3. Conflicts of interest at the Amazonian pioneer fronts in the 1980s

3.1. Land conflicts

The pioneer front areas in Amazônia Legal were characterised by confrontation and clashes between different social actors in a permanent struggle for land access and spatial domination of rain forest areas. The state monopoly of violence was rarely existing in these peripheral regions, or the official institutions were weakened or frequently corruptible. Land use conflicts of varying extent and intensity existed despite state spatial planning, administrative measures and existing legal requirements. Violation of law plays a key role in most conflicts of interest. Unequal balance of power and unequal power of disposition of natural resources lead to indirect "structural violence" (Galtung 1972) or even to direct violent activities between persons or groups involved.

Land conflicts finally mean suppression and driving out of the weakest actors. This happened despite the fact that in many cases huge land reserves were available, often considered inexhaustible. One of the basic problems was the untrustworthiness of land titles, sometimes based on dubious or falsified historical documents, on federal, state or municipal allocations or by forging of the land register through bribery. Demands for ownership of large landholders occupying land in frontier areas frequently were entirely unfounded. Many real estate owners acquired land by illegal procedures (*grilagem*).

Since the 1970s, land reclamation of competing social actors increased rapidly and conflicts of interest expanded and intensified in many Amazonian regions.[49] The strategy of rapid occupation and valorisation of land by exploiting natural resources and gaining economic profits enabled a steadily escalating rivalry concerning land use. Coexistence of competing social groups and their different economic systems was only possible with restrictions. The official authorities responsible for government-controlled spatial organisation of frontier regions neither were financially nor personally well-equipped to resolve the outstanding problems and bringing peace to all the actors in this tense atmosphere.

49 On land conflicts in general in Amazonia cf. Ianni (1979a; 1981); Mahar (1979); Barbira-Scazzochio (1980); Becker (1982); Foweraker (1982); Schmink (1982); Morán (1983); Schmink and Wood (1984); Martins (1982); Bunker (1985); Hecht and Cockburn (1990); Kosinski (1991); Kohlhepp (1977a; 1979); Kohlhepp and Coy (1986); Coy (1988).

There were conflicts between the capitalist frontier and the peasant frontier. Regional smallholders, squatters (*posseiros*) without land titles and migrants from other Brazilian regions settled in state-organised or private colonisation projects, trying to survive by fighting the space-grabbing activities of large landowners. These *fazendeiros* counteracted the peasants' aim to improve their living conditions using slash-and-burn agriculture in a land rotation system to guarantee a subsistence economy. Cattle ranchers burning large forest areas and expanding their pastures, large soybean farmers increasing plantations and using extensive infrastructure or sawmill owners trying to get precious wood regardless of owning the terrain interfered directly or indirectly in the way of life of peasants. Land speculation plays a significant role in realizing pressure on squatters in spontaneous settlement activities. As a rule, there was no understanding between the conflict parties. In case of refusing the displacement, large landholders frequently used their *pistoleiros*, a private militia resolving any problem by acts of violence, very rarely being sentenced.

During the military regime, protests against illegal activities of large landholders had been difficult and frequently could be interpreted as anti-governmental actions and resistance against law and order. In some regions with anti-guerrilla military operations, e. g., in the Araguaia-Tocantins region (Bico de Papagaio), extensive land occupation of some economic groups or *fazendeiros* obtained support of the Military Government.

Government-controlled development planning in pioneer regions and the decision makers of newly founded municipalities frequently exercised a superficial control of the actors' activities and favoured capital holders and their influence on the local economy against interests of smallholders. In an increasing extent in the 1980s, Christian organisations (Comissão Pastoral da Terra, CPT, founded in 1975) struggling for social justice and human rights offered advice and support to small farmers and landless people, addressing land distribution and violence problems. After re-democratization, party affiliation gained importance and had a decisive influence on land conflict problems. At the extractive pioneer front, land conflicts between gold and diamond miners (*garimpeiros*), rubber tappers (*seringueiros*), traditional groups gathering Brazil nuts and on the other hand large-scale mining, timber companies or cattle ranches resulted in violent clashes. Frequently, the conflicting situation remained unsolved during longer periods.

In most cases, no one of the neo-Brazilian social actors was open to discussion with each other and a general characterisation of land conflicts at the frontier was a struggle of everyone being against everyone and every group fighting for its own interest unwilling to make concessions. Sometimes, police had to take action in case of ubiquitous invasions of colonisation projects, *fazendas*, forest reserves, and Indigenous reservations. Frequently, INCRA had to start legal proceedings against the "owners" of *fazendas* without land title or only installed for land speculation purposes, threatening settlers in official projects.

All these groups acted in a shared belief that the Indigenous population in Amazonia and their territories should not impede the space-consuming economic activities of the powerful as well as the weak participants of the exploitation process. Peasants feared attacks by neighbouring Indigenous groups, the large actors were scared by the loss of time and profit by the intervention of the government agency for Indigenous affairs FUNAI to protect Indigenous groups and areas. The different social actors did

not show any empathy and understanding for the basic needs of the Indigenous people, their traditional way of life and their land property rights, prescribed by law. Indigenous reservations were ultimately favoured but, in many cases, not respected, and invasions have often ended in massacres with casualties on both sides.

3.2. Situation of the Indigenous people: Violence, displacement, attempts for protection in Indigenous "reservations" and the problem of invasions

The history of integrating the Amazon region into the neo-Brazilian economic system is characterised by violence against the Indigenous population, displacement of tribes, causing socio-cultural fragmentation and even extermination. The attack of modern "civilization" on the Indigenous living space in Amazonia was threatening the existence of dozens of Indigenous tribes. From the disparaging point of view of some Brazilians at the frontier, the Indigenous people were considered *bichos da mata* (forest animals) during the first phase of the Amazonian exploitation.

Focus of the conflicts between the Indigenous groups and the modern Brazilian social actors were land occupation and the rights of disposal of the regional natural resources. In contrast to the logic of economic interest groups trying to "valorise" the natural potential, to the Indigenous population the tropical forest areas are the basis of their physical, social, and cultural survival.[50]

In 1910, the Brazilian government had started a policy to protect the Indigenous population, concentrating on the so-called "pacification" of these groups. The direction of the new Indian Protection Service (SPI) was given to Cândido Mariano da Silva Rondon, who had Bororo origin and decades of experience in expeditions in Amazonia and contacts with Indigenous tribes. The legislation that established the SPI "explicitly stated that it was the obligation of the Brazilian government to protect Indians against the destructive effects of frontier expansion and to defend their lives, liberty, and property against extermination and exploitation" (Davis 1977, 3). The rights of Indigenous people to live on their lands and to continue their ancient and traditional ways of life were recognized by the legislation. Brazilian governments established an orphan-like guardianship for the Indigenous population to defend their legal privileges. Although there have been more than 30 legal statutes demonstrating the consciousness of official obligations as to the Indigenous people, the reality did not prove the implementation of those legal guarantees.

During the first decades, the pacifist ideals of Rondon were successful with the motto "Die if it be necessary but kill never". Indigenous posts in the frontier regions were created. The Indigenous tribes accepted the gifts and overtures of the SPI agents, but later they often suffered from rubber tappers, logging companies and settlers encroaching on their territories. The SPI tried to mediate, but often Indigenous tribes were displaced or killed, died from the transmission of infections or were eventually

50 Among the numerous publications on the Indigenous population in Amazonia and related conflicts of interest cf. Ribeiro (1962; 1970); Lévi-Strauss (1963); Hopper (1967); Meggers (1971); Dostal (1972); Brooks *et al*. (1973); Hanbury-Tenison (1973); Junqueira (1973); Davis (1977); Hemming (1985); Hartmann (1989); Villas-Bôas and Villas-Bôas (1973; 1994).

marginalised. From 1900 to 1957, the Indigenous population dropped from about one million to less than 200 000 and 87 tribes disappeared. The remaining tribes were classified in four categories: Relative isolation, intermittent contact, permanent contact, and integration (Ribeiro 1957). In 1957, over 120 tribes lived in the Amazon region, most of them in small groups between 100 and 500 individuals.

During the *Estado Novo*, the Brazilian government had started a campaign to conquest the "west" of the interior, creating in 1943 the Roncador-Xingu Expedition and the Foundation Central Brasil. The aim of the Roncador-Xingu Expedition was to research the natural conditions and spatial distribution of the Indigenous tribes as a basis for mapping the regional settlement of Central Brazil. Access road construction with the rest of the country, the setting up of some urban nuclei (Aragarças, Xavantina) and the installation of some military bases (Serra do Cachimbo, Jacareacanga) as posts of support to secure air traffic to Manaus by radio contact could be realised (Kohlhepp and Dutra e Silva 2022). As the expedition faced great logistical difficulties, complicated contacts were made with Indigenous tribes, in 1945 with the "hostile" Xavantes and in 1946 with the Kalapalos on the Culuene river in the upper Xingu region (Villas-Bôas and Villas-Bôas 1973; 1994). The Foundation Central Brasil, incorporated into the expedition, had the instruction to organise and coordinate the exploration and colonisation of the Brazilian West, especially the regions of the Araguaia and Xingu rivers.

These two institutions definitely marked the policy of expansion of the agricultural and demographic frontiers of Central Brasil and had a decisive influence on subsequent development policy in this region.

In the late 1950s, new agents were contracted, and the administration of the SPI became deeply infested by corruption. There was little control over the activities of SPI agents and the quality of contacting the Indigenous tribes deteriorated. Economic motives rather than humanitarian considerations began to form the Indigenous policy of the military regime in Brazil. In 1968, the Minister of the Interior commissioned the attorney general Figueiredo to carry out a detailed investigation on corruption and crimes among officials of the SPI. The "Figueiredo Report"[51] – obviously it got "lost" afterwards – "found evidence of widespread corruption and sadism, ranging from the massacre of whole tribes by dynamite, machine guns and sugar laced with arsenic […]" (Davis 1977, 10). These accusations had worldwide repercussions and caused shocks, protests and a flood of newspaper articles and radio reports. It became clear that SPI agents, landowners and speculators had passed infectious diseases to Indigenous tribes without immunity against influenza, measles, or tuberculosis. Even the Brazilian *Jornal do Brasil* called these crimes genocide and violation of human rights. Nearly half of the 700 SPI employees were charged with crimes or dismissed.

The Military Government closed the Indian Protection Service and in 1967 established a new government agency: the National Indian Foundation (FUNAI), submitted to the Ministry of the Interior. When political hardliners and staunch development supporters like the new President Médici and his Interior Minister Costa Cavalcanti started building the Transamazônica in Amazonia in 1970, the pressure on the Indigenous tribes intensified. Developing the Amazon region and the Brazilian economic "miracle" made new headlines. The official slogans "Land without people for people without land" and "We don't let some Indians hinder our progress" became

51 Comments on the Figueiredo Report (5115 pages) cf. Davis (1977).

well-known and clearly demonstrated that the existence of the Indigenous population and their territories were disrespected. Because of worldwide protests in favour of the Indigenous people in the Amazon region, some international organisations[52] had the opportunity to make investigation trips in Amazonia, the Brazilian government being compelled to give infrastructural support.

During the military governments, Amazônia Legal went through intensive agricultural colonisation with enormous migration waves despite of difficult ecological and poor soil conditions. Spontaneous colonisation activities turned out to be highly problematic for Indigenous territories. *Posseiros* tried to survive at the conflict-ridden Amazonian pioneer fronts and being in trouble they did not respect Indigenous reservations. Until the mid-1980s, the Indigenous population in the Amazon region suffered most from the attacks of "wild capitalism" by large groups with an enormous number of cattle raising farms,[53] mining projects, regional development activities based on the newly installed road network, and huge constructions of hydroelectric power plants. The prospecting boom of mining companies with camps for geological research, heavy machinery, blasting operations, construction of access roads, airfields, helicopter landing strips and aircraft noise caused a permanent molestation of the Indigenous people nearby.

Loggers from timber companies and *garimpeiros* with uncontrolled activities and high spatial mobility, willing to use violence, were extremely difficult to control. In case the Indigenous resisted, cruel "punitive expeditions" were organised in which the tribes were deliberately killed or expelled so that the disputed areas remained "indian-free". The contact of some Indigenous tribes with highway construction workers had negative consequences such as prostitution, alcohol, and forced labour services. Infrastructural and economic projects and FUNAI's low budget prevented organising more contact expeditions to relatively isolated Indigenous areas before the tribes were surprised and shocked by the encroaching modernisation.

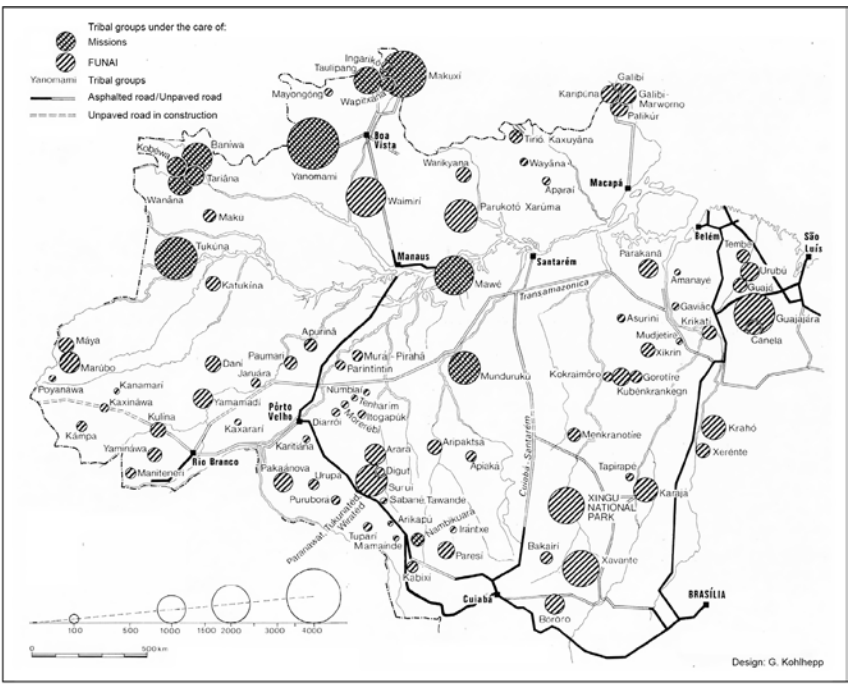
In the mid-1980s, the Indigenous population approximately totalled 150–200 000. Two thirds of the Amazonian tribes had less than 500 people. Only very few Indigenous tribes amounted to more than 5000 persons, such as the Ticuna in eastern Amazonia, the Makuxi and the Yanomami in the border region of Roraima with Venezuela (Fig. 6). The number of Indigenous people living in isolation without contacts with the neo-Brazilian world remained unknown.

These tribes obviously lived in the northern, north-western und western parts of Amazonia. Besides the territories at the periphery of Brazilian Amazônia Legal, the distribution of the Indigenous population in Amazonia focussed on the middle and upper courses of southern tributaries of the Amazon river. The reason for this was the danger posed by *seringueiros* invading the forests, starting from the Amazon river towards the south, i. e., upstream of the tributaries. The Indigenous tribes retreated to the non-navigable upper courses of the hydrographic tributary system, which were inaccessible to the invaders (Kohlhepp 1987a).

52 Among others, the Primitive People's Fund (Hanbury-Tenison 1973) and the Aborigines Protection Society (Brooks *et al.* 1973).

53 Cf. chapter I.1.2.1.

Fig. 6: Indigenous population of Amazonian tribal groups



Source: Draft in Kohlhepp (1986, 173; 1987a, 45); data from Dória and Ricardo (1972) and Brooks (1974).

Over the millennia, Indigenous peoples have adapted their economic system of hunting, gathering, shifting cultivation and population growth through birth control to the ecological conditions of the tropical rain forests, the biodiversity and the carrying capacity of the food potential of their territories. They had developed a tradition of extracting medicinal plants in the rain forest. Grasses, herbs, flowers, tree bark, animal secretions etc. were used by shamans to relieve pain, infections, inflammation and to cure a wide variety of illnesses, including malaria and snake bites. The shock of conflicting contacts with "modern civilisation" caused demoralisation, loss of cultural identity and of economic independence. In this apparently hopeless situation at the end of the 1960s, the birth rate of the Indigenous population in many tribes declined nearly to zero as a sign of losing the will to live.

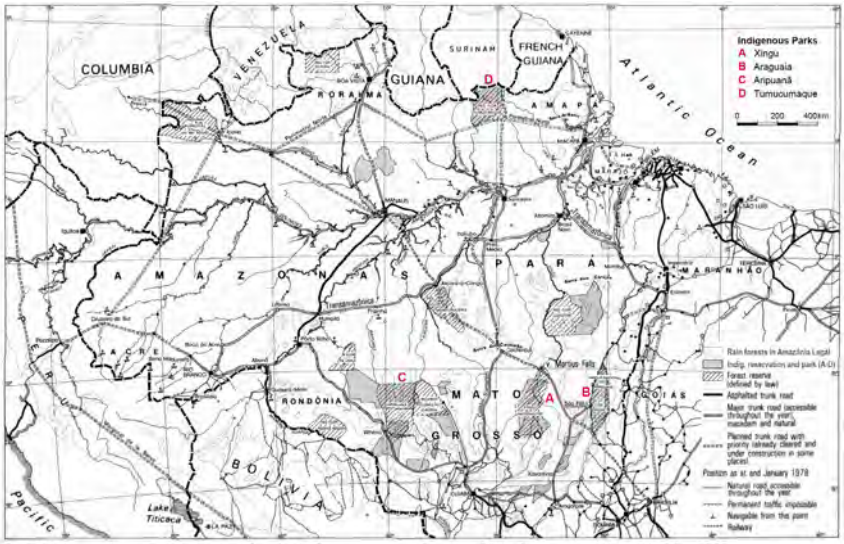
Indigenous lands must be properly demarcated, but in the 1980s demarcation remained in a preliminary phase. Each ecological zone is an integrated system of interactions between plants, animals, soils and shows a predictability of natural resource locations (Posey 1982; 1987). Indigenous villages are located amid the maximum of species diversity because each zone provides natural products and attracts different game species during different seasons. The shifting cultivation systems of the Indigenous populations are more complicated than those used by the *caboclo* population and better adapted to tropical conditions. They prevent exposure to direct sunlight and tropical rainfall, avoiding erosion and leaching (Goodland and Irwin 1975).

3.2.1. Indigenous parks and reservations

Two opposing models of Indigenous policy existed in Brazil: The first was radically protectionist. The Indigenous tribes were to be protected by the government in closed "Indian parks and reservations" from border attacks and gradually prepared as independent ethnic groups to integrate into Brazilian society and economy. In contrast, a second model had been developed during the SPI period and was later assumed by the FUNAI. It was a developmentalist approach, based on the rapid integration of Indigenous groups into the regional economy and rural class structure as a reserve labour force (Davis 1977).

After decades of discussions about the installation of Indigenous reservations, in 1961 the legal protection of National Parks was a first step. The National Parks of Xingu, Araguaia and Tumucumaque, in 1969 Aripuanã was added, were declared forest reserves and Indigenous protection areas (Fig. 7). The three Villas-Bôas brothers played a very important role in organising peaceful contacts with the Indigenous tribes and were named directors of the Xingu National Park. As they noted, in 1946 Indigenous tribes were living in nearly unchanged conditions as described by the German physician and ethnologist Karl von den Steinen during his expeditions in the 1880s.[54]

Fig. 7: Major road construction, national parks, Indigenous reservations, and forest reserves in Legal Amazonia at the end of the 1970s



Source: Documents and maps of SUDAM, FUNAI, DNER, IBDF; cf. Kohlhepp (1977a, 22; 1984a, 651).

To defend Indigenous populations from pressure of pioneer front expansion, some reservations had been legalised. However, only very few successfully realised their function. Indigenous land needs to be properly demarcated, but in the 1980s demar-

54 Karl von den Steinen (1886; 1894) had a great influence in evolving Brazilian ethnology of Amazonian Indigenous tribes. Cf. Villas-Bôas and Villas-Bôas (1973; 1994); Hartmann (1989). Cf. Hemming (2019).

cation was still at a preliminary stage. The main problem of modern exploitation and regional development planning in Amazonia was the need for large areas of land for the shifting cultivation methods of Indigenous tribes, which were on a collision course with the planning ideology of politicians and development technocrats (Kohlhepp 1987a). They criticised the large reservation areas for "some" Indigenous people, were poorly informed and compared the area to the land of a settler family in a colonisation project.

In 1970, the Military Government named General Bandeira de Mello, a military intelligence officer, as the new president of FUNAI. He claimed that the protection of the Indigenous population under FUNAI tutelage would be coordinated with the programme for roadbuilding, occupation, and settlement of Amazonia. In October 1970, a contract between FUNAI and SUDAM was signed to pacify Indigenous tribes along the prospected route of the Transamazônica. FUNAI agents had to prevent Indigenous tribes to be an "obstacle" for the rapid occupation of Amazonia and to provide workers' protection against supposed Indigenous attacks.[55]

In the same year, Brazil's President General Médici announced a new "Indian Statute" with directions for the Indigenous policy in the Amazon region, posing a threat to the territorial integrity of Indigenous tribes urging "to intervene in native areas and physically to relocate Indian tribes" for different purposes like public works of interest to national development or to maintain national security (Davis 1977, 58).

The government of Mato Grosso had made land concession areas available to southern Brazilian colonisation companies, and there was intense speculation on land before the establishment of the Xingu National Park. In northern Mato Grosso, land conflicts turned out to be dangerous for the Villas-Bôas plans of an Indigenous park. By fraud and falsifications, large areas had been stated officially as not inhabited by Indigenous people and were thus freely available for sale. In 1996, the sum of private land titles in Mato Grosso amounted to 120 % of the state area (Röper 2001, 177). Protests of the Villas-Bôas brothers forced the state government by pressure of the federal government to annul land titles in the supposed park area. Although the originally planned park area had been strongly reduced, the Xingu National Park was given an area of 22 000 km².

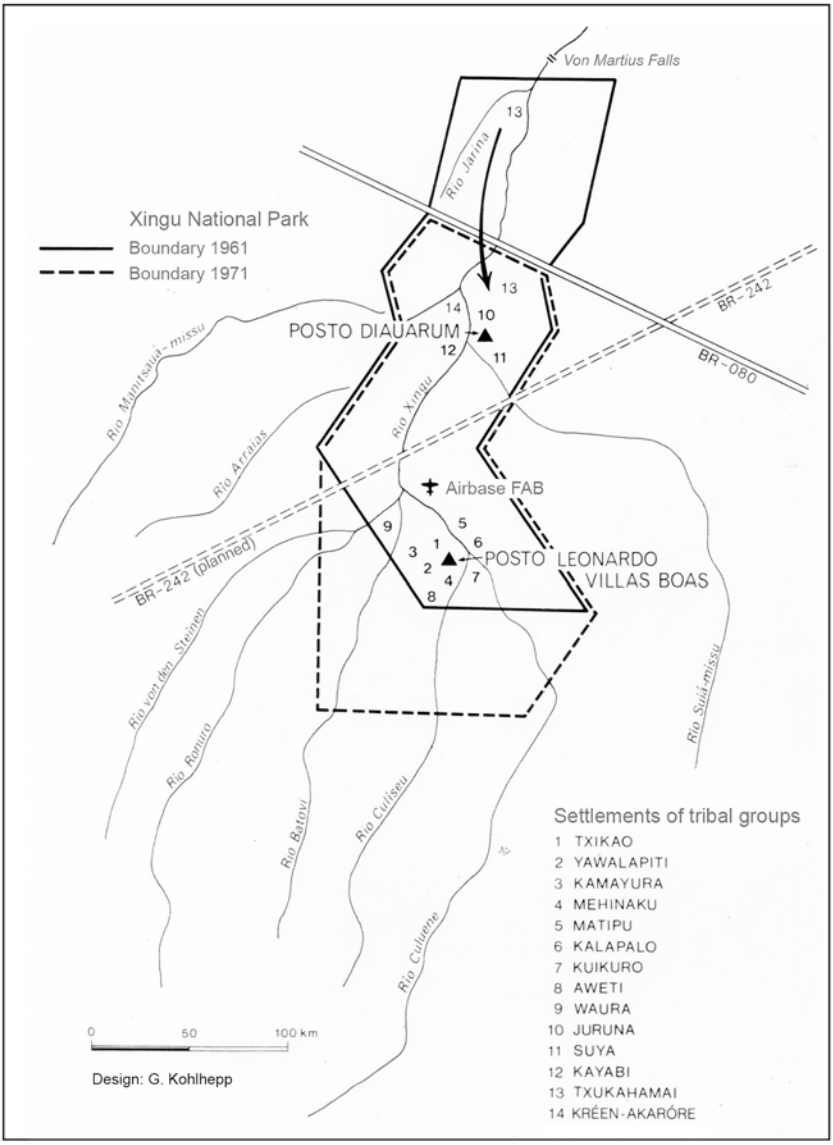
Unfortunately, as part of the Amazon road building programme in 1971, the northern part of Xingu Park was cut off by a road (BR-080), which was originally supposed to connect Brasília with Manaus but was never completed. The section of road that runs through the Xingu Park could have been built outside the park, but the pressure from the large livestock groups obviously had a decisive influence. One of the main groups affected was the Txukahamai[56] tribe, which had recently been resettled to the Xingu Park, but was now relocated again to the south to the central area of the park, where another 13 tribes and about 1500 Indigenous people lived (Fig. 8). The area lost in the north of the Xingu National Park was added in the south, with serious ecological consequences, as the *campo cerrado* vegetation there could not be used as habitat for Indigenous groups of forest dwellers. The fights of the Villas-Bôas brothers for survival

55 In September 1973, during the visit of the author in the camps of the Transamazon road workers between Sucundurí and Jacareacanga, they were digging ditches filled with petroleum round the camp, setting fire at night against threatened "attacks of Indigenous tribes or jaguars."

56 The Txukahamai, more specifically Mentuktíre, a northern Kayapó tribe.

of the Indigenous groups were successful in preventing the crossing of the planned BR-242 road. Two Indigenous posts were organised to support the Indigenous groups, giving preventive health measures and medical care. There was a permanent threat of influenza or measles infections during contacts with the official personnel or the staff of the Brazilian Air Force with a small base inside the Park.

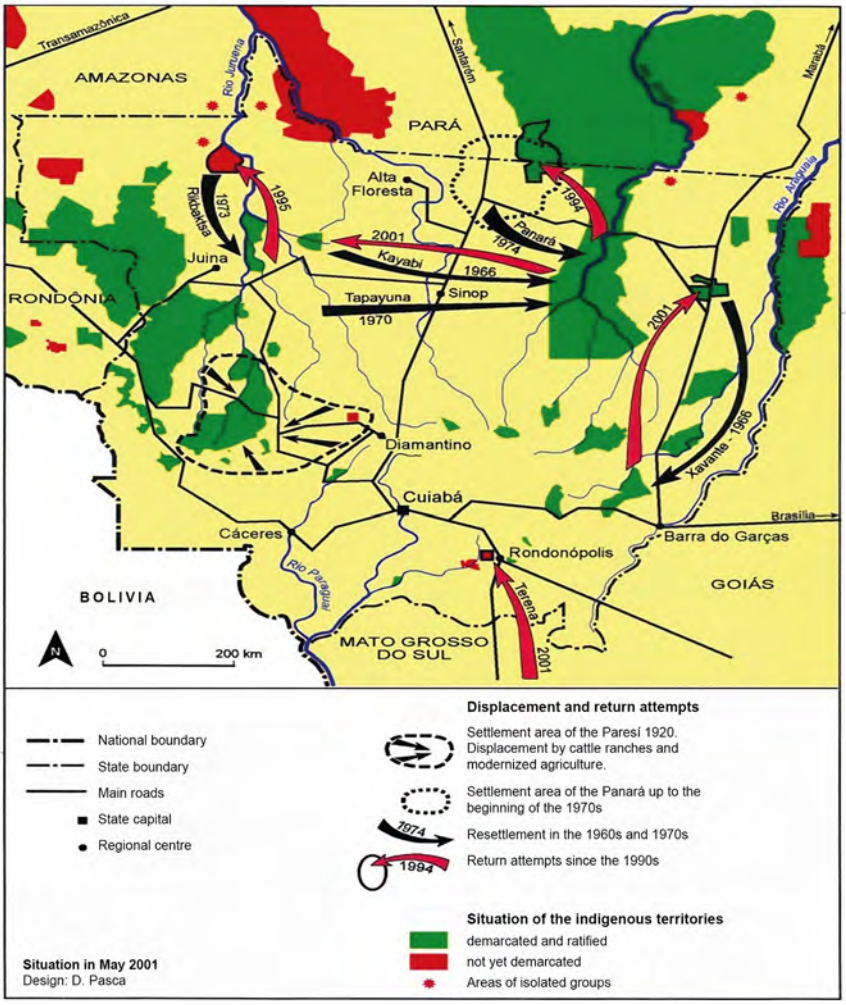
Fig. 8: Xingu National Park and settlement areas of Indigenous tribes



Source: Documents of FUNAI. Cf. Junqueira (1973, 11), Kohlhepp (1986, 178 f.).

With the Indian Statute, the Park was named Xingu Indigenous Park in 1973. The area of the Park was extended in 1984 when the lost region was regained and finally demarcated in 1987. This could only be realised because parts of the Mentuktíre refused to leave their original territory and were unwilling to resettle in the Park (Pasca 2004).

Fig. 9: Displacement, relocation, and resettlement of Indigenous tribes in Mato Grosso



Source: Based on the map of Pasca (2004, 163).

Displacement of Indigenous tribes from their traditional environment to other areas and the resettlement of some tribes into the Xingu Indigenous Park caused enormous problems because of different ecological conditions, a new neighbourhood, loss of cultural identity and difficulties in getting used to new surroundings. Fig. 9 gives an idea of the complicated scenario of displacement and resettlement of Indigenous tribes in Mato Grosso and in some cases their "victories" to return to the original territory.

In the case of the Panará – formerly called Kreen-Akarore – the construction of the Cuiabá–Santarém road (BR-163) destroyed their living area and the Villas-Bôas felt compelled in 1974 to resettle this strongly weakened and humbled group – loss of 90 % of its population by infectious diseases – into the Xingu Indigenous Park. In the 1990s, they regained a part of their original territory with support of some NGOs.[57] The Kayabí and the Tapayuna had to be resettled into the Xingu Park after rubber tappers and colonisation activities (Gleba Arinos) (Kohlhepp and Dutra e Silva 2022) in northern Mato Grosso invaded their territories and permanent violent conflicts occurred. The Rikbáktsa had to leave their territory in 1973 and regained part of it in 1995.

The Villas-Bôas convinced Indigenous groups to remain as an autonomous group until the time of a more direct contact with the neo-Brazilian people. The aim was to preserve the social cohesion in each of the tribal groups. Doubts always remained present about the strategies to protect the Indigenous population against the counterstrategies of government institutions and economic pressure groups.

> But what kind of protection can we offer? Perhaps what we are really interested in is the little bit of land the Indian still possesses. Or perhaps we are seeking a source of cheap labour. This is how you can interpret all the humanity we have been imposing on the Indian.[58]

During the military governments, the newly installed FUNAI was not adequately equipped. Only few newly trained employees were contracted, experienced ethnologists (*sertanistas*) especially lacking, an insufficient number of vehicles and motorboats available. Scarce financial funds prevented medical care and social support. Protection of the borders of reservations could hardly be realised. This proved a restricted room for manoeuvre. However, it should be emphasised that some experienced FUNAI *sertanistas* worked with utmost attention in trying to contact peacefully Indigenous tribes under very difficult circumstances, working totally isolated. While cultural traditions and territorial integrity of the Indigenous tribes should have been protected, FUNAI had to submit to the strategies of the federal government's regional policy, favouring the exploitation of natural resources by private economic companies. The legally defined obligations were ostensibly realised, experienced anthropologists were put aside and discrimination of the Indigenous population hardly hidden.

Obviously, the official FUNAI programme was a camouflage and in the guiding principle of the Military Government the Indigenous people had no importance at all. For most of the military leaders[59] and politicians, Indigenous tribes were a nuisance and spoiled the "Amazonian miracle." The protection of Indigenous territories was accepted until such time as state planning and integration strategies or powerful private economic interests came into conflict with reservation policies. In Brazil, installing of

57 Sources of Fig. 9: Pasca (2004, 163; 2005); Archive of OPAN, Cuiabá; survey of documents by Dan Pasca in the Instituto Socio-Ambiental (ISA) in 2001.

58 Orlando Villas-Bôas, former Director of the Xingu Indigenous Park, cited in: Davis (1977, 47).

59 Fortunately, there were exceptions to this rule: The Commander of the Brazilian Air Force (FAB) in Amazonia, Brigadeiro João Camarão Telles Ribeiro, interested in geographical research, invited the author in October 1975 to join an inspection flight to several Indigenous areas and the National Park Tumucumaque. There was a missionary outpost at the Tiriós tribe and a military station of the FAB on the national border with Surinam.

Indigenous reservations had been a topic for decades and remains controversial until today. Enemies of an adequate Indigenous policy argued in an underhanded manner like supporters of the Indigenous people that reservations for human beings would demonstrate an inhuman "zoo-effect." Experienced *sertanistas* emphasised the need of a slow preparation of native people for contacts with the outside world. They considered well protected reservations including ecologically adequate living space to be inevitably necessary.

The process of installing and legalising Indigenous reservations had been slow and heavily disputed. Even after having been officially announced, reservations always remained under pressure of economic activities in the surroundings. Until the mid-1980s, only in 8 % of the Indigenous reservations the demarcations became legally effective. The exploitation of the Amazon region always was characterised by the invasion of Indigenous areas and even of officially legalised reservations.

3.2.2. Problems of invasions of Indigenous territories

One of the first well documented invasions of Indigenous areas during the period of the military governments was the case of the Cinta Larga tribe in North Mato Grosso and Rondônia. Already in the beginning of the 1960s, a 1.8 million ha forest reserve was established by law between the Juruena and Arinos rivers. In 1969, the Aripuanã National Park was created to the west of the forest reserve and a reserve for the Cinta Larga was established. They had been contacted in 1968 and represented one of the largest Indigenous groups in Amazonia with more than 10 000 people and more than 100 villages. This group and the Suruí tribe had already suffered from the intrusion of rubber tappers and *garimpeiros* into their land in earlier decades. Colonisation companies and cattle ranchers came to the area claiming false, previously "acquired" land titles. A rubber extraction company had attacked a Cinta Larga village by dropping poisoned sugar and firing explosives from the air.[60] Many bloody clashes with Indigenous groups occurred and had a worldwide publicity.

In the 1970s, large cassiterite deposits in the Aripuanã Park were discovered and a frantic activity of national and international mining companies started. Geological investigations on mineral resources with airstrips for researching groups caused stress to the Indigenous people, resettlement projects were discussed, and the area of the Aripuanã Park was reduced. The Cinta Larga were the victims of the new mineral boom in this region. More mineral resources were only supposed to exist, such as titanium and uranium, but never extracted. The Aripuanã Indigenous Park never had a positive effect for the Indigenous people. Many Cinta Larga suffered from infectious diseases (tuberculosis, hepatitis), the FUNAI personnel did not take any precautions (Davis 1977, 87) and only a small group survived. The government declared the region a restricted area because of strategically important mineral resources.

The installation of a scientific centre "Cidade Humboldt" for geological and mineralogical research, studies on the potential of natural resources of the Amazon ecosystems and applied sciences was announced in 1972 (IPEA/IPLAN 1973; Davis 1977; Kohlhepp 1977a). This was supposed to be the Military Government's response to international concern about environmental issues and the future of the Amazon region,

60 This incident in 1963 became known as "Massacre at parallel eleven" (Davis 1977, 79).

referring to the Man and the Biosphere programme of the UNESCO (1971) and the UN Conference on the Environment in Stockholm (1972). After a first effort to build installations and to realise cooperation with federal, regional, and scientific institutions for a scientifically based regional development planning, the Humboldt project – under administration of the National Council for Scientific and Technological Development (CNPq) – did not succeed because of bureaucratic problems. Already in 1975 it was forgotten and during the Polamazônia programme it was not mentioned again.

In central Rondônia, the final demarcation of the reservation of the Uru-Eu-Wau-Wau was part of the reformulation of the Polonoroeste programme.[61] The area was invaded by settlers and gold-prospectors, and other invasions were caused by road construction nearby. The overlapping of the Indigenous reservation and the National Park Pakaas Novos (under the auspices of IBDF) caused administrative and legal problems. A National Park with options of tourism is not compatible with the status of an Indigenous reservation. This has been a constant problem since the reservation policy began in 1961 and has never been resolved. In other Indigenous areas, conflicts increased when invading *posseiros* were taken hostage by Indigenous groups. The FUNAI staff was not well equipped, and no trained anthropologist worked in Rondônia in the 1980s. The staff number was by no means sufficient to control the 16 Indigenous reservations. Additional means for "Indigenous posts," for vaccination measures, and the technical infrastructure of the agency were lacking. In the mid-1980s, 30 % of the state area of Rondônia were declared Indigenous reservations and forest protection areas, but effective control failed to materialise (Kohlhepp and Coy 1985; 1986).

The decision to realise a master plan for a highway network in Amazonia was the most serious problem for a sound planning of Indigenous reservations. Roads drawn straight without detailed topographical knowledge – despite aerial and satellite imagery – crossed numerous Indigenous territories and, a few years later, reservations and forest reserves. The Brazilian Army Corps of Engineers and large private road construction companies with heavy machinery equipment, produced by multinational companies, were the main actors. International loans to finance this programme were available, among others the largest World Bank loan ever for a road project.

About 5000 Indigenous people in 29 tribes were supposed to live along the Transamazônica and the Cuiabá–Santarém road, among them the Kreen-Akarore and the Parakanã. The Parakanã had earlier contacts with the neo-Brazilian world, but when the Transamazon road crossed their territories a so-called "pacification expedition" had a disastrous consequence for the tribe. After contacts with FUNAI staff and road construction workers, the Paracanã were stricken with influenza, infections and veneral diseases. The Kreen-Akarore (Panará) – as mentioned above – had been resettled in 1974 into the Xingu Indigenous Park after the traumatic effect of invasions of their territories. They were in a state of sickness, hunger, and despair. Brooks (1974) called these events "ethnocide in the Amazon".

The territories of the Waimiri-Atroari, located north of Manaus, had been isolated during a long period. The tribe of more than 2000 people was described as "hostile" and contacts ended fatally. A failed attempt of the Italian Father Calleri at "pacification" became known worldwide when in 1968 the Waimiri-Atroari killed all the team members. In 1971, a reservation was decreed, but the construction of the Manaus–BoaVista

61 Cf. Chapter I, 2 and Fig. 5.

road (later extended to Caracas), passing through the Indigenous reservation, started at the same time.[62] The Waimiri-Atroari tried to resist the invasions and showed their fighting strength by shooting arrows against helicopters of the Brazilian Army Corps, responsible for the road construction. Although they had accepted gifts, they killed 15 FUNAI agents who had invaded their territory and destroyed an Indigenous post after confronting them with bulldozers, logging and helicopter noise (Davis 1977; Kohlhepp 1977a). A leading FUNAI agent called for revenge by an armed attack "with dynamite, grenades, tear gas, and bursts of submachine guns to give the Indians a demonstration of the force of our civilization."[63] These events had an extended coverage by the international press. Violent attacks of the Waimiri-Atroari against the use of repressive military force to control the tribe continued and road construction was delayed. Some of the Waimiri-Atroari withdrew inside the reservation, heavily reduced in area because of the reservoir of the hydroelectric power plant Balbina and by cassiterite mining. Other tribe members had contact with road workers, suffered from diseases, and remained in a humiliating situation.

North of the Amazon river, the planned routing of the Perimetral Norte, an east-west axis, touched the southern limit of the Tumucumaque National Park and threatened to cross the huge Yanomami territory in the west of Roraima state. About 10–15 000 Yanomami living in hundreds of isolated Indigenous villages at the border region of Brazil and Venezuela very rarely had contact with Italian catholic and North American evangelical missionaries. In 1975, an Italian Salesian priest tried to make contact with a group of Yanomami at the end of the forest clearance for the Perimetral Norte route.[64] When the discovery of a large uranium deposit in the Surucucus region was announced in 1975, the situation of the Indigenous people seemed to get worse. Brazil had planned to install eight nuclear power plants in an agreement of advanced technology with the Federal Republic of Germany and the extraction of uranium in Roraima was threatening. In an interview, the Governor of Roraima, General Ramos Pereira, commented "that an area as rich as this – with gold, diamonds, and uranium – cannot afford the luxury of conserving half a dozen Indian tribes who are holding back the developing of Brazil."[65]

As is so often the case, the announcement of mineral deposits was used as a strategy to overcome existing planning and legal regulations. The exploitation did not begin when the nuclear programme was delayed and was only realised on a small scale decades later. Finally, the construction of the Perimetral Norte was stopped because of insurmountable difficulties with granite intrusions of the Guiana shield and the perception that this road had no longer priority in Brazil and no connection was planned in Colombia.

In the 1980s, the Yanomami territories were frequently invaded by *garimpeiros*. Airstrips and access roads were often destroyed by military forces but always rapidly reconstructed by the gold prospectors. Fig. 10 shows the distribution of Indigenous ar-

62 Cf. Fig. 7.

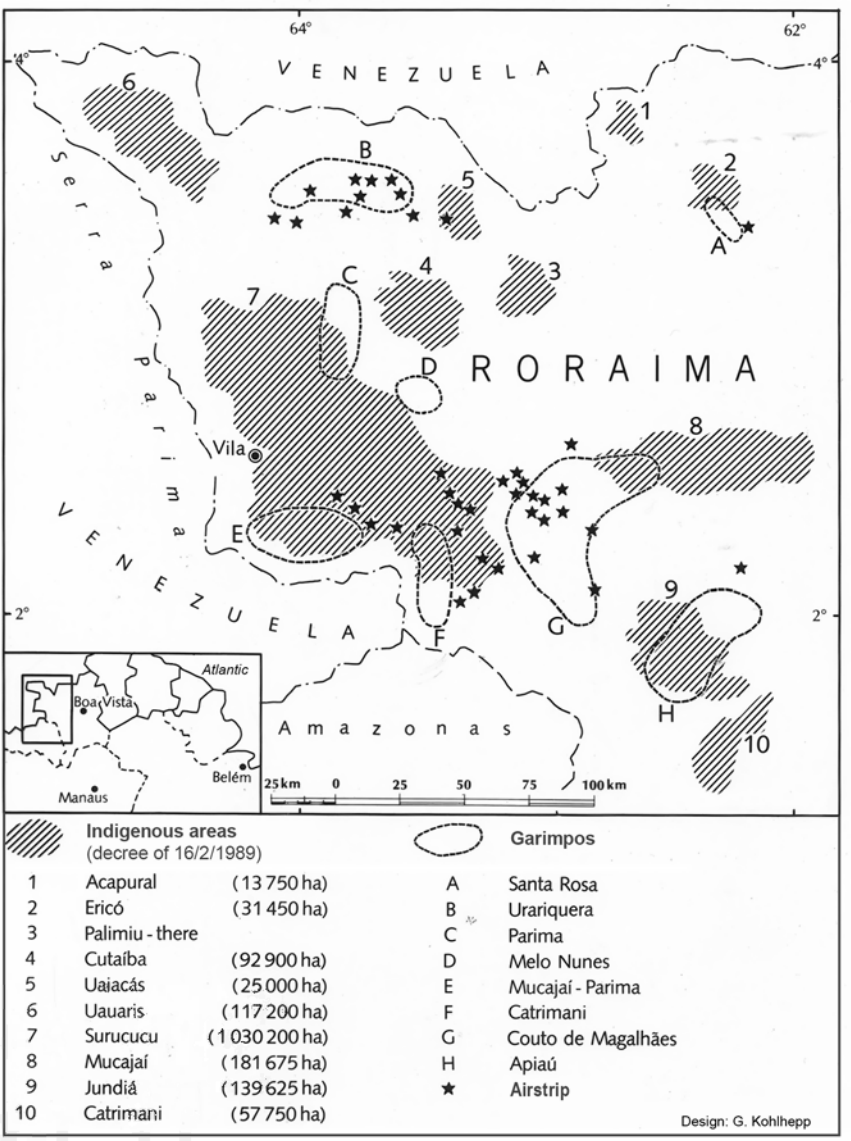
63 FUNAI agent Amáncio, director of the pacification efforts along the Manaus–Boa Vista road, cited in Davis (1977, 97).

64 Visit of the author at km 211 of the Perimetral Norte, west of the camp of the construction company Camargo Corrêa near Caracaraí, in October 1975. Cf. Fig. 7.

65 *O Estado de São Paulo*, March 1, 1975.

eas, *garimpos* and the high number of airstrips, many inside the Indigenous areas. The Roraima state government was not interested in strict restrictions on the *garimpeiros*, who contributed to a flourishing gold trade and positively influenced the economy in the state capital Boa Vista. Extensive air taxi traffic remained unimpeded. Gold mining activities and massacres against Yanomami people are continuing until today.[66]

Fig. 10: Invasions of garimpeiros *in Yanomami territories in 1989*



Source: Kohlhepp (1998b); based on: *Jornal do Brasil*, June 25, 1989, p. 14.

66 See chapter III.3.

3.2.3. Missionary activities

In the 1970s and 1980s, the situation in the Tumucumaque National Park,[67] located near the border to Surinam, was relatively calm because of the isolation of the Park area, at that time only superficially demarcated. Access to the Park was only possible by the Brazilian Air Force (FAB). In Tumucumaque, the FAB had a border detachment, an airstrip on a *cerrado* area, and supplied goods and petroleum for the military station and the Franciscan Mission of the Tirió tribe, established on the upper Parú de Oeste. The Tirió – in 1975 about 250 people in Brazil – lived on both sides of the border, in Surinam two protestant missions were set up. Many Tiriós crossed the border. In the mid-1970s no invasions in the Tirió territory occurred. The missionaries organised the construction of a village, the Mission Tiriós. Some Tirió decided not to live in the Mission but with easy access to the central village and its service infrastructure.

Obviously, a good cooperation of the FAB, mission and the Indigenous people existed.[68] Assistance to the Tirió in healthcare and education was provided by the priests and air transport by the FAB in case of emergency. The missionaries acted as intermediaries between the state and the Indigenous people, preparing them for a future peaceful coexistence with the non-Indigenous population. Vaccination programmes had been implemented by the Evandro Chagas Institute, among others. Only in the 1980s, FUNAI started working among the Tirió and supplied additional health service.

Divergent opinions exist on the implications of missionary activities with Indigenous people. It is evident that most catholic and protestant missionaries in recent years have been strongly supportive and protective of the Indigenous population and, with the exception of a few fanatical missions with fundamental evangelical credentials, are more involved in social and medical care than in the tradition of converting the Indigenous population to Christianity. Open-minded missionaries inform tribal groups about the dangers of civilisation, economic exploitation, displacement, and diseases. Efforts are being made to conserve and teach Indigenous languages, elaborating rules of grammar, written documents on Indigenous legends and vocal music.[69] In most cases, missionaries have better control over Indigenous contacts with traders, *garimpeiros* and loggers than state agency personnel. Frequently, missionaries disagreed with FUNAI decisions, and they were not well accepted by government agents because of competing interests in serving. The dependence of the Indigenous tribes on the supply of goods, the problem of selling artifacts outside the boundaries of reservations or missions as well as the appropriate and hygienic use of clothes are topics of divergent opinions. Missionaries try to make a peaceful, slow transition into the modern world possible, helping to impede violent conflicts with neighbouring people. For groups of economic interest, they are the most persistent enemies and frequently

67 Cf. Fig. 7.

68 During the visit of the author at Tumucumaque in October 1975, the military personnel had no access to the Indigenous village and the German Franciscan missionaries had an open communication with the tribe members.

69 In the 1940s, the German ecologist Harald Sioli visited the Franciscan mission at the Cururú river, an affluent of Rio Tapajós, and published his detailed observations on the very positive activities of the missionaries in relation with the Mundurukú. Long before SPI agents came to this isolated place, the missionaries were of great importance for the sound and undisturbed existence of these tribes (Sioli 2007).

they live under constant threat. Some missionaries and priests in urban communities had been assassinated because of their long-term intervening on behalf of the Indigenous survival.

In 1973, the Indigenous Missionary Council (CIMI), created by the National Conference of Bishops, tried to develop an Indigenous consciousness in Brazil by encouraging encounters of representatives of the different ethnic groups. The Indigenous problems had an international repercussion and catholic and protestant welfare organisations began supporting autochthonous Indigenous projects.[70] A serious problem was the danger of splitting different ethnic groups through competing missions, which weakened ethnic survivability. Especially difficult was the attitude of evangelical missions concerning methods of catechisation. They rejected the reformulation of the proclamation of the Gospel and activities to improve the social and material needs of the Indigenous people (Prien 1989).

In 1980, the ecumenical meeting in Manaus for Indigenous pastoral care in Amazonia started a revival in respecting Indigenous culture, ethnic identity, their right of self-determination and to live on their traditional territories prescribed by law. The reality of the last decades concerning "integration" and "acculturation" clearly demonstrated the impossibility of planning a rapid integration of Indigenous people into the neo-Brazilian society. Integration was combined with "justified" fighting and violence against tribal groups, "pacification", numerical decimation, relocation, reservations, sometimes forced working conditions, religious conversion, physical and psychological degeneration, and marginalisation (Kohlhepp 1987a, 47–48). The loss of cultural identity, natural religion, language, tribal relations, norms for sustainable living and self-sufficient economy in a traditionally used ecosystem resulted in complete uprooting and demoralisation.

In the 1980s, Indigenous tribes started to stand up, protesting against lacking justice in cases of murder, violence, invasions, and the danger of forced relocation. They occupied local FUNAI office buildings, blocked roads, airstrips of *garimpos* and demanded a reformulation of the Indigenous policy. Some Indigenous tribes intensified political actions and in 1982 a chief of the Xavante became delegate in the Brazilian Parliament.

The situation of the Indigenous population in the decades after the 1980s will be analysed in the mega-project Programa Grande Carajás, the Pilot Programme to conserve the Brazilian rain forests (PPG7) and during the Bolsonaro Government.[71]

3.3. Deforestation and forest reserves until the end of the 1980s

During the 1980s, deforestation of tropical rain forests in Brazilian Amazonia began to increase rapidly. Lowland rain forests are characterized by a multi-storied structure, comprising three or four stories. Primary forests of the moist tropics are characterised by high biological diversity.

70 In Germany an "Ecumenical Committee for Indigenous Affairs" (ÖAI) was created in 1974 and the ecclesiastical relief organizations "Bread for the world," Misereor and Adveniat became important supporters of the Indigenous people worldwide (Prien 1989).

71 Chapters I. 4.2.; 4.5; II. 2.4.4; III. 3.

Large-scale deforestation was realised by groups of woodcutters (organised by logging firms – *empreiteiros* – with 100–150 workers) cutting trunks with axes or power saw or – in large companies – using bulldozers and chains to pull down shallow-rooted trees, burning afterwards hundreds of hectares to get areas for livestock or arable farming. In projects of roadbuilding, mineral extraction, industrial districts, or flooded reservoirs of large hydroelectric power plants, clear-felling is used to remove all the vegetation in one cutting. This is the case when there are only a few commercially valuable species in the forest, making selective felling uneconomic. Parts of large estates, still tree-covered, were taxed at a rate of 3.5 % of their unimproved property value. By using the land, taxes could be greatly reduced. Use in this context means deforestation. It is therefore in the interest of large landowners to completely clear their land up to the permitted percentage of 50 % at that time, even if they have no intention of using it.

The programme for expanding the generation of hydroelectric power, using the natural hydropower potential of the Amazon region, provided for the establishment of numerous power stations and the creation of immense reservoirs. The Tucuruí reservoir, covering 2430 km², had already shown that clearing areas which are later to be flooded is an extremely expensive procedure that is hardly ever profitable. In view of this fact and the relative lack of relief energy in the Amazon Basin, most of the planned reservoirs and the related infrastructural installations will flood large areas of still intact forest. The Balbina reservoir with 2360 km², located in the northeast of Manaus, required 31 times the surface area per MW of installed capacity compared even with Tucuruí (Fearnside 1989a; Kohlhepp *et al*. 1987). In the 1980s, Eletrobrás still had the basic plan to build 79 reservoirs in the Amazônia Legal planning region, with most of the reservoirs located in the tropical forest area. The area flooded was estimated to be almost 100 000 km². Apart from the destruction of the rainforest, the serious ecological consequences and the irreplaceable loss of species and gene pools, this would endanger territories and living space of some Indigenous tribes.[72]

In small-scale agrarian colonisation, peasants fell and burn only some hectares per year, using a primitive shifting-cultivation system on their plots with a restricted area. Before burning, they sell valuable timber to sawmills. Mass migration of settlers into the rain forests of Amazonia – in state or private colonisation projects or spontaneously – caused an extreme expansion of deforestation by accumulation of thousands of deforesting small-holdings, observed in some regions like Rondônia,[73] Mato Grosso or Pará.

With the 50 % clause in the 1980s, Brazilian law stipulated that 50 % of the land must be preserved as forest to avoid uncontrolled clearing. This clause turned out to be a more theoretical rule, controlling was nearly impracticable. By reselling legally owned land, another 50 % of the remaining forest could be cleared and so on, in effect allowing for complete deforestation.

The use of tropical timber and timber production have a long tradition and correspond to the growing demand in industrialised countries. The extent to which a forest is destroyed by logging operations primarily depends on the felling methods. Selective felling is a procedure in which only a few trees of commercial value are removed, in many cases with high logging and transportation costs. Mahogany (*Swietania macro-*

72 Cf. chapter I, 3.2.

73 Cf. chapter I, 2.

phylla) is one of the highly valorised species and preferentially exported. Damage is often caused by logging roads. When only very few trees are extracted per hectare, at least 10 % of the overall forest is destroyed. Tropical hardwoods are principally used in the construction sector for making windows and doors. Timber from tropical forests is used for furniture, in the form of veneers, plywood, as railway ties or in bridge construction. In the 1980s, the reason for using tropical woods was the low price compared with domestic timber species in non-tropical countries.

Only a portion of the stem wood is used. Roughly 50 % of the wood mass of each felled tree is left in the forest to rot because transport is not economical. A high percentage of the fuelwood cut from trees to be burnt is used domestically or in industrial steam engines.

A new wave of destruction of rain forests was associated with charcoal production used in the manufacture of pig iron. Since the start of the Grande Carajás Programme (PGC) in the mid-1980s, the use of iron ore in smelter sites along the Carajás railroad was planned to develop a regional iron and steel industry. There are no pit-coal deposits in Brazil with an adequate high quality for iron and steel production. For financial reasons, no plans to import pit-coal-based coke existed. As it is economically unprofitable to produce pig iron in electric furnaces, the production of charcoal did in fact form the basis for the Brazilian iron industry. In 1986, 36 % of the iron produced in Brazil were based on charcoal use in blast furnaces. In East Amazonia, an area of 15 000 km² was considered necessary for charcoal production. According to Brazilian law, each consumer of charcoal must prepare an afforestation plan which guarantees that 50 % of the need will be met after 10 years. Up to 1987, no one of the pig iron manufacturers had met the target of an own afforestation. Even immediate afforestation carried out for the next 10 years – given the necessary growth period of the trees – the wood will have to be cut from the surrounding rain forests.[74] The wood felling activity increased rapidly, and numerous charcoal kilns arranged in batteries of 10 to 20 units had been built along the highway axes.[75]

Large-scale afforestation in Amazonia with different species was only realised in the Jarí-Project, the felled wood being used for the huge pulp mill installed at the Jarí river.[76]

The *cerradão* transition forests between the *campos cerrados* and the moist tropical forests are especially endangered by fires from pasture preparation in the *cerrado* region. Deforestation fires to clear primary forests through cattle ranching or slash-and-burn agriculture often encroach on standing forests. The vulnerability of the Amazonian rain forests to fires favoured by El Niño droughts and general climate changes with rainfall deficits or changes in the lengthening of the rainy season was increasing sharply. The problem first became apparent in the 1980s.

A high percentage of the occurring deforestation has been and still is illegal. The fundamental problem was the difficulty to control and impose sanctions on illegal deforestation. In the 1980s, the Brazilian Institute of Forest Development (IBDF, created in 1967) was the responsible federal agency until the 1989 creation of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) under the Ministry

74 Cf. IDESP (1987); Kohlhepp *et al.* (1987).

75 Cf. chapters I, 4.2.5 and II, 7.

76 Cf. chapter I, 1.2.5.

of Environment. Both institutions were not sufficiently equipped, and their budget did not cope with the challenges of organising an effective deforestation control of the huge tropical rain forests.

It is important to emphasise that already in 1934, the Forest Code was the first Brazilian forest law on a federal level, distinguishing forests as "protected," "reforested" and "productive." This forest code was motivated more by the demand to regulate logging activities than to protect the forests. Although reafforestation of non-Amazonian rain forests had been propagated in the 1950s and early 1960s ("for every tree felled, two must be planted"), devastation of tropical forests continued. The New Forest Code of the Military Government in 1965 described forests as "goods of public interest," facilitating a flexible interpretation of legal disposition. Owners of private forests outside Amazonia had to protect 20 % of the forest. In Amazonian private properties, deforestation was only allowed up to 50 % of the area. Unfortunately, this ecologically sensible law could be circumvented through repeated sales of parts of the land, allowing almost the entire area to be legally cleared. In Brazil, this strategy was called "mathematics of devastation."

The natural rain forest area[77] of Amazônia Legal amounted to 4.1 million km², i. e., 81.3 % of the planning region's area. Until 1975, only 0.6 % of the rain forests had been cleared. By 1978, the clearing rate had increased to 3.7 %. A very alarming increase in the clear-cutting rate to 9.2 % occurred by 1988.[78] In absolute terms, almost 378 000 km² of Amazonian rain forest have been lost (Table 8). This is more than the area of the Federal Republic of Germany today.

Many scientists[79] had pointed out the high rates of increase in deforestation in Amazonia, particularly in some sub-regions of Rondônia, Mato Grosso and Pará and along the major long-distance roads in construction. The high rates of deforestation in Maranhão and Tocantins (in 1988 separated from Goiás) were related to the relatively low proportion of natural rain forests compared to the national area.

A World Bank study (Mahar 1989) heated up the discussion on deforestation. The area of forest cleared was calculated to be 12 % of the total area of Amazônia Legal. The arguments about the deforestation data took on a political dimension when scientific data from INPE (National Space Research Institute) (forest loss: 9.2 %; reference area: natural forest area) were corrected in an official presentation to 5.12 % (reference area: planning region).[80] The sensitivity of the Brazilian government to the issue of deforestation was made clear when President Sarney used the World Bank data as an opportunity to launch a fierce polemic against international "attempts to undermine and influence Brazil's internal affairs." Similar arguments can be observed in the communication of governments until recent years.

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77 Data from: Skole and Tucker (1993, Table 2, 1906); the rain forest area was calculated by IBDF with 3.878 million km² (cf. Kohlhepp 1987a, 63).

78 Data after: INPE (2000) (absolute data of deforestation), author's own calculations of the share of the natural rain forest area. Data 1978 (January), 1988 (April).

79 Among others Sioli (1956; 1973; 1984); Valverde and Freitas (1980); Sternberg (1981); Fearnside (1982; 1986a; 1989b); Morán (1990; 1993); Bremer (1999); Anhuf (2008; 2010).

80 In the end, the numerical INPE value had to be corrected to 7 %, as the cleared areas before 1975 had not been taken into account.

Table 8: Deforestation in the Brazilian Planning Region Amazônia Legal 1975–1988 (% of the natural rain forest area)

Amazon States	Natural rain forest area* (1000 km²)	% of state area	Deforestation** (in %)			up to 1988 (1000 km²)
			1975	1978	1988	
Pará	1183.6	93.8	0.7	4.5	11.1	131.4
Amazonas	1531.1	97.2	0.05	0.1	1.3	19.9
Amapá	137.4	98.4	0.1	0.1	0.6	0.8
Roraima (T)	172.4	76.4	?	0.1	1.6	2.8
Maranhão	145.8	55.7	?	43.8	62.3	90.8
Tocantins[1)]	30.3	10.9	?	10.6	71.2	21.6
Mato Grosso	527.6	58.6	1,1	3.8	13.6	71.8
Rondônia	212.2	89.1	0.3	2.0	14.1	29.9
Acre	152.4	99.7	0.8	1.6	5.8	8.8
Amazônia Legal	**4092.8**	**81.3**	**0.6**	**3.7**	**9.2**	**377.8**

1) Tocatins 1988; = Goiás (northern part) 1975, 1978

*) Data after: Skole and Tucker (1993, 1906, Table 2)

**) Data after: INPE, 2000 (absolute data of deforestation); calculation of % of natural rain forest area: G. Kohlhepp. Data: 1978 (January), 1988 (April)

Source: Kohlhepp (1998a, 54, Table 1).

Notwithstanding the methodological difficulties in interpreting satellite imagery and attempts to exert political influence on published data on deforestation, it was evident that deforestation increased almost exponentially in the 1980s. Repeated demands to put a stop to the deforestation activity in Amazonia remained unsuccessful. Preventive measures would be needed to create a framework of practical action: High taxes should be imposed to reduce land speculation; financial incentives for environmentally incompatible development projects should be stopped; compliance with statutory environmental regulations should be more strictly monitored and offenders should be more severely punished. International assistance in form of the Tropical Forestry Action Plan and the new concept of "debt-for-nature swaps" should be considered. However, the international interference in deforestation in Brazil had to be managed extremely cautious to convince governments of the possibility of alternatives to deforestation and of slowing down this devastating process.

Without an effective implementation, **Forest Reserves** are subject to a wide range of threats and invasions. One of the first forest reserves (Forest Reserve Juruena) in Brazilian Amazonia was created in the 1960s between the Juruena and Arinos rivers in Mato Grosso with a statutory area of 1.8 million hectares. But in the years that followed, financial and institutional constraints, as well as access via navigable rivers

and roads, facilitated the illegal activities of colonisation projects, cattle ranches, gold prospectors and tin miners (Kohlhepp 1977a).

In Rondônia, four forest protection areas with a total area of 1.85 million hectares were implemented under the auspices of IBDF. Two "Biological Reserves" did not involve any human interference. In case of the "National Forest" there was a possibility for a limited utilisation, controlled by IBDF (e. g., limited wood-exploration, afforestation, tourism). Limited use was also possible in the "National Park". In all these reserves, invasion problems occurred frequently, especially by a high number of sawmills invading for illegal timber extraction. Control of forest reserves was undertaken by the newly established Forest Police, a peloton of the Military Police of Rondônia. Equipment costs were met by the Polonoroeste programme (Kohlhepp and Coy 1985). Attempts to avoid forest fragmentation on private land by establishing large block reserves to create the minimum areas required for species protection failed due to the lack of protection of forest reserves. The reserves had been misinterpreted by peasants as potential areas for future land use (Coy 1988).

In many other regions, forest reserves in the 1980s existed only on paper.

Indigenous reservations in the Amazon Basin are as effective as uninhabited National Parks in stopping deforestation and forest fires. Preservation of tropical rain forests is of fundamental importance for the Indigenous population in Amazonia, as analysed above. The Indigenous tribes adapted their economic system with hunting, gathering and a highly efficient shifting cultivation to the ecological conditions of the tropical rain forests and their biodiversity. However, Indigenous reservations, which are urgently needed on the pioneer front, must be properly demarcated and their remaining forests protected.

But the Indigenous people were not the only social groups having their living space in rain forest regions. The survival of the autonomous rubber tappers (*seringueiros*) and their families depended on the collection and use of the products native to the forest (fruits, oils, gums, medicinal plants, etc.). They have developed means of ecologically sustainable use. A new concept arose in 1985 in setting up "extractive reserves" (Allegretti 1990), a term for renewable resource use patterns in the tropical rain forests of Amazonia. The concept of reserve areas for extractivism – with renewable forest resources open to economic activities by the traditional local population – was obviously similar to the concept of "Indigenous reservations", which are protected by law for the exclusive use of the respective groups. At the end of the 1980s, the economic feasibility of the extractive reserves was still in question in terms of prices, transport possibilities and market conditions. Doubts remained (Homma 1994) about the future inclination of these groups to stay within this system of traditional economy, when other economic options or alternatives emerge. As will be analysed in chapter II.2., the concept of "extractive reserves" became a new impetus within the International Pilot Programme to Conserve the Brazilian Tropical Rain Forests in the 1990s.

Another group of people who live off the products of the tropical forests are the collectors of the edible fruits of the Brazil nut tree (*Bertholletia excelsa*). The Brazil nut is of high commercial value and put on the market in its trading centre Marabá. Unfor-

tunately, Brazil nut trees, under the largest trees in the Amazon forests with up to 50 m, have been felled for charcoal production in the Grande Carajás Programme.[81]

Deforestation consequences became better known by an intensifying scientific discussion in the 1970s and 1980s.[82] In tropical rain forest ecosystems, a large part of the important nutrients is stored in the vegetation. Three quarters of the carbon are contained in the biomass itself and only a small part of the nutrients in the soil. The ecosystems can maintain themselves even on nutrient-poor soils, since the nutrients circulate in a self-contained system that is well adapted, preventing their loss by soil fungi (*mycorrhizae*). The breakdown of the highly complicated and susceptible ecosystems of tropical rain forests is caused by the destruction of the closed nutrient cycle by slash-and-burn methods of deforestation. Widespread deforestation has had disastrous effects on the loss of genetic diversity, nutrient leaching, decomposition of organic matter, soil degradation and erosion. Humus only accumulates in the topsoil. Ferralitic, strongly weathered and leached soils predominate in the tropics and have one of the lowest storage capacities for nutrients of all soil types. It became clear, that agricultural activities on Amazonian *terra firme* soils will be ecologically limited. Weischet (1980) called this the "ecological handicap" of the inner tropics. Only shifting cultivation methods of small Indigenous groups, tested over a long period, turned out to be adapted to the ecological conditions in Amazonia. They only caused "needle pricks" (Sioli 1983) in the tropical rain forests and worked the slowly regenerating areas only after decades.

In the Amazonian rain forests, about 20% of the earth's carbon in living biomass is sequestered. Deforestation means high CO_2 emissions contributing to an increase in temperature, a "greenhouse effect" and the problem of regional and global climate change. The dangers of increasing temperature, regional variability of rainfall, changes in the hydrological cycle and problems of dryness – combined with the danger of additional forest fires – were discussed on a scientific level already in the 1980s, but not appreciated by planners and Brazilian politicians. One of the fundamental problems is that many of the effects of climate change impact in ecological systems only are detectable after irreversible processes have been set in motion (Fearnside 1985, 88). The popular discussion about the function of tropical rain forests for the world's oxygen supply as the "lung of the world" was a misinterpretation in a popular periodical in Brazil of an interview of Harald Sioli.[83]

81 See chapter I, 4.2.5; Deforestation of Brazil nut trees was denied officially but could be proved during field work of the author in the region in 1986.

82 Among many others: Sioli (1973; 1983), Salati (1979), Weischet (1980; 1981), Fearnside (1982; 1985), Bremer (1999).

83 Personal communication of Harald Sioli to the author; Sioli (1983), Fearnside (1985), Kohlhepp (1989b). See chapter III.2. in this publication.