the government of President Lula da Silva. The BSM could have been better harmonized with the PPCDAm if it had made specific linkages to the implementation of the Rural Environmental Registry of private properties (CAR) and the Forest Code (Nepstad and Shimada 2018; Gibbs *et al.* 2014).

However, since 2012 deforestation has increased again as the control measures used to slow deforestation have begun to weaken. Increasing soybean prices caused a resurgence of direct soybean-related deforestation without passing an initial period as cattle pasture. Recently a report by Global Forest Watch estimated this deforestation in 2019 as an area of 29 000 ha (Schneider *et al.* 2021), another study calculated the direct deforestation by new soybean plantings in Mato Grosso as of at least 42 000 ha since 2020 (Finer and Ariñez 2022).

From the perspective of corporate risk management, the BSM is probably the world's most successful value chain intervention for addressing tropical deforestation. Certainly, the effectiveness of this intervention and its contribution to regional solutions to tropical deforestation would be greater if they were designed to reinforce land-use regulations and public policies and programmes for successful transitions to

sustainable development (Nepstad and Shimada 2018). However, BSM measures were insufficient for solving tropical deforestation in large areas.

The soybean moratorium was restricted to the Amazon rain forest biome where only 10 % of national soybean production is taking place and soybeans are frequently being planted on former pastures. During the 1980s and 1990s, the humid savannah (*cerrado*) ecosystem has been transformed into a high-production region for soybeans and other commodities with the loss of a large part of the natural tree and shrub vegetation,[237] which could be legally cleared. Environmental protection measures in the *cerrado* were much weaker than in the Amazon region. Over the last 20 years, the extent of soybean production in this biome has more than doubled, direct vegetation conversion to soybean was almost twice as high as in the Amazon biome. In 2019, a third of the entire South American soybean planted area was located in the *cerrado* (Schneider *et al*. 2021).

The expansion of the Brazilian soybean production was motivated by the high degree of absorption capacity of the European Union market. The intervention of the soybean moratorium was mainly due to the severe environmental requirements imposed by the Europeans. China, with 32.4 % the most important market for Brazilian exports, in 2021 was the leading importer of soybeans worldwide and by far the largest sales market for Brazilian soybeans with 70 % of the soybean export value share (quoted from de.statista.com in 2021). This could mean that the much lower importance that China devotes to environmental policy issues could also facilitate the expansion of soybean cultivation in Brazil into the Amazon biome. Since 2020, Brazil has been the world's leading producer and exporter of this oilseed ahead of the US and has recently benefited from the escalating trade war between China and the US. The competitive situation between the US and Brazil in soybean exports shows that transport costs can be of decisive importance.[238]

4.4. Soybean production in Mato Grosso and the impact of logistical optimisation of export-oriented soybean transport in Amazônia Legal

Soybean cultivation in Mato Grosso showed a steady increase until the year 2000 and an extreme expansion between 2000 and 2005, whereby the cultivation area was doubled. Between 2010 and 2015 another increase in the cultivated area by about 50 % brought the soybean area to 9 million ha and reached a volume of 10 million ha in 2020 (Fig. 31). With 645 000 hectares, the municipality of Sorriso on the BR-163 road has the largest area under soybean cultivation in Mato Grosso.

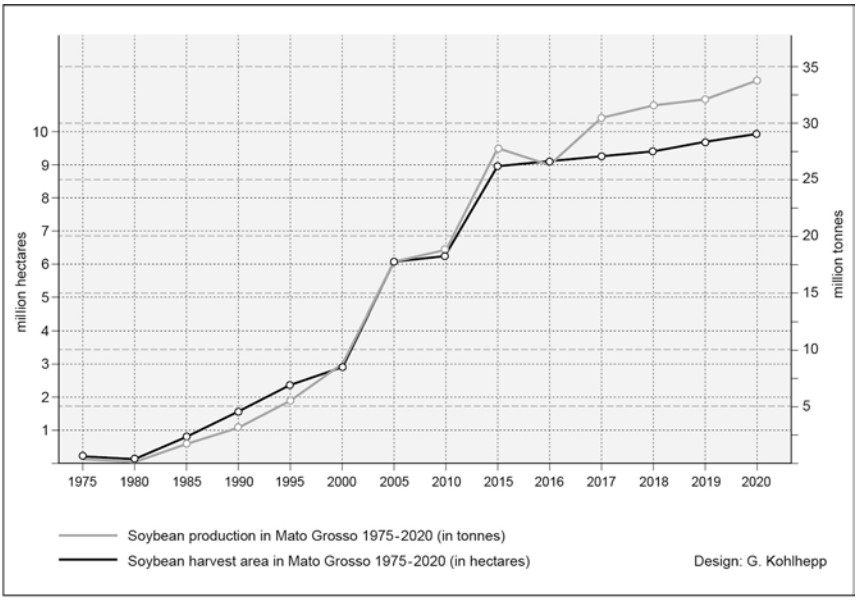
Soybean production has continued to reach new records over the past two decades, with a very strong increase until 2015 and further significant annual increases. In 2020, Mato Grosso reached a harvest quantity of 33.8 million t of soybeans (Fig. 31)., i.e., 28.7 %

237 From August 2020 to July 2021 deforestation of the Brazilian *cerrado* amounted to 8531 km² (WWF).

238 Brazil's transport costs are much higher than those in the United States. In the US, the cost of transporting a ton of soybean from farms to the export port averages US$ 15. Brazilian farmers pay an average of US$ 37 per ton (cf. Vera-Diaz *et al*. 2009, 15). According to IMEA data of 2018, one t of soybean from Sorriso/MT via Santos to China: US$ 117. From Iowa /US via New Orleans to China: US$ 58 and from Córdoba (Argentina) to China: US$ 52 (Coy, Töpfer and Zirkl 2020, 53).

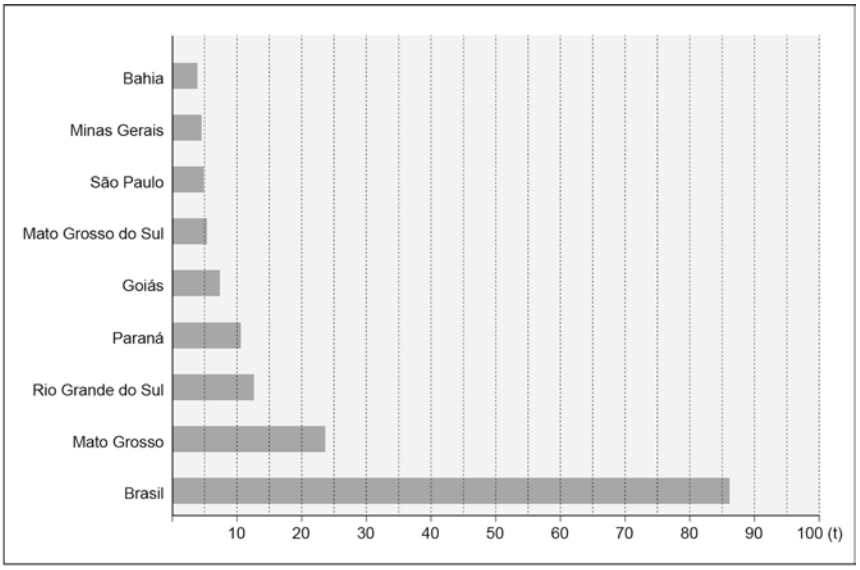
of the Brazilian soybean production. Rio Grande do Sul and Paraná followed by a long way with 15 % each. In Brazilian soybean export, Mato Grosso also holds first place with 23.7 million t (27.5 %), ahead of Rio Grande do Sul (14.6 %) and Paraná (12.3 %) (Fig. 32).

Figure 31. Soybean harvest area and production in Mato Grosso 1975–2020



Source: Data provieded by Sérgio Leal, SEDEC- Mato Grosso, in 2021.

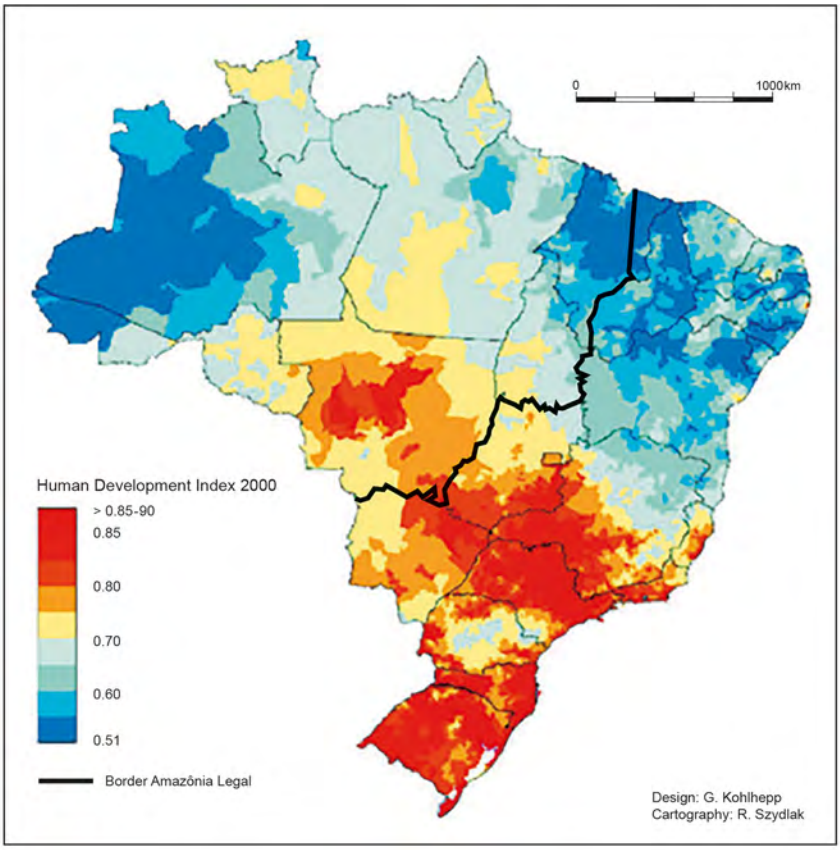
Figure 32. Brazilian soybean exports in 2021 (by State; in millions of t)



Source: CONAB data 05/2021: harvest 2020/21.

Due to mechanisation of cultivation and high input of fertilisers and pesticides, productivity (1975: 1400 kg/ha) has risen to 3492 kg/ha by 2021, which in addition to ecological consequences also caused enormously high operating costs. The importance of soybean cultivation in Mato Grosso is underlined by the fact that this state in 2021 made a decisive contribution to Brazil's leading position on the world market with a production of 135.4 million t, that is 37.3 % of the world's soybean production. The US holds the second place with 31 %. Since 2020, Brazil is the leader in soybean exports with 86 million t, i.e., 50.3 % of worldwide exports, followed by the US with 36.3 %.

Figure 33. Human Development Index (HDI) in Brazil



Source: Bertrand, Mello, and Théry (2007, 25); data IPEA.; published in: Kohlhepp (2010b, 99).

The expansion of the modernised agricultural economy led to a wedge-shaped penetration of high Human Development Index (HDI) values[239] inland, especially in the core areas of soybean cultivation with young, dynamic pioneer towns and immigra-

239 Although the HDI indicators (life expectancy, literacy rate, purchasing power) certainly do not allow for a comprehensive analysis of the level of development, the values give a very clear picture of the regional disparities in the sum of the areas for the general standard of living.

tion from the South in the state of Mato Grosso (Fig. 33). Economically successful agro towns, such as the self-proclaimed "soybean world capital" Sorriso in northern Mato Grosso with a good infrastructure, stand out but also emphasise the disparities of "winners" and "losers" of this path of development within the state. Due to the relatively small population of 3.5 million inhabitants in Mato Grosso, the factor "purchasing power" of the "winners" is increasingly noticeable in HDI values. Since the data of Fig. 33 are based on the year 2000, the disparities certainly have increased.

The huge production of the agricultural commodities soybean and maize in Mato Grosso required a more complex logistical network and expansion of transport routes and export ports in order to supply the world market with these agricultural goods by more efficient logistics for the Brazilian agribusiness. The ever-increasing penetrating of the cultivation areas inland and thus into the tropical rain forests increased the distances to the traditional soybean exporting seaports of Santos (SP), Paranaguá (PR) and São Francisco do Sul (SC) in Southeast and South Brazil to more than 2000 km. Especially in the first two ports, which were already heavily congested and where truck queues of tens of kilometres often formed in the high season after the soybean harvest, the ports in Amazonia have become a good option for this grain flow.

Initially, from Mato Grosso to São Paulo and Paraná there were precarious road connections, which were then supplemented by asphalt roads and railways. In order to shorten the distances to the customer countries in Europe and East Asia and thus the transport costs, the agricultural goods of Mato Grosso were transported via the road axis BR-163 (Cuiabá–Santarém: 1732 km) to be exported via the Santarém port in the Amazon region. The reduction of transport costs also played an important role in the competition with the US, the other large soybean and maize producer and exporter.

After an early announcement of the construction project of the BR-163 in the mid-1960s, the road construction began in 1971. While the highway in Mato Grosso to the border with the state of Pará was asphalted in the 1980s, it had been proposed to pave the road entirely as part of the Avança Brasil project (2000–2007). However, the section in Pará[240] remained as an earth road that led through dense tropical rain forests, with a high threat potential for Indigenous territories and enormous environmental destructions. In 2019, the long-disputed asphalting[241] was completed with a 51 km long stretch of the highway until Miritituba, a new port at the Rio Tapajos.

Until a few years ago, the unpaved sections of BR-163 in Pará were the nightmare of all trading and transport companies as well as truck drivers, because in the rainy season – especially from December to June – trucks with up to 40 t of cargo got stuck for days due to the extremely bad conditions of the earth road with mud holes, impassable runs and precarious wooden bridges. Huge queues of heavy trucks caused enormous delays in transports, hindering the flow of agricultural crops from the region.

Santarém, the end point of highway BR-163 – on the right edge of the Tapajós river, about three kilometres from the confluence with the Amazon River – is a strategic port between the road and waterway modes for the transport of goods via the BR-163 and the Tapajós and Teles-Pires rivers. On a leased area with the loading facility of Car-

240 In Pará, asphalt was only available from Santarém to the small town of Rurópolis on the Transamazônica.

241 The details of the Plan of Regional Sustainable Development of the Area of Influence of the Highway BR-163 (Cuiabá–Santarém) are dealt with in chapter II.5.

gill, Santarém initially was the main export port for grains in the north. Due to public protests in Santarém against the expansion of soybean cultivation and the activities of trading companies, some large companies have concentrated their activities to Miritituba, making this port the main transshipment point of the so-called "Arco Norte" (Northern Arch). The Arco Norte system also meant the establishment and privatisation of new loading and transshipment stations in Amazonia, combined with a transport realignment of the export system for agricultural commodities, started during the Avança Brasil programme and continued in the Growth Acceleration Programme.

The term Arco Norte is defined as a logistic strategy that refers to ports and stations of transshipment north of the 16th parallel south, in the states of Rondônia, Amazonas, Pará, Amapá and Maranhão. The Arco Norte system is formed by transshipment ports: Itacoatiara in the state of Amazonas; Santarém, Barcarena, and Vila do Conde in Pará; São Luís and Itaquí in Maranhão, and Santana in Amapá, from where the agricultural products proceed for export overseas (Fig. 34). Two stations of transshipment of cargo are operational support for the multimodal corridors: Porto Velho in Rondônia and Miritituba in Pará, among others (Russo *et al*. 2022).

Since 1997, the terminal of Porto Velho had been used as a private terminal of the Amaggi group for soybean transhipment using bulk bin barges via the Madeira river to Itacoatiara, in a distance of 1060 km. The BR-364 to Rondônia, opened in the 1960s and asphalted in the 1980s, brought a significant transport and freight cost advantage for the soybean growing areas in the mid-west of Mato Grosso around Sapezal (850 km to Porto Velho) and the Chapada dos Parecis. At that time, large road sections to Santarém were not asphalted. Using the highway to Porto Velho, transport costs decreased by one third and transport time by three days from 11 to 8 days on average (river transport: Porto Velho–Itacoatiara: 4 days) in relation to transport via Paranaguá in South Brazil (Blumenschein 2001, 69). The Cargill company has been operating in Porto Velho since 2003 and considered it a strategic location for transportation of grains produced in Rondônia and in the mid-western region of Mato Grosso. The transshipment with convoys of bulk bin barges (40 000 t) is destined for Itacoatiara or directly to Santarém. Between July and November there can be problems on the Rio Madeira due to low water and sandbanks.

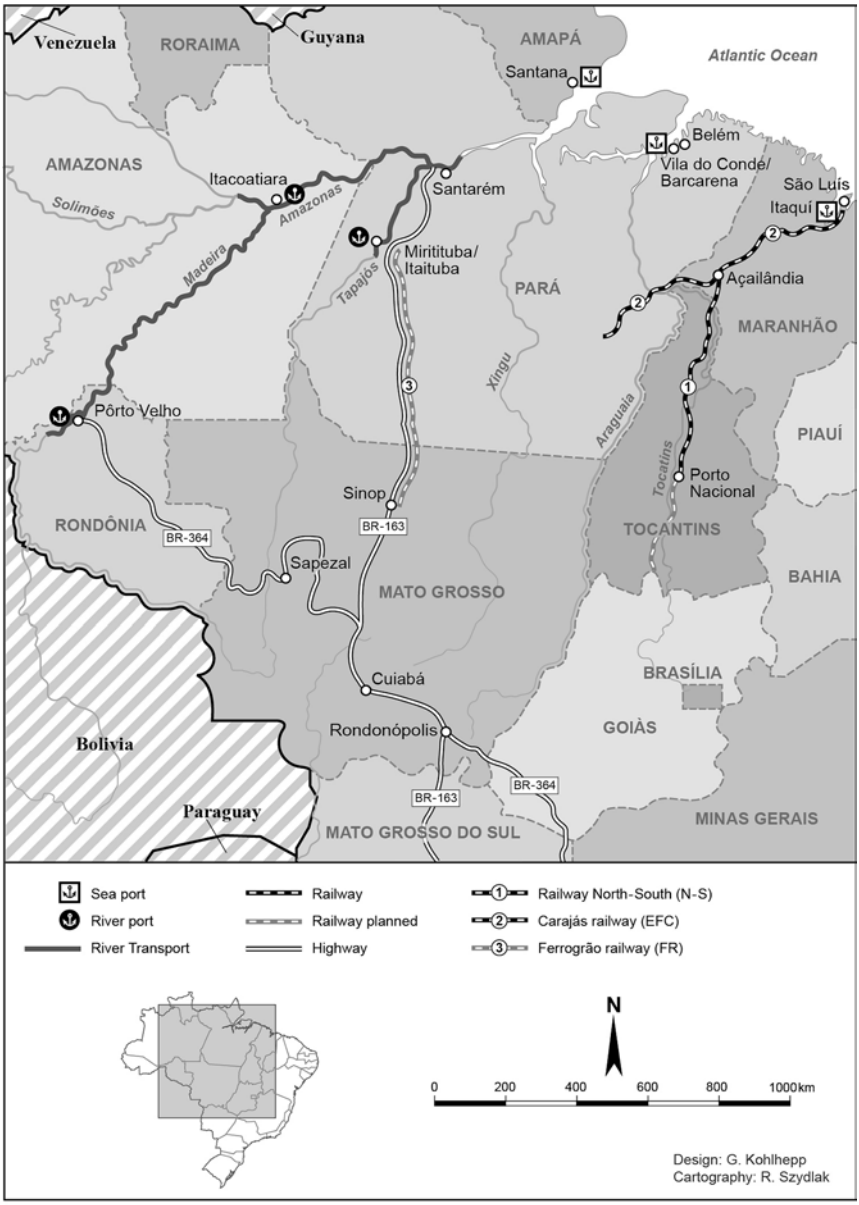
The port of Itacoatiara is located in the state of Amazonas, on the left margin of the Rio Negro, near of its affluence to the Solimões/Amazon river. This port has a profoundness of 11 meters. The main product exported in this port is soybean through a bulk carrier terminal.

The transshipment terminal of Miritituba in the municipality of Itaituba in Pará, located on the Rio Tapajós, began operating in 2016. The transshipment operation consists of the reception of trucks and the loading of bulk bin barges. Miritituba stands out for allowing the distribution of grains produced in the Midwest, using the BR-163 road for transports from the central region of Mato Grosso (Sinop, Sorriso among others) to the transshipment terminal of Miritituba at a distance of about 1000 km. Miritituba is "a bottleneck in the infrastructure of the country."[242] Five large trading companies are present, dominated by a joint venture of the national giant Amaggi and Bunge, one of the leading transnational tradings worldwide. River transport with barges allows freight cost savings of up to 40 % compared to ports in the South and

242 According to the Minister of infrastructure Tarcísio de Freitas in 2021.

Southeast, which can only be made by trailer. Transporting grains between Miriticuba and Vila do Conde/PA (1100 km) for export, vessels load fertilisers on the return trip.

Figure 34. The new transportation network "Arco Norte" for agrobusiness commodities in Mato Grosso



Source: Author's design, according to Lima and Penna (2016, Fig. 5); Russo *et al.* (2022, Figs .3, 6); Souza-Higa and Gatti (2020) and own additions.

The great economic success of soybean farmers, trading groups and also of international financial institutions is offset by the problems of the local and regional population caused by transport and transshipment activities. Taking Miritituba as an example, this small district of Itaituba is a very poor location with a high level of poverty: its GDP per capita is almost half the index of the state of Pará (INESC 2021). The main impact on daily life in Miritituba is the traffic of up to 1500 trucks per day in the period of high harvest causing noise, pollution, and dust clouds. In addition to the disturbance of a never-ending queue of heavy vehicles passing through a small town, obstructed access to livelihood resources, increases in violence, drug trafficking, and prostitution were reported.

Local Indigenous leaders of the Munduruku call the complex in Miritituba district "illegal" because the companies involved did not comply with Brazilian law, requiring prior consultation with traditional communities. The absence of a dialogue between companies and the affected communities has been lamented by the Indigenous and riverside populations. In contrast, tradings claim that they operate legally and have met all the licensing requirements by the environmental secretariat of Pará. Licenses approved were contested by the population, public institutions, experts, and civil society groups.

Waterway and port projects have been a concern for the Munduruku of the Médio Tapajós for decades. Artisanal fishing for subsistence and the boat traffic of the local population was severely disturbed by the intensive traffic of bulk carriers transporting commodities. Access to many areas in the riverside area has been banned. In the environmental impact assessment of projects planned, ecological and socio-economic impacts were mostly ignored, or only vague actions were proposed to mitigate them. Compensation for the forced insertion into global production chains and for obvious losses and impairments was never granted.[243]

The commodity transport companies took total control of the river. Hundreds of communities of Indigenous or traditional fishing populations suffered from reduction of fishing stock and of fish quality because of water pollution and protested against the great damage to the entire environment.

The port of Vila do Conde in Barcarena, Pará, an important port for loading of alumina, hydrate and aluminium ingots,[244] is becoming very attractive also for the draining of soybean produced in the North and Northeast regions to the external market, consolidating itself as a new alternative of maritime transport.

The Itaqui port in Maranhão is directly connected to the Carajás railroad operated by the Vale company, transporting iron ore from the Serra dos Carajás mines.[245] From Açailândia/MA, there is a connection by the North–South railroad until Porto National in Tocantins (720 km). The North–South railway (EF-151) was designed 40 years ago to be the backbone of the national railway system, integrating the national territory, and contributing to reduce the logistical cost of freight transport of agribusiness production like soybeans and maize as well as fertilisers and fuels. After long start-up difficulties and temporary standstill, the continuation from Porto Nacional in southern

243 Cf. https://www.tapajosdefato.com.br/noticia/288/arco-norte-um-projeto-de-destruicao-para-a-amazonia (accessed September 12, 2022).

244 Cf. chapter I.4.4.2.

245 Cf. chapter I.4.2.4.

direction via Ouro Verde/Anápolis (Goiás) and Estrela d'Oeste (São Paulo) (1540 km) was completed in June 2023, allowing a connection with the Paulista railway network in the Southeast, giving access to the port of Santos. In Rio Verde (Goiás), a large multimodal terminal was built for soybeans and fertilisers with the capacity to move 11 million tons per year. Another terminal is working in São Simão (GO/MG) with a capacity to handle 5.5 million tons of soybeans, maize and soybean meal per year.

In the north, the broad gauge North–South railway connects with the Carajás railway in Açailândia (MA), from where the port of Itaqui can be reached. A 480 km railway connection from Açailândia to the important port of Barcarena/Vila de Conde (Pará) is planned.

The port of Itaquí has a strategic location in relation to the Asian market whose route is via the Panamá canal. In addition, compared to the ports in Southeast and South Brazil, this port shortens the shipping time by about 7 days, which favours competition for Arco Norte. The biggest demand, related to the increase of grains production in the states of Maranhão, Tocantins, Piauí, and Bahia[246] is the amplification of the operational capacity of the Itaquí port (Russo *et al*. 2022).

The terminal of Porto Nacional is localised on the Rio Tocantins, 60 km from Palmas, the capital of Tocantins. Transhipment of the soybean production of Mato Grosso is carried out through the highway (BR-158) to the North–South railroad destined to the Itaqui port in Maranhão.

Besides the Rio Madeira corridor (Porto Velho–Itacoatiara) and the Tapajós–Amazonas corridor (Miritituba–Vila do Conde, among others) there is a projected corridor of the Ferrogrão, the grain railway. This railway project, a nine-year-old strategic project of the largest multinational agribusiness companies, was designed to be implanted parallelly to the BR-163 between Sinop in central Mato Grosso and Miritituba on the Tapajós river in Pará (935 km). The aim is to replace a significant part of truck transport and reduce CO_2 emissions by up to 1 million t[247] and to cut back transport costs for the export of agrarian commodities by 30 to 40 %. The project is already controversial in the planning phase. On the one hand, it is intended to prevent deforestation due to the route along the BR-163, on the other hand, strong interventions in the socio-economic situation of the regional population and an additional deforestation potential are feared. So, the project is constantly objected by Indigenous peoples and communities in the region (Russo *et al*. 2022; INESC 2021).[248] Legal hurdles still stand in the way of the project, as both Indigenous territories and the Jamanxim National Park would be affected by the construction.

Not only the well-known big transnational traders are trying to influence the development decisively, but also China is taking action. China is increasingly trying to invest in domestic companies, logistics, warehousing, transport (interest in the Ferro-

246 In recent years, soybean cultivation in Mato Grosso has expanded into the outskirts of the Amazon biome. More recently, also in Northeast Brazil soybean production increased in the states of Maranhão, Tocantins, Piauí and Bahia, the so-called MATOPIBA region.

247 According to the Ministry of Infrastructure; cf. https://www.germanwatch.org/en/eu-regulation-deforestation-free-products (accessed September 12, 2022).

248 According to Tapajós de Fato the logistical processes for the construction of these projects are already ready, regardless of popular opinion. This is disrespectful to social movements, Indigenous council unions and other entities who live there or who take their livelihood from this territory (cf. link in footnote 243).

grão railway [Abdenur *et al*. 2021]) and trading. China has also invested heavily in the traditional export ports of Santos and Paranaguá (Coy *et al*. 2020, 37 f.).

Now the Amazon ports have exporting capacity, the challenge is transporting the soybeans to the transshipment terminals and ports. The round trip has been reduced from 10 to 4 or 6 days on an average. Given the production and export growth forecast for the next decade, it is crucial to avoid a shortage of port capacity to meet regional export needs.

The volume of soybean and maize handled in Brazilian ports between 2010 and 2019 increased by 350 %. In 2020, 104 million t of soybean exports left Brazilian ports. In 2010, the Arco Norte ports participated with 23 % in handling Brazilian soybean and maize, increasing to 31 % in 2015. In 2020, the ports of Amazônia Legal came up to 50 % of transhipment into grain freighters to overseas. This means that the ports of Amazonia have already caught up with the competitors in Southeast and South Brazil and will probably soon have overtaken them. In exports of soybean and maize, after the still leading port of Santos the port of Vila do Conde/Barcarena is already in second place, followed by Santarém. Freight costs have roughly halved and due to the asphalting of BR-163, which was completed in 2019, freight costs in Mato Grosso have also fallen significantly (Sorriso–Mirituba 2020 to 2021: 16 %) (Borges 2021; Souza-Higa and Gatti 2020). Due to the new export corridors, some towns that have gained importance as hubs of soybean handling to the Southeast will also lose importance in the coming years. This applies, for example, to Rondonópolis, a regional centre in southeastern Mato Grosso, up to now the control centre of regional soybean trade (Friedrich 1999).

The boom in soybean cultivation in Amazônia Legal is strongly encouraged by reductions in transport costs. About 30 % of the cost of producing soybeans is associated with transportation; therefore, high transport costs are the main constraint on the expansion of agriculture in Amazonia. Investments by the Brazilian Government's Pluriannual Plans have improved transportation networks. Paving of highways means promoting the expansion of a globalised agricultural frontier, strongly dominated by external decisions, and – consequently – leads to an ever-faster deforestation of large areas for cattle ranching, soybean expansion and logging activities with extremely high environmental and social costs. Between 1978 and 1994, approximately 318 000 km² of rain forest were eliminated within 50 km of major paved highways, accounting for more than two-thirds of the total Amazon deforestation. Paving the Cuiabá–Santarém road (BR-163) expanded the area where growing soybeans is economically feasible by about 70 percent, from 120 000 to 205 000 km². Most of this new area is in the state of Pará and is covered largely by forests (Vera-Diaz *et al*. 2009).

The Brazilian government considered paving the BR-163 to be a priority for regional and national integration. Its completion in 2019, originally planned for 2008, in reality reduced the cost of transporting soybeans. In North Mato Grosso, the expansion of the soybean agribusiness caused deep transformations of economic, social and territorial structures. This is especially true for the BR-163 corridor.[249] Under the influence of a highly modernised and globalised production system, regional and local actor constellations, social and power relations, have been subject to profound changes (Coy, Töpfer, and Zirkl 2020; Coy and Huber 2020; Coy *et al*. 2021).

249 The specific problems will be analysed in chapter II.5.2.