Chapter 33
The Transamazon Highway: Past, Present, Future

Robert Walker, Stephen Perz, Eugenio Arima, and Cynthia Simmons

33.1 Introduction

The geography of Brazil has long constrained its economic development and physical expansion. A coastal range rising in many places to 1,000 m (3,281 ft) stymied its westward expansion off the Atlantic seaboard for centuries, a barrier that was only overcome in the 20th century with the penetration of the interior first by railroad, then by highway (Pfaff et al., 2009). The truck and automobile made possible an efficient terrestrial linkage with the far reaches of the country, especially the north, a region that for centuries remained an autarchic backwater, with closer relations to the European continent than the heartlands of São Paulo and Rio de Janeiro in the south (Weinstein, 1983). Thus, the creation of modern Brazil was in many respects made possible by its highways, and the movement of capital and labor across the coastal ranges to the vast resources of the interior, natural riches that helped create the wealthy nation we know today.

This chapter considers the most recent phase in the evolution of Brazil's spatial economy, namely the penetration of its northern region, which encompasses Amazônia. The opening of Amazônia was driven in large part by the construction and improvement of federal highways in a series of megaprojects that continue to this day (Walker, Diniz, Caldas, & Chermont, 2008). We focus our attention on the most famous of these, the so-called Transamazon Highway, which forms part of BR-230 in the official highway nomenclature of Brazil. Planned in the 1960s, the Transamazon Highway was inaugurated on 30 August 1972, perhaps the most notable consequence of the federal government's strategy at the time to link isolated Amazônia with the Brazilian homeland to the east and south. Originally planned as a corridor connecting, via asphalt surface, north and northeast Brazil with Colombia, today's Transamazon Highway stretches about 2,900 km (1,800 mi) to the west from its Amazonian starting-point in Maranhão, ending without pavement in Lábrea, a small town in Amazonas State just west of BR-319, the ground connection between

R. Walker (✉)
Department of Geography, Michigan State University, East Lansing, MI 48824, USA
e-mail: rwalker@msu.edu

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Fig. 33.1 The extent of BR-230

Porto Velho in Rondônia and the industrial capital of the basin, Manaus (Sant'Anna, 1998). Much of the highway remains as when it was first built, unpaved and impassable during the rainy season. Nevertheless, its thoroughfare has decisively cut open the Amazon forest to the south of the river, forever changing the cultural landscape of both Brazil and the region it made accessible to the world (Fig. 33.1).

This chapter focuses attention on the historical dimensions of the Transamazon project, and on environmental, cultural, and economic impacts arising in the aftermath of its inauguration in the early 1970s. Since then, extension and improvement of the Transamazon Highway has proceeded in fits and starts, slowing to a stop through the difficult and inflationary 1980s, but continuing with the economic recovery in the mid to late 1990s, with large projects currently underway to pave large stretches of dirt and gravel surface. Thus, although what we discuss refers largely to a work in progress, enough time has passed since its initiation that we can provide at least a partial assessment of the road's legacy, both the good and the bad.

We start by considering the Brazilian Highway system in order to establish a working terminology and context for the text that follows. After this comes a discussion of the highway's implementation, which was part and parcel of government initiatives starting in the mid-1960s to develop Amazônia and connect it to the rest of Brazil. We consider both the grand colonization schemes envisioned to accompany and validate the highway's construction, as well as the hard grinding reality of what the colonists faced, and overcame, to take advantage of government investment. Next comes an accounting of the many impacts that have been engendered by the Transamazon project, not the least of which has been the opening of the heart of the world's largest closed tropical forest to agriculture, its most controversial, and valuable, consequence. We conclude the chapter with a brief consideration of

the policy environment affecting present-day Amazônia, and with a call to strike a balance between the region's development and its long-run conservation.

33.2 Roads in the Amazon

33.2.1 Nomenclature

The Transamazon Highway is part of a well-articulated system of Brazilian highways possessing two nomenclatures of interest to the present chapter, one associated with the *Instituto Brasileiro de Geografia e Estatística*, or IBGE, and the other, with the *Ministério dos Transportes*. We also consider an academic distinction between *official* and *unofficial* roads that has been adopted by researchers studying Amazonian development; this distinction sheds light on the spatial processes of road-building and the patterns of forest fragmentation that result. IBGE identifies the highway system with a jurisdictional hierarchy distinguishing federal, state, and municipal roads, which is completely analogous to the federal (i.e., interstate), state, and county breakdowns of the road transportation system in the U.S. Alternatively, the naming convention of the *Ministério dos Transportes* focuses strictly on the federal system and elaborates a typology reflecting the geography of Brazil. Thus, both the IBGE and *Ministério dos Transportes* nomenclatures refer to so-called, *official* roads, those built by some level of Brazilian government, and maintained as such.

33.2.2 Official Versus Unofficial Roads

Discussions of the Amazonian road network would be incomplete, and misleading, without consideration of roads that federal bureaucracies overlook, although with some exception, as will be discussed momentarily. These are the so-called *unofficial* roads implemented by private citizens (Brandão & Souza, 2006; Perz et al., 2005; Perz, Caldas, Arima, & Walker, 2007; Perz, Overdevest, Caldas, Walker, & Arima, 2007). *Official* roads, be they federal, state, or municipal, are typically built in the interest of regional development or local traffic circulation. They may be paved or not, but tend to be maintained with some regularity. In contrast, *unofficial* roads are constructed mainly by private citizens seeking to expand local transportation services to exploit resources (Perz, Caldas, et al., 2007; Perz, Overdevest et al., 2007). They are less likely to be paved than *official* roads, and maintenance is haphazard, particularly outside of urban settlements. Distinctions between official and unofficial roads can be difficult to make. In areas of colonization, private citizens frequently take it upon themselves to build roads to provide a better means to transport their agricultural products or logs to market, but they may do so with the active participation of municipal government. Should the road emerge as important to the community's or region's transportation network, it may be absorbed by the government system, becoming an official road at the municipal, state, or even federal level.[1]

Table 33.1 Build-up of the official highway system in Amazonia

	Federal	State
1968	400	0
1975	17,504	13,276
1981	18,672	31,044 (1985)
1999	19,223	37,410

Paved and Unpaved components of system. To create the data, a digital road data (1993) was obtained from Departamento de Geografia, Universidade Federal Fluminense, Campos Praia, Vermelha, Niteroi, Brazil. The 1993 digital map included road jurisdiction and type, and was used to created digital maps, determining attributes from paper maps (1987, 1975, 1981) from the Diretoria de Planejamento, Department Nacional De Estradas De Rodagem, Ministerio Dos Transportes, Republica Federativa Do Brazil. A second digital map for 1999 was later obtained in 2004 with more accurate geometry. The digital files from this map were used to revise the earlier years

Although the federal and state components of Brazil's official road system have expanded in Amazônia over the past few decades, from 400 km (249 mi) in 1968, to 56,635 km (35,191 mi) in 1999 (Table 33.1), this is overshadowed by growth of the unofficial system. For example, in central Pará State, federal and state roads account for 3,616 km (2,247 mi), while the unofficial network reaches 57,896 km (35,975 mi) (Brandão & Souza, 2006). These numbers translate into a much higher network density for *unofficial* roads, as has been demonstrated by Arima, Walker, Perz, and Caldas (2005) in the vicinity of the Transamazon Highway (BR-230), where the unofficial density (0.062 km/km^2) is an order of magnitude greater than the federal and state infrastructure (0.004 km/km^2). The growth of this *unofficial* road system is one of the significant impacts of the Transamazon Highway.

33.2.3 BR-230

As indicated, the *Ministério dos Transportes* nomenclature focuses strictly on the federal system. As such it reflects objectives of developing the economy at the national level.[2] Ground transportation in Brazil has presented a number of spatial challenges resolved by the establishment of a federal system comprising (1) a radial network centered on the capital, Brasília; (2) north-south linkages connecting the southern core with the northern periphery; (3) corridors from the coastal plain across the mountains into the *planalto* of central Brazil and the Amazon Basin; and (4) diagonal pathways from the heartland of São Paulo and Rio de Janeiro to the north and west, seeking continental integration and access to the Pacific. Each of these spatial challenges is met by a specific type of federal highway, identified as radial, longitudinal, lateral, and diagonal, respectively. The parallel numbering scheme is 0, 1, 2, and 3. Thus, a federal highway designated as BR-0** indicates

Fig. 33.2 Transamazon highway road sign

an arbitrary radial highway in the system; the acronym, BR, identifies the road as federal. As for the Transamazon Highway, the *Ministério dos Transportes* identifier is BR-230 (Fig. 33.2), in which case the Transamazon is immediately recognizable as a lateral road connecting the Amazon Basin to the coastal plain to the east. The component of the identifier represented by "30" refers to spatial ranking from a northerly to southerly orientation, with the number increasing toward the south.

Another east–west corridor was envisioned for Amazônia, BR-210, or *Perimetral Norte*, a road meant to parallel the Transamazon Highway to the north of the river. This highway would connect Macapá, the capital of Amapá state across the mouth of the Amazon from Belém, to the Colombian border. In so doing, it would make accessible the hidden riches of the region, and facilitate commerce with Brazil's northern neighbors, Venezuela, Suriname, and Guyana. Although early efforts succeeded in opening certain components of this corridor, its implementation has largely stalled, and still remains on the drawing board for a future date (Sant'Anna, 1998). The government's present day attention has focused on completing other projects, as promulgated by planning administrations of both President Henrique Cardoso and Lula da Silva. Of these, improvements of the so-called Soy Highway (The Santarém-Cuiabá, BR-163) and the road it crosses in the heart of Amazônia, namely the Transamazon Highway, are of top priority.

33.3 Building the Transamazon Highway

33.3.1 Long-Term Objectives and Strategy

The campaign to build Brazil's road system is the outcome of a long term development project starting in the middle of the 20th century, with the strategic move of the

nation's capital to Brasília, off the coastal plain where Brazilian society had developed for centuries, leaving the vast center of the country almost empty (Pfaff et al., 2009). Thus, the push to integrate Amazônia via transportation corridors shows significant continuity with the long term process of Brazil's spatial evolution from a coastal nation to a transcontinental power. Indeed, Brazilian society, politicians, and strategic thinkers had long hoped to connect southern agriculture to northern trade outlets, which transportation investments under federal administrations of the 1960s and 1970s ultimately accomplished (Valverde & Dias, 1967; Walker, Browder et al., 2009). In pursuing this historic goal, President Juscelino Kubitschek (1956–1961) initiated the Belém-Brasília Highway, linking the new capital of Brazil with the de facto capital of Amazônia. Following this, successive regimes, most notably that of the military government, laid down a network designed to traverse the region from east to west, and to connect its various components by direct ground linkage to the economic core in the south of the country.

Figure 33.3 shows Amazônia's current network of federal roads, and reveals the spatial logic of the government planners of the 1960s and 1970s. Specifically, the network reveals linear edges connecting nodes defined by pre-existing settlements. These edges, each one associated with a federal highway, were laid in very long segments running hundreds of miles between the settlements, serving as so-called *pontos de ajuda*, or "points of help," for construction crews and the storage of road building equipment during the rainy season (Hébette et al., 2002). The main

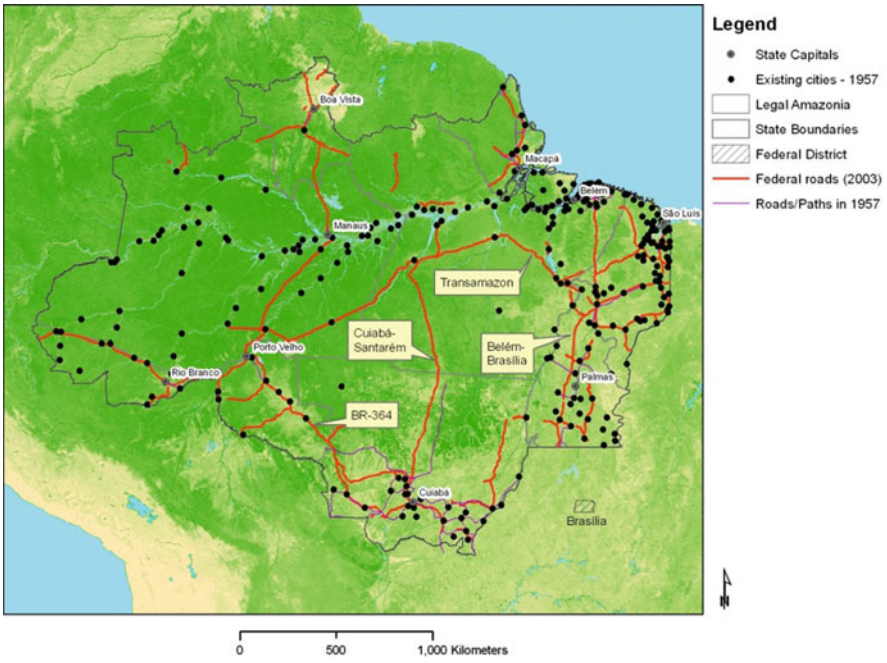

Fig. 33.3 The federal highway network in Amazonas

elements of the federal system show only one significant detour from the straight-line network as described. This detour, along the Transamazon Highway in the State of Amazonas, carried the road south in an obtuse angle from its eastern and western extensions, evidently to avoid an extensive area of wetlands on the southern flank of the Madeira River, below the towns of Manicoré and Novo Aripuanã. The Transamazon Highway, the subject of the present chapter, links up the northeastern part of the country, historically poor and subject to drought, to the development frontiers of Amazônia. Its specific construction geometry carried it point by point across the basin, touching old settlements located on five major southern tributaries of the Amazon River, the Tocantins, the Xingu, the Tapajos, the Madeira, and the purus rivers. These towns, Marabá, Altamira, Itaituba, Humaitá, and Lábrea, respectively, had emerged long before near rapids or at river confluences (Fig. 33.4) which gave them locational advantages with respect to the region's early economy based on the extraction of forest products.

33.3.2 The Development Initiatives

The immediate history of the Transamazon Highway is intimately bound up with development plans executed by the military government that took power by force in 1964, ousting President João Goulart. Efforts here start with *Operation Amazônia,* comprising government actions and laws passed in 1966 and 1967 in order to pursue both economic and geopolitical objectives relative to Amazonia. Notable among these was the creation, in 1966, of the *Superintendência do Desenvolvimento da Amazônia*, or SUDAM, which functioned as a disperser of credit subsidies and a clearing house for investment projects in the north (Kleinpenning, 1977). During

Fig. 33.4 Port of Altamira on Xingu river

its checkered history, SUDAM provided funds to many dubious projects that did little to develop Amazonia, but contributed mightily to its initial deforestation (e.g., Hecht, 1985). Such subsidies to capital, begun under the military regime, have continued to this day under a variety of programs, forming one of the foundations of the region's development.

The ostensible rationale for *Operation Amazônia*, as articulated by the generals in charge, was to bring a "people without land, to a land without people," although commentators have called attention to the government's strategic desires to secure its empty borderlands and enhance its bureaucratic prestige (Kleinpenning, 1977; Smith, 1982). Another contributing factor was populist unrest that had been suppressed following the ouster of President Goulart. Some of the most radical sectors of Amazonian society at the time, the Peasant Leagues aligned with the Brazilian Communist Party, were particularly active in the Northeast, and had undertaken a program of direct action expropriation of large holdings. Agrarian unrest gave impetus to the military's seizure of power, and its early interest in opening Amazônia to Brazil's rural poor via colonization. Once power had been secured, however, the regime brutally suppressed any stirrings of resistance. In Amazonia, a group students and intellectuals from the south initiated a campaign of Marxist insurgency in the early 1970s, near the eastern terminus of the newly constructed Transamazon Highway. The army deployed about 20,000 troops to engage the 60–70 would-be revolutionaries, killing all but a few (Simmons, Walker, Arima, Aldrich, Caldas, 2007).

As a background motivation to *Operation Amazonia*, construction and completion of the Belém-Brasília Highway (BR-010) had sparked mass migration of about two million spontaneous colonists, who settled at roadside, built towns, and introduced a cattle economy, thereby promoting development at very low cost (Moran, 1983; Valverde & Dias, 1967). Work on this highway began shortly after the formation of a commission in 1956, tasked with establishing a ground connection linking the two cities within a ten year period (Hébette & Marin, 2004). Although the roadbed was opened in 1960, an all-weather asphalt surface did not completely connect Belém with Brasília until 1973. The highway was inaugurated on 13 January 1974, a bureaucratic irony given the Transamazon Highway, whose development it made possible, had already been christened (Hébette & Marin, 2004).

Operation Amazônia first favored the lower Amazon basin, but created a free trade zone in Manaus in 1967 in order to disperse its efforts spatially. The momentum of *Operation Amazônia* continued building under the *First National Development Plan* (1972–1974) via tax exemptions and credit subsidies which attracted capital to the region and stimulated colonization (Browder, 1988a; Hall, 1987, 1989; Mahar, 1979; de Santana et al., 1997). The occupation of the arc of deforestation, particularly in northern Mato Grosso and Southeastern Pará State, was largely stimulated by these fiscal incentives, although entrepreneurs from the south had been preparing long in advance for the ultimate opening of the region (Fernandes, 1999). Key to the prospects of *Operation Amazônia's* success, and the generals' plans for Brazil, was implementation of the Transamazon Highway, promulgated under the *National Integration Plan* (PIN) of 1970, which predated

then complemented the *First National Development Plan*. Ostensibly conceived in response to humanitarian concerns stemming from drought in northeastern Brazil, PIN elaborated an extensive colonization program, in addition to the construction of a highway, and, therefore, in contrast to the Belém-Brasília project, which had built a highway and nothing more. The colonization program was grandiose in its intention to settle 100,000 families between 1972 and 1976, and possibly as many as 1,000,000 within the first ten years of implementation (Hamelin, 1991; Kleinpenning, 1977). A population of 100,000 families would have been equivalent to about half a million individuals, assuming an average family size of five. Thus, PIN's demographic impact even as planned was small when compared to the number of poor and landless peasants in Brazil in the early 1970s (Wagley, 1974).

As shown in Fig. 33.1, BR-230 is ultimately planned to link João Pessoa in the State of Ceará with Benjamin Constant on the border with Colombia. However, by the term "Transamazon Highway" we only refer to that part traversing Amazônia, starting in the town Estreito on the Tocantins River, in the southwestern part of Maranhão State, and trailing west to Lábrea.[3] Indeed, to the east of Estreito, Brazil rapidly desiccates into the sorrows of the dry *caatingas*, which are nearly dessert and provide for a hardscrabble rural existence. The Transamazon portion of BR-230 was built in two stages starting in 1970, and funded in part by the World and the Inter-American Development Banks with about US$ 400 million (Kleinpenning, 1977; King & McCarthy, 2005; Sant'Anna, 1998). The first stage, linking Estreito with Itaituba, in Pará, was completed by September 1972; this was followed a year and a half later (March 1974) by the link from Itaituba to Humaitá, in Amazonas (Kleinpenning, 1977; Sant'Anna, 1998).[4] Several large Brazilian multinationals did the work, and the labor force numbering into the hundreds of men crowded in makeshift camps along the construction route (Moran, 1981; Velho, 1981). Some of these workers were skilled employees of the corporations who operated equipment and received reasonable compensation (Smith, 1982). Others, particularly the men who cleared the forest in advance of road construction, were local contract workers from the region and the northeast, who suffered low wages, tropical diseases, and grueling labor (Smith, 1982).

Most of the right-of-way cut through lands that the federal government had appropriated from the State of Pará; specifically, the generals declared 100 km (62 mi) on either side of the planned road as a federal domain for colonization and agro-industrial development (Moran, 1981). When completed, construction costs for the Transamazon were reported at US$ 53,710 per km, yielding a total cost for 2,900 km of US$ 156 million. Applying a deflator to translate 1972 US$ into current ones, the total cost from Estreito to Humaitá calculates at about US$ 700 million.

33.3.3 PIN and the Transamazon Highway

As already indicated, PIN called for an extensive colonization project, to be realized by the development of settlements, or *Projetos Integrados de Colonização*

(PICs). These would accommodate mostly poor farmers and landless individuals, but also more highly capitalized interests dedicated to agro-industrial development. Although implemented in both the States of Pará and Rondônia, the first test came in Pará, where the PICs formed geographic spaces that mapped the right-of-way of the Transamazon Highway (Kleinpenning, 1977; Moran, 1981; Smith, 1982). The PICs planned and implemented in the lower basin, with varying degrees of success, were PIC-Marabá, PIC-Altamira, and PIC-Itaituba (Moran, 1981). Once promulgated and set in motion, they proved to be monumental undertakings for the federal government, involving the coordination of highway construction with settlement policy, against a background vision of developing an agrarian society of explicitly spatial order, inspired by central place theory and a cadastral geometry that ultimately gave rise to the so-called fishbone pattern of deforestation.

As planned, the Transamazon Highway would be oriented, roughly, on an east-west transect. Settlement roads (or *travessões*) (Fig. 33.5) would sprout every 5 km (3.1 mi) and run about 10 km (6.2 mi) north and south, providing property boundaries for 100 ha (247 acre) lots. These lots were surveyed as 500 × 2,000 m (1,640 × 6,562 ft) properties along the main axis of the Transamazon Highway, aligned

Fig. 33.5 Travessão or settlement road

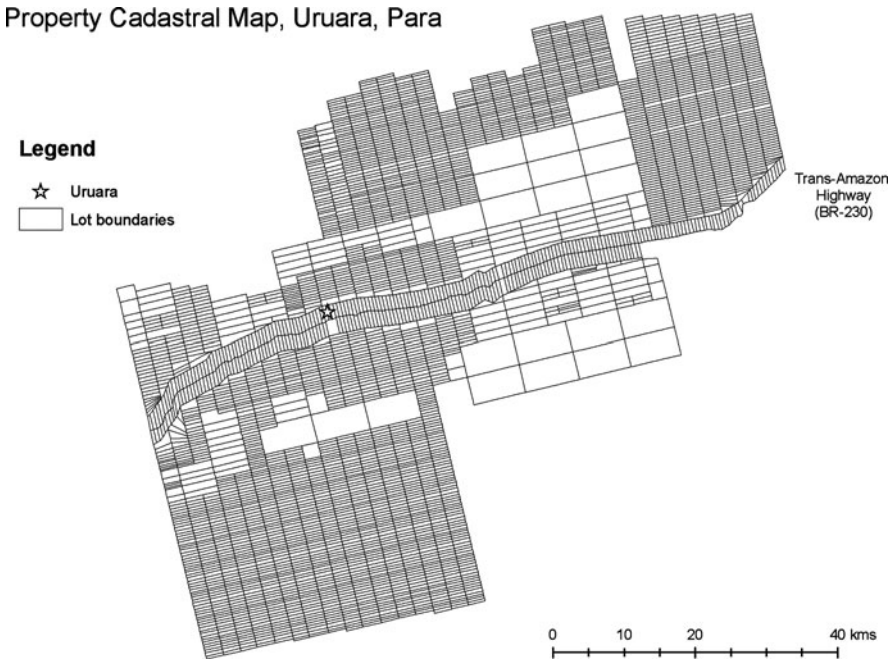

Fig. 33.6 The cadastral geometry of Transamazonia colonization

vertically above and below it. Back from the highway in the strips of land, or *glebas*, stretched between the settlement roads, the 100 ha (247 acre) lots, in 450 × 2,500 m (1,476 × 8,202 ft) rectangles, lay horizontally with shared back boundaries. Figure 33.6 reproduces the original cadastral planning map for an area of colonization west of Altamira, near the town of Uruará (Fig. 33.7).

A critical component of the land occupation plan was a hierarchy of central places involving the *agrovila*, the *agropolis*, and the *ruropolis*. These were meant to be urban centers of increasing complexity that would deliver an increasingly sophisticated array of services to colonist populations. The *agrovila*, the smallest of these central places, would be situated one per *gleba*, and provide basic services to the approximately 50 families (48–62) expected to settle in its vicinity (Kleinpenning, 1977; Smith, 1982). One rung up the urban hierarchy, the *agropolis* was conceived as a small town of perhaps 300 families, providing marketing and storage facilities for 22 *agrovilas* (Moran, 1981; Smith, 1982). Here would also be found restaurants, government offices, sawmills, and small-scale manufacturing (Moran, 1981). Finally, a *ruropolis* would crown the spatial configuration as a development pole. Planners conceived the *ruropolis* as home to about 1,000 families, and a true urban center, with high order government and financial services, rural industries, and infrastructure, even motels (Moran, 1981). As it turns out, these plans were ultimately developed only for the section of the Transamazon Highway west of Altamira to about 120 km (74.5 mi), given the riches of the soils there, and an

Fig. 33.7 Town of Uruara

early surge in population. Thus, as of 1971, the government intended to build 66 *agrovilas* and 3 *agropolis*, with one *ruropolis* emerging later, but farther west at the intersection of the Transamazon (BR-230) with the Santarém-Cuiabá (BR-163) Highway. As for the other lands of the three Transamazon PICs, the intention was to open them to dispersed settlement (Kleinpenning, 1977).

The PIC program was initiated by a national campaign offering attractive incentives that could hardly be neglected by Brazil's rural masses, the majority of whom were poor, if not living in outright poverty (Moran, 1981). For those who responded to the call, there was land, most importantly, the demarcated 100 ha (40 acre) lots for individual households that have just been discussed. Further, to let families secure a precarious foothold in the forest, the government provided six months of salary, at minimum wage, and cheap credit, payable at 7% interest (Moran, 1983). Beyond these financial essentials, the government provided price supports for rice, and even built houses, at least in the beginning.

33.3.4 Early Aftermath of Highway Construction and Colonization

Although the government offered generous support at the outset, more colonists arrived than could be accommodated, and many new arrivals went needy. They had left difficult lives, mostly in the northeastern part of the country, famous for its droughts and rural hardship. Many of the migrants, ostensibly from the southern part of the country had, in fact, begun their lives in the northeast, having first gone south for relief from poverty before heeding the government's call to conquer the Amazon (Hébette, Alves, & Quintela, 2002; Moran, 1981; Velho, 1981). The problems the colonists faced at the outset were soon compounded by poor government planning.[5]

To make matters worse, government policies shifted away from the populist tilt of the early PIN years. This shift probably had a basis in the *latifundia's* interest in the land bank of Amazônia, and efforts starting in the 1960s to claim large tracts of land, ranging into the hundreds of thousands of hectares, by notable capitalists of the period such as Lunardelli and Lanari (Fernandes, 1999). Thus, in 1975, the PIN program was abandoned to make way for an exclusive focus on agro-industrial ventures. The *Second National Development Plan* (II PND 1975–1979), with its growth pole policy for the region (POLOAMAZÔNIA), was predicated on the role of Amazônia in generating foreign exchange via export-oriented activities such as ranching, timber, and mineral extraction (Browder, 1988b; Hall, 1987, 1989; Mahar, 1979, 1989; de Santana et al., 1997).

The retraction of support for colonization ultimately did not stem the migratory flow, as we shall discuss shortly. But it did allow the government greater fiscal flexibility in the provision of subsidies to the interests of capital, which certainly stimulated market-oriented development along the Transamazon Highway. In fact, the cadastral geometry of PIC colonization provided not only for poor colonists, but also set aside land for the development of properties ranging up to 3,000 ha (7410 acres) starting in 1973 (Kleinpenning, 1977). Many of these large holdings, cleared and dedicated to ranching by the mid-1980s, are still active today, and readily visible on satellite images (Aldrich et al., 2006).

It has often been suggested that colonization under the PIN program was a failure. Indeed, it is hard to argue otherwise, if the intention of the plan was to solve problems of rural insurgency and starvation in the northeast. Even on its own terms, the pace of settlement was slow, and the government did not manage, for whatever reason, to meet its obligations, a fact that surely stemmed some of the response that had been anticipated. As of the mid-1970s, on the order of 6,000 families had come to settle along the Transamazon Highway, with about 1,422 in Marabá by 1975, 3,000 in Altamira by 1977, and 1,450 Itaituba by 1977 (Miller, 1983). Before proceeding, it is important to point out that the "empty" land referred to by the generals had never, in fact, been empty. Amazônia had long sheltered large populations of indigenous peoples, to be discussed in the sequel (Denevan, 1992), and extraction of wild rubber and Brazil nuts had attracted northeasterners to lonely stretches of the Araguaia, Xingu, and Tapajos Rivers by the late 19th century (Velho, 1981). Numbers, of course, were small, and settlement, highly dispersed.[6]

Infertile soils undermined the viability of PICs in both Marabá and Itaituba, and attention soon focused exclusively on Altamira, but only to the west, from 20 to 120 km (12.4 to 74.5 mi) from town (Hamelin, 1991). As for the planned urban hierarchy, only one *agropolis* took root, the town of Brasil Novo found 40 km (24.9 mi) west of Altamira directly on the Transamazon Highway. Although remnant structures of the *agrovilas* can still be seen on several of the *travessões*, those that were built disappeared as functioning units of an urban hierarchy. A single *ruropolis* emerged, Ruropolis Presidente Médici simply known as Ruropolis today.[7] Found at the intersection of BR-163 and BR-230, the town is now starting to grow, not as a service center for a bustling collection of small towns, but as an increasingly

important cross-roads in the emerging agricultural economy of Amazônia (Brown, Koeppe, Coles, & Price, 2005; Jepson, 2005).

The difficulties of development along the Transamazon Highway, and its lazy pace of improvement during the first several decades of its existence, are probably best interpreted not as an outcome of government failure, but as a consequence of broader conditions affecting the Brazilian economy throughout the period. Indeed, as the 1970s faded into the 1980s, the Brazilian economic "miracle" gave way to the looming disasters of high inflation, structural readjustment, and economic recession. Both colonists and large holders found themselves increasingly on their own in their efforts to gain footholds on the frontier. The transition from military to civilian government in 1985 also brought changed attitudes, particularly with respect to cultural and environmental resources (Simmons, 2002). Amazônia, once a wilderness to be conquered and subdued, was increasingly seen as a reservoir of cultural and ecological treasures, a viewpoint that altered policy in the region, and put brakes on development that were only intensified with the hyper-inflationary period of the early to mid-1990s, before the success of the new monetary policy of the *Plano Real*.

Figure 33.8 demonstrates the timing of expansion and improvement of the Transamazon Highway, starting shortly after its inception. This figure shows maps covering the so-called "Amazônia Legal," a federal planning unit roughly coterminous with the Amazon basin. They include a portion of BR-230 to the east of Estreito, since a large part of Maranhão States lies within Amazônia Legal. As can be seen, the opening of the Transamazon roadbed was accomplished by 1975. After this, improvements stopped, except for paving east in Maranhão, completed by 1981. The three maps are somewhat deceptive in showing an asphalted segment at the western terminus near Lábrea. In fact, Federal Highway BR-319, linking Porto Velho and Manaus, was paved at the time of construction, in 1972 and 1973 (Fearnside & De Alencastro Graça, 2006). The segment of BR-230 heading west to Lábrea may very well have formed part of the project. In subsequent years, this entire section of the federal network fell into neglect due to low traffic volumes, with BR-319 becoming impassable by 1988 (Fearnside & De Alencastro Graça, 2006). With this in mind, the sequence of maps in Fig. 33.3 reveals the government's retreat from its early development vision and abandonment of the region.

33.3.5 The Transamazon Highway Today

The present chapter acknowledges the grandiose vision of PIN, and the authors have personal experience with old colonists embittered by what the government said it would do, but did not. Frustrations in general have remained high for decades at the Transamazon Highway's lack of paving (Fig. 33.9), and seeming government indifference in providing basic health and educational services throughout the region. That said, recent years have brought renewed government interest, and paving projects along substantial segments of the Highway. As can be seen in Fig. 33.1, the entire stretch of road between Marabá and Altamira is now being

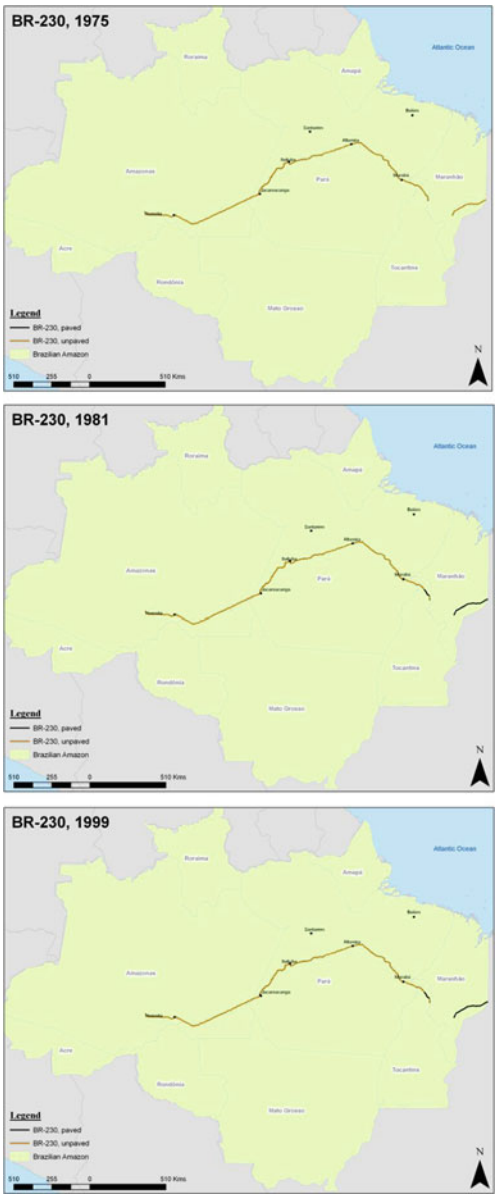

Fig. 33.8 Phase of construction for the Transamazonia highway (*top*) 1975, (*middle*) 1981, (*bottom*) 1999

asphalted. Of course, thousands of kilometers remain, but the pace of improvement has accelerated with the stabilization of the currency in the late 1990s, and a strong Brazilian economy. Government and societal objectives remain unchanged from the military period, with strategic goals of securing international borders and establishing closer economic ties with neighbors to the north and west (Sant'Anna, 1998; Walker, Browder, et al., 2009).

Fig. 33.9 Logging truck on unpaved Transamazonia highway

Further, continental integration via transportation infrastructure has emerged as a grand hemispheric design under the initiative, *Integration of South American Regional Infrastructure* (IIRSA by its Spanish acronym). IIRSA is a discussion forum initiated in 2000 that involves all 12 South American countries in an effort to develop an "intermodal" transport network of rivers and highways. IIRSA has identified 10 terrestrial axes that will link the South American countries in a network of transportation routes by land and by water. Of these, three involve Amazonia, placing Brazil's ecologically sensitive north in a bull's eye of continental infrastructure. The Inter-American Development Bank (IDB), the Andean Finance Corporation (CAF), and the Financial Fund for the Development of the River Plate Basin (FONPLATA) are some of the deep pockets that will broker the tens of billions of dollars needed for IIRSA's plan.[8]

The current economy and population of the Transamazon region show signs of expansion, and the agricultural development envisioned by a long succession of government planners starting with the Kubitschek administration. Table 33.2 presents numbers for both population and size of cattle herd, given cattle

Table 33.2 Cattle herd and population in the Transamazon Corridor, 2007

	Cattle Herd	Population
Amazonas		
Apuí	130,371	17,451
Canutama	13,618	11,463
Humaitá	20,801	38,559
Lábrea	285,519	36,909
Manicoré	56,390	44,327
Maués	22,358	47,020
Novo Aripuanã	11,620	18,196
Para		
Altamira	402,340	92,105
Anapu	280,321	17,787
Brasil Novo	225,866	18,749
Itaituba	174,318	118,194
Itupiranga	290,000	42,002
Jacareacanga	26,789	37,073
Marabá	430,300	196,468
Medicilândia	143,359	22,624
Nova Ipixuna	74,600	14,086
Novo Repartimento	363,456	51,645
Pacajá	256,420	38,365
Placas	59,450	17,898
Rurópolis	117,821	32,950
Senador José Porfírio	60,899	14,302
Trairão	68,497	16,097
Uruará	293,640	35,076
Vitória do Xingu	195,201	9,693
Total	4,003,954	989,039

Source: www.sidra.ibge.gov.br

ranching has become Amazônia's primary agricultural activity, even by small producers. The numbers for Table 33.2 sum the data for all Amazonian counties through which the Transamazon Highway passes (Fig. 33.10), beginning with Marabá, given this was the start-point for the colonization programs. As the table shows, the region's population has climbed to nearly one million people. This number compares favorably to the 100,000 families (Fig. 33.11) that were to come in response to the PIN program in the 1970s, and would have been consistent with a population doubling in about thirty years had the planners been right. Although not an exceptionally high population growth rate (∼2% by the "70 year" rule), it is, nevertheless, respectable.

More striking is the build-up in the cattle herd. In fact, early government planners wished to develop ranching in Amazônia, but their expectations for small-holders were focused on crops like rice and cocoa they thought would be well suited for tropical moist conditions. The cattle economy was to emerge in the southeastern part of Pará State and northern Mato Grosso, near the drier ecotone with the Brazilian savanna known as *cerrado*. Indeed, early capitalists began staking claims

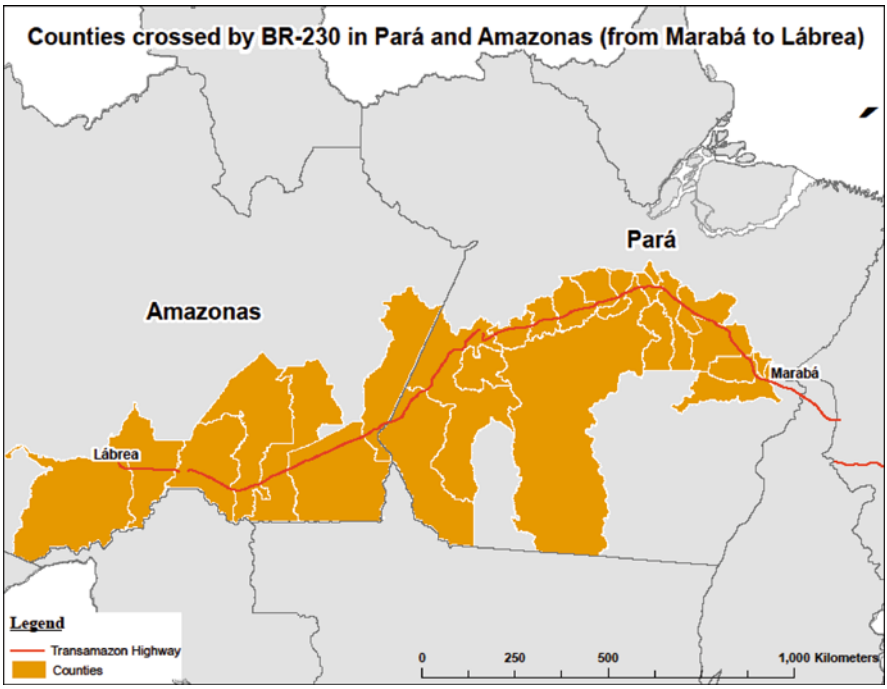

Fig. 33.10 Counties crossed by BR-230 in Pará and Amazonas

Fig. 33.11 Transamazonia colonist family

here with the intention of ranching prior to PIN, prior to the generous subsidies of the early military government, and prior to the paving of the Belém-Brasília Highway (Fernandes, 1999). As of 1973, the agronomic outcome was largely consistent with government expectations, and a grand total of 706 head of cattle grazed in PIC-Altamira, the only colonization area that showed signs of agricultural life. Although a few others may have been scattered across the Transamazon region, their numbers were probably few. Thus, the current herd of about four million animals represents explosive growth.[9] It is a significant portion of Amazônia's herd of 70,000,000 found primarily on the drier margins of the basin in Southeastern Pará, Northern Mato Grosso, and Rondônia (Walker, Browder, et al., 2009).

33.4 Impacts of the Transamazon Highway

33.4.1 Deforestation

The Belém-Brasília Highway (BR-010), important in establishing an early north-south link in Brazil's highway system, passed through the lower basin, but its route traversed primarily areas of *cerrado*. Thus, significant penetration of the closed moist forest did not occur until the construction of BR-364 in Rondônia, BR-163 in Mato Grosso and Pará, BR-319 in Amazonas, and BR-230, the Transamazon Highway, in Pará and Amazonas. Of these, BR-364 and the Transamazon Highway have precipitated the most impact. The Transamazon Highway has captured the public's imagination to a greater degree, perhaps because of its namesake, but also because its considerable length passes entirely through formerly closed moist forest.

Although the Transamazon Highway remains mostly unpaved to this very day, it has succeeded in opening the inner part of the basin and its ecosystems to substantial agricultural impact, as just indicated. Investment in transportation is often seen as critical to efforts at economic development, particularly in developing countries (Owen, 1987; Vance, 1986). Railroads were important to the integration of the U.S. economy in the 19th century, and roads have often been built in frontier settings, to stimulate migration in advance of demand for transportation (Friedmann & Stuckey, 1973). The expansion of the federal highway network in Amazônia is no exception to this model. Although it took time, the region's agricultural economy now makes extensive use of its highways, which have provided some degree of upward mobility for resident populations (Ozório de Almeida, 1992; Perz, 2001; Schneider, 1995).

But Amazônia's agricultural economy, in large part centered on the Transamazon Highway, is a two-edged sword that has brought economic development at considerable expense. Since roads began their steady trek across the region, human populations have risen sharply, reaching about 20 million in the Brazilian portion of the basin alone (Walker, Browder, et al., 2009; Santos, 1980). As part and parcel of this phenomenal growth, over 16% of the 4 million km^2 of the original forest has been transformed, mostly into pastures (Alves, 2007) (Fig. 33.12), with significant consequences for both ecological and cultural resources. That roads are implicated

Fig. 33.12 Pastures where forests once stood

in forest losses in Amazônia is hardly controversial, and has been well documented by econometric research (Anderson, Granger, Reis, Weinhold, & Wunder, 1996; Anderson & Reis, 1997; Pfaff, 1999; Reis & Guzmán, 1994; Reis & Margulis, 1991; Wood & Skole, 1998). Moreover, GIS analysis shows a strong link between the location of roads and the extent of cleared lands in Amazônia, with almost all deforestation occurring within a narrow strip along the region's major roads, including the Transamazon Highway (Laurance et al., 2001; Alves, 2002, 2007). In this chapter we have focused on roads as corridors for the in-migration of colonists, mainly poor farmers who occupy holdings of 100 ha (40 acres) or less, and engage in diversified agriculture that typically includes a small herd of cattle (Walker, 2003). Roads also attract more potent deforestation agents, particularly capitalized ranchers and loggers, whose actions account for the lion's share of forest loss and degradation (Alves, 2002, 2007; Walker, Browder, et al. 2009). In this regard, the Transamazon Highway has functioned as an important logging frontier (Merry et al., 2006), and, as already discussed, is home to large consolidated holdings that show almost complete deforestation over thousands of hectares (Aldrich et al., 2006). Although most deforestation has occurred on the region's southern and eastern margins, all of the large highways like the Transamazon make dramatic slices through the heart of the forest.

33.4.2 Endogenous Road-Building

The deforestation agents attracted to the region are those who build the *unofficial* roads discussed earlier in the chapter. Such roads are linked to the official road

Table 33.3 Unofficial road construction. Transamazon highway

Agent	Total (km)
Federal Government (F.G.)	162
Loggers	153
Mayor	184
Private Company	9
Ranchers	17
Colonists	61
F.G and Colonists	11.5
Mayor and Loggers	157
F.G. and Private Company	10
F.G. and Mayor	35
Unknown	71

system in a positive feedback that drives continuing expansion of the transportation network, with land cover change. Specifically, the Transamazon Highway has opened the region to economic agents who – in seeking profits or simply improved livelihoods – clear land to create agricultural enterprises. Then, in order to make better use of their captured resources, they build new roads on their own account, or in cooperative ventures with other agents, including local politicians. These roads improve productive efficiencies that raise rents and continue attracting economic factors in a cycle that extends the agricultural frontier by its own momentum. As described, *unofficial* roads are endogenous to deforestation, in contrast to exogenous federal roads like the Transamazon Highway, which are imposed from outside by agents of the state, and initiate the cycle of environmental change from its starting point.

The authors have studied the extension of *unofficial* roads between Altamira and Itaituba, in the old colonization region of PIC-Altamira. In 2004 they visited seventeen *travessões* along a 75 km (46.6 mi) stretch of the Transamazon Highway, centered on Uruará, to determine the agents involved in unofficial road construction, and the dynamism of their road building activities. Data presented in Table 33.3 reveal a complex process involving loggers, colonists, ranchers, and other private interests, as well as the mayor and the federal government. Sometimes these agents work alone, but often they form productive alliances. In all, the authors identified 52 separate road building events that began in the early 1970s and added 870 km (541 mi) to the local network.

The town of Uruará was "abandoned" by the federal government before colonization actually got underway, and even the initial opening of many *travessões* was undertaken by local interests (Hamelin, 1991). Consequently, colonization followed the pattern of direct action land reform, spontaneously unfolding in the region independently of federal government support, or intervention (Simmons et al., 2007). Although loggers were heavily involved in road construction, the emergent landscape presently reveals the famous fishbone pattern (Fig. 33.13), given a large population of colonists and their interest in securing property titles. Early road extensions were undertaken to make room for new arrivals, who mimicked the

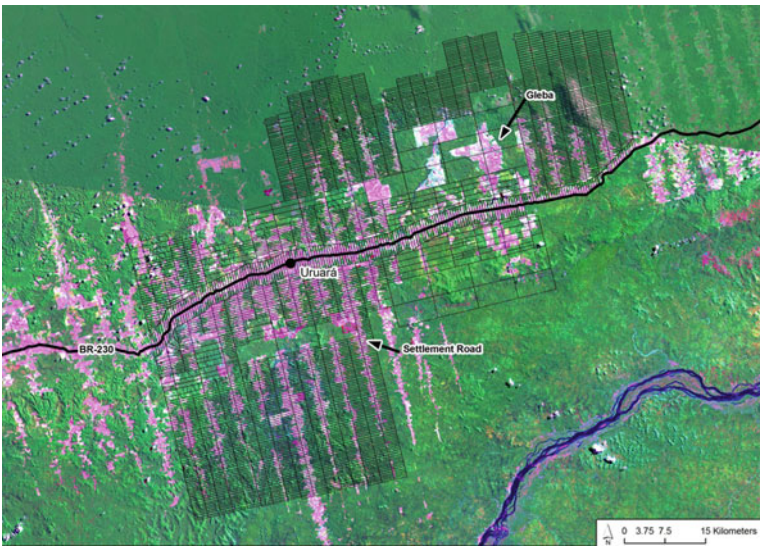

Fig. 33.13 Cadastral geometry and fishbone settlement

cadastral geometry of the original PIC in order to facilitate land claims. In general, the office of the mayor has found ample reason to help the colonists given electoral considerations, and loggers have their own motivations provided by loopholes in the Brazilian law that allow wood to be taken from small holdings without a management plan (Arima et al., 2005). Today, the *travessões* of Uruará run far from the main axis of the Transamazon Highway, to the north and south. The port town of Santarém, over 200 km (124 mi) away, can now be reached by *unofficial* roads, cutting the trip from Uruará via BR230 and BR163 by half a day.

33.4.3 Climate Change

Loss of primary forest along the Transamazon Highway, driven by the interacting process of deforestation and road building just described, has no doubt impacted biodiversity, given the high degree of species endemism of Amazonian forests. The physical nature of the cut, which has opened a strip of agriculture anywhere from a few to 100 (62 mi) wide over most of the road's length, also appears to have impacted local microclimate (Moore, Arima, Walker, & Ramos da Silva, 2007). Experimental simulations with a regional climate model suggest that continued development of the Transamazon Highway corridor will desiccate locations along its route, particularly in the vicinity of Altamira and the intersection with BR-163 near Ruropolis and Itaituba. Desiccation extends the full length of the road west, to its current end point at Lábrea. Of course, the drying-out of Amazônia to a tipping point is a clear and present danger associated with continuing agricultural

development in the region as a whole. Scientists have long speculated that rainfall reductions stemming from an altered hydrometeorology could alter the vegetation-bound cycle of rain that currently supports Amazônia's lush ecology (e.g., Serrão Nepstad, and Walker, 1996). Whether that cycle is now being broken remains a critical, if unresolved, issue (Costa, Botta, & Cardille, 2003; Durieux, Machado, & Laurent, 2003; Marengo, 2004; Negri & Adler, 2004).

33.4.4 Indigenous Peoples

Perhaps the greatest destructive impact of the Transamazon Highway has been the loss of cultural resources stemming from contact between Brazilian society and the indigenous peoples who have called Amazônia home for millennia. Although Amerindians have long populated the basin throughout its vast reaches, the upper and middle Xingu basin, which the Transamazon Highway helped open to Brazil, remained an indigenous refuge until well into the 20th century, largely unaffected by the encroachment of Brazilian civilization that affected all the other major tributaries quite early. Here, fearsome rapids blocked passage south, and kept explorers and exploiters confined to the downstream reaches of the river below Altamira (Schmink & Wood, 1992). Clearly, the Transamazon Highway brought changes, and bloodshed, in a tragedy that spread across Amazônia with the building of the federal system of roads, and with the enthusiasm of colonists and speculators for the lands made accessible, which were often tribal territories.

The first author visited such a tribal area in 2002, about 100 km (62 mi) south of the Transamazon Highway on the Iriri River, a large tributary to the Xingu (*Cachoeira Seco do Iriri*). The Amerindians encountered attested to their bloody confrontations with colonists developing lands off the Transamazon Highway, and their decision, only twelve years previously, to sue for peace, knowing that continued conflict would spell their doom. By the visit in 2002, a FUNAI presence had been established on the reserve, bringing rudimentary medical services and basic education in small shacks, a physical statement of the government's recognition of their indigenous rights. This recognition, however, had not eliminated all conflict. The author witnessed a party of warriors (*guerreiros*) returning from an action against encroaching fishermen, who were exploiting what the Indians claimed were their waters. The action, which involved the destruction of a catch of fish, was in reprisal for the disappearance of one of their own, presumably by murder.

Many indigenous peoples have been put under severe pressure in Amazônia since the 1970s with the massive investments in infrastructure and the energetic response of Brazilian society to settle its tropical frontier. Tribes experiencing the greatest impact are found in more settled parts of the basin, like the Bragantine region between Belém and Maranhão State. Here, groups such as the Tembê find themselves under attack, their lands being taken, their way of life in rapid, unwanted transformation.[10] Elsewhere, the story is different, due to actions by the federal government, and the willingness of the indigenous peoples to defend themselves and their territories. Of critical importance in this regard has been the declaration

of indigenous reserves. Historically, Brazil's policy on indigenous peoples has been to assimilate them. To accomplish this, the Brazilian government created indigenous agencies; the current one, *Fundação Nacional do Índio*, or FUNAI, was put in place in 1967 by the military government. The assimilation policy changed in the wake of democratic reform, particularly with the Constitution of 1988; it gave new directions to the relationship between post-Colombian Brazilian society and Amerindians (Simmons, 2002). Specifically, it proclaimed the sovereignty of native peoples and accelerated the demarcation of 375 indigenous reserves, encompassing about 1 million km^2, a fifth of Brazilian Amazônia. Although the indigenous peoples of present-day Amazonia have experienced hardship and loss owing to their uninvited contact with Brazilians, they have not generally been forced onto reservations far from their homelands, and enlightened policy of recent years has granted them a substantial amount of political autonomy.

The Transamazon Highway passes through, or very close to, a number of these reserves, bringing both advantages and disadvantages to the native peoples who call them home (Fig. 33.14).[11] Although Convention 169 of the International Labor Organization ensures Amerindians the right to the exploit their territorial resources, both Agenda 21 (Rio Summit) and the 1996 Indigenous Lands Project of the G7 Pilot Program to Conserve the Rainforest express an expectation of indigenous environmental stewardship. This expectation is also stated in the Brazilian Forestry Code

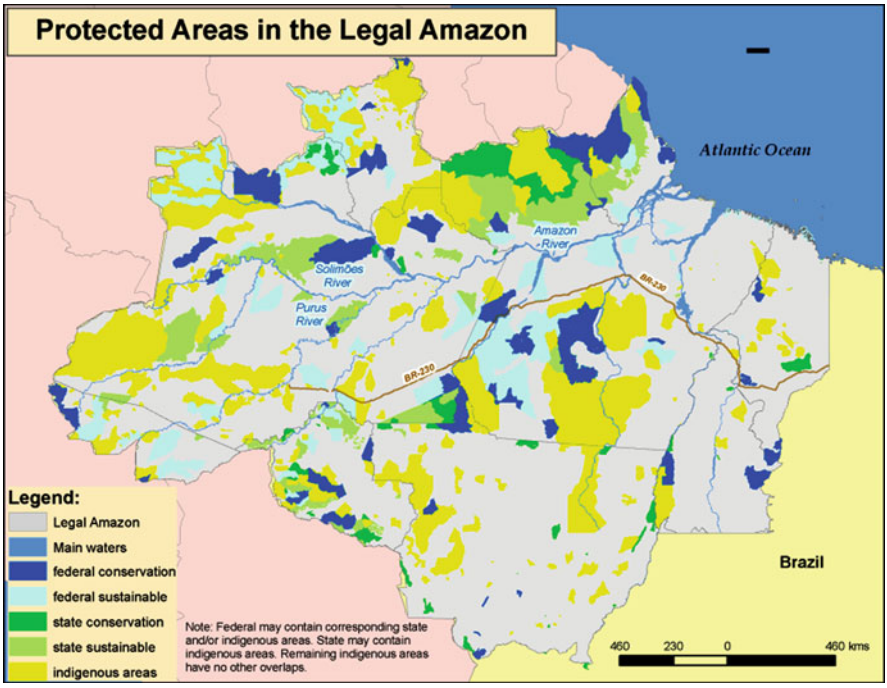

Fig. 33.14 Protected areas in the Brazilian Amazonas

(www.funai.gov.br) and the National Plan for Protected Areas (decree no. 5758, April 13, 2006). Democratic reform, and awareness of the impacts of Amazonian development on its native inhabitants, have shaped policies of cultural conservation that possess significant environmental spillovers (Simmons, 2002).

33.5 Conclusions

The Transamazon Highway was built pursuant to a policy elaborated by Brazil's military regime in 1970, but it fulfilled a long standing vision to develop the country. Democratic administrations have continued to extend and improve what was begun over three decades ago. Although the highway did not achieve the grandiose dreams of those who built it, and although critics have not been shy in describing its impacts on Amazônia's environment and native cultures, the Transamazon Highway is a *fait accompli*, at least the 2,900 km (1,802 mi) that link the relatively dry borderlands of Maranhão, with Lábrea on the Purus River, in the heart of Amazonas state. The genie is out of the bottle.

This chapter has pointed out the good and the bad, and approached the Transamazon Highway as the two-edged sword that it is, bringing development with destruction, in much the same way that the Transcontinental Railroad opened the American West to colonists, forever altering the prairie ecosystems of the plains and the indigenous populations that depended on them. The parallel with North America's frontier has been pointed out before, as has the comparability of Brazil's historic mandate to open Amazônia with the concept of "manifest destiny," an obvious expression of national will to Americans who were drawn west once the railroad had paved the way (Walker, Browder, et al., 2009).

Luckily, there are grounds for hope that Brazil can do a better job than the U.S. in developing its last frontier. With respect to the native peoples of Amazônia, the Brazilian government showed considerable foresight two decades ago when it created the indigenous reserves. Although state support has not always been consistent, the 1988 constitution empowered Amazonian tribes to act as necessary to defend their resources and way of life. A considerable amount of research shows that these long term residents of Amazônia are both willing and capable of resisting the encroachment of loggers, farmers, and ranchers, even when located nearby active settlement frontiers (Deruyttere, 1997; Euler et al., 2008; Ferreira n.d.; Mahar & Ducrot, 1998; Nepstad et al., 2006; Ribeiro, Verissimo, & Pereira, 2005; Schwartzman & Zimmerman, 2005; Zimmerman, Peres, Malcolm, & Turner, 2001).

In addition to the cultural security offered indigenous peoples, Brazil has taken important steps to defend its ecological treasures (Simmons, 2002). Although Brazilian environmental legislation dates back to the early 1930s (Machado, 1995), democratic reform helped defenders of the Amazonian environment have their say. In this regard, the creation of the National System of Nature Conservation Units, or SNUC, has led to the setting aside of about 1.25 million km^2 in the region. This program classifies protected areas, or PAs, into *integral protection* and *sustainable use units*, including parks, biological reserves, ecological stations, natural heritage

reserves, wildlife refuges, national forests, and extractive reserves. Protected areas, both indigenous reserves and components of SNUC, account for close to 40% of the Brazilian Amazon. Thus, laws requiring the maintenance of native forest on private holdings boost the legally mandated minimum forest extent to a rather high number. Regional climate models suggest that the maintenance of protected areas in Amazônia can buffer against a climate tipping point, with its threat of widespread desiccation and conversion of forest to scrub savanna (Walker, Moore et al., 2009).

Whether Brazilian society will honor its self-made pledges remains to be seen. Brazil, a sovereign nation, certainly has a right to develop the resources within its boundaries. Nevertheless, since the 1970s, the exercise of this right in Amazônia, involving mega-projects like the Transamazon Highway, has sparked a vocal response, both within Brazil and beyond its borders. Brazil rightfully observes that the U.S. was free to build its railroads at the cost of native cultures and magnificent ecosystems. Of course, this was done in a less civilized time, before ecology had blossomed as a discipline, before anyone understood the importance of biodiversity, and before the threat of global warming united the world as a citizenry in peril.

As for the Transamazon Highway, the damage has been done, and improvements such as paving are not likely to spark the massive loss of forest observed after its initial opening (Anderson et al., 2002; Pfaff et al., 2007). This qualified statement is based, however, on the assumption that the last leg will not be built out to the border with Colombia, which would necessitate penetration of protected indigenous lands (see Fig. 33.7). Brazil has come of economic age during this past decade, a maturation based in part on agriculture, much of it found in a region that only four decades ago remained mysterious to the world. The Transamazon Highway helped make this hidden region known, and in so doing changed it forever. Brazil and the world community must now work to see that changes from this point forward achieve maximum effect, for both Amazonian residents, be they native or new arrivals, and for future generations who also have a right to an Amazônia that has not been sacrificed on the altar of development.

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Notes

1. For example, BR-421 in Rondônia, which goes from Ariquemes to Guajará-Mirim, was originally had a "picada," or unpaved footpath, dating from the 1960s.

2. See www.transportes.gov.br/bit/br/BRs.htm
3. Amazonia refers to the hydrological basin or to the region at large.
4. Since then, only 180 km (111 mi) have been added, connecting Humaitá with Lábrea, on the Purus River.
5. For example, the government originally intended settlers to live in the agrovilas, not their properties. This posed severe problems in accessing their properties, given they could be many kms distant.
6. The first author undertook an expedition on the Iriri River in 2002, 100 km (62 mi) south of the Transamazon Highway. On the order of fifty families lived along 300 km (186 mi) of the river, mestizo descendents of local Indians and migrants responding to two rubber booms.
7. A second ruropolis, Mirituba, was planned and initially implemented at a location near Itaituba (Kleinpenning, 1977). It has largely been absorbed by Itaituba.
8. See www.iirsa.org/acercadeiirsa.asp?CodIdioma=ESP
9. The comparison areas are not exact. Marabá certainly had a few cattle by 1973, but at that time the county was much larger and included nearly half of all lands in the so-called South of Para; since then, it has been partitioned on several occasions to a relatively small size, as given in Fig. 33.5 (Simmons et al., 2007).
10. The lead author visited the Tembê reserve in the mid-1990s, and visited the indigenous lands on invitation by a leader of Brazilian settlers engaged in a territorial incursion.
11. The Transamazon Highway crosses very closely by reserves for many tribal peoples, including the Apinayes, Parakana, Koatinemo, Kararo, Arara, Caitutu, Pirahã, Tenharim, and Mundurucu.

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