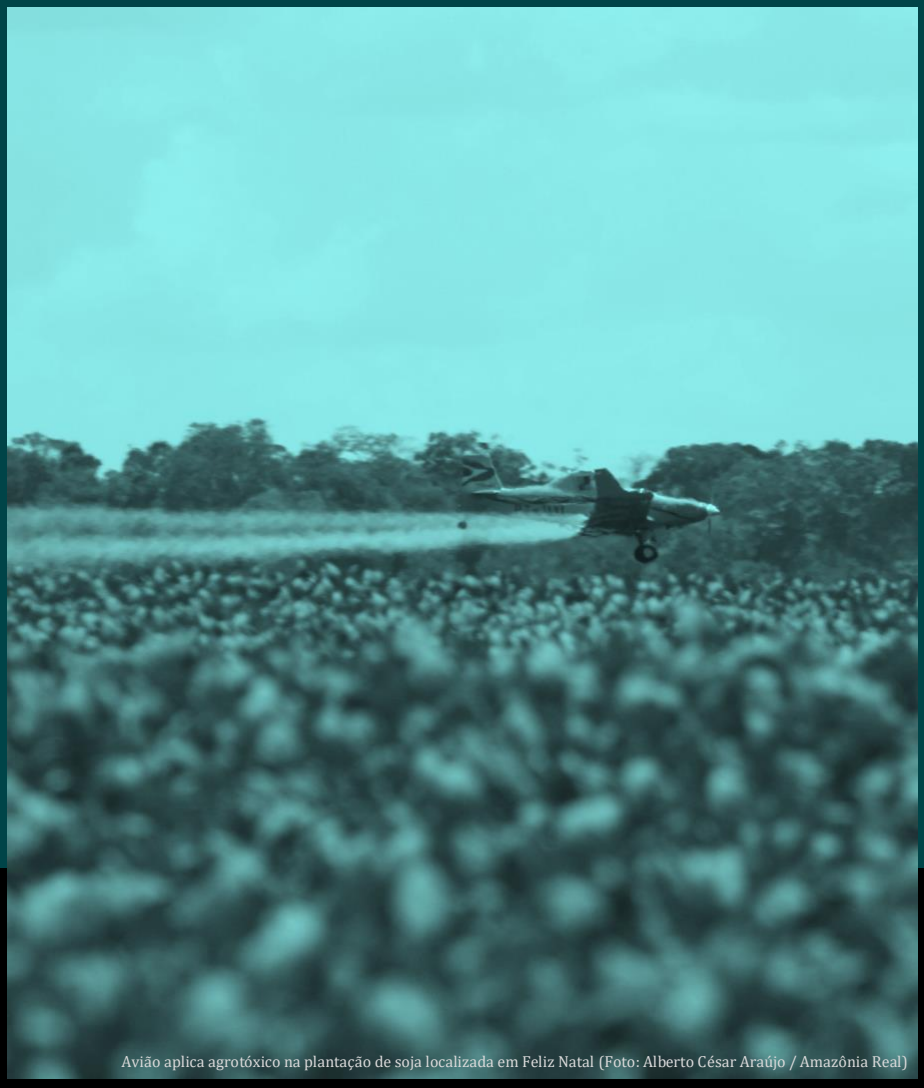
Chapter 15 In Brief

Complex, diverse, and changing agribusiness and livelihood systems in the Amazon



Avião aplica agrotóxico na plantação de soja localizada em Feliz Natal (Foto: Alberto César Araújo / Amazônia Real)

THE AMAZON WE WANT
Science Panel for the Amazon

Complex, diverse, and changing agribusiness and livelihood systems in the Amazon

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Key Messages & Recommendations

1) Amazonian communities and populations have long relied upon a combination of diversified subsistence, waged, and commercial activities for their livelihoods.
2) Larger commercial and agro-industrial enterprises have been expanding rapidly across Amazonian countries, notably cattle ranching, soy complex, and palm enterprises.
3) Pro-growth incentives (i.e., financial, institutional, infrastructural, political, and for research) that favored larger-scale producers and agribusiness over family producers have pushed many out of agriculture, encouraged deforestation, and driven other socioenvironmental impacts.
4) Public land, as well as lands with complex and collective tenure regimes, have been massively transferred, both legally and illegally, for private use, engendering social conflict, marginalization of small producers, and high migration rates to cities and into wage labor.
5) Family-based agroforestry, fishery, and agricultural systems have persisted and adapted to multiple challenges, and provide promising examples of more sustainable production systems that should constitute a core focus of future policies.
6) Government support and technical assistance should be provided to community-based management systems, as well as a robust research agenda that builds on local knowledge systems.
7) Collaborations between local producers, cooperatives, research institutes, and industrial and manufacturing processing facilities should be stimulated, considering Indigenous and place-based ecological knowledge and promoting science, technology, and innovation (ST&I) strategies with participation by smallholder producers.

Abstract This chapter focuses on recent changes in the structure of systems of production in the Amazon, exploring their implications for the region's environment and society. It also high-lights local responses to these challenges, and opportunities for more sustainable production systems. An in-depth quantitative case study on the Brazilian Amazon is presented.

Complex, diverse, and changing structures of production Rapid expansion of largely agro-industrial economies greatly impacted public lands, and has been favored by pro-growth policies (see Chapters 14 and 17).

The discussion in this chapter is weighted towards the Brazilian Amazon due to the rich data available (see the Agricultural and Livestock Censuses of 1995[1], 2006[2] and 2017[3] of the Brazilian Institute of

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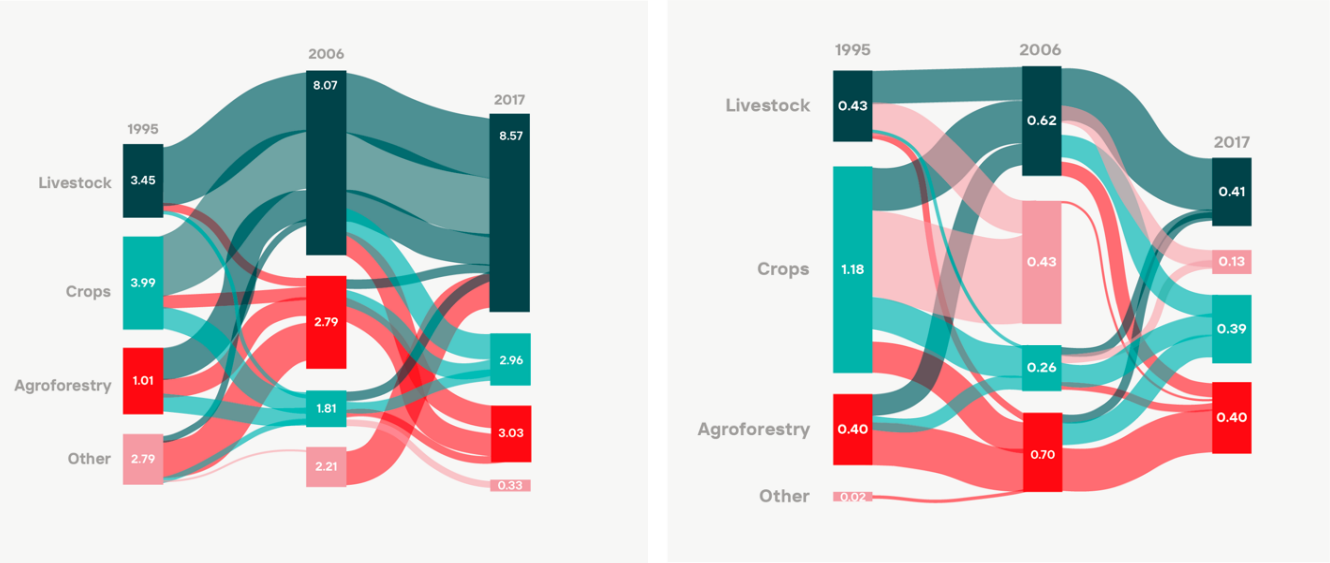

Figure 15.1 Shifts in land use and employment among family-based production trajectories, 1995-2017 (millions)

Geography and Statistics, IBGE). Favored by pro-growth policies, the gross value of agricultural, livestock, and extractive production (GVP) of municipalities in the Brazilian Amazon grew from USD 5.1 billion in 1995 to USD 16.1 billion in 2017. Agribusiness production systems grew from 48% to 80% of the total GVP[1-3], while the small farm sector collapsed from 52% to 20%. Agribusiness growth also entailed appropriation of about 13 million hectares (ha) of public land. This structural land-use shift resulted in deforestation of 20.8 million ha, a critical reduction in labor demand (from 2.3 million to 1.7 million workers), and massive out-migration from agrarian employment to jobs in infrastructure, extractive industries, and Amazonian towns and cities.

Family-based agroforestry and fisheries Family-based agroforestry and fisheries systems are the oldest and most diverse livelihood groups in the region (see Chapters 8 and 10). Between 1995 and 2017, rural agroforestry establishments in the Brazilian Amazon increased from 125,000 to 186,000, and their contributions to the economy grew 4.3% annually on average, reaching USD 1.1 billion; 92% of the 400,000 people in the sector are family workers[1-3].

Complex agroforestry systems are prevalent throughout Amazonian lowlands and the "Andean Amazon". Fisheries are a core component of these systems, providing a major source of livelihoods and nutrition for many riverine communities[4–6], including urbanized ones. Several types of fisheries sub-sectors, often overlapping, exist in the Amazon, from those practiced by family groups in small riverside communities to and urban areas, to large commercial enterprises centered around urban areas. Community-led grassroots movements are developing and promoting policies that recognize decentralized practices and support collaborative community-based management systems.

Family-based crop systems in the Amazon A number of federal agricultural policies and programs have been created in Brazil since the 1970s, and especially in the 1990s, to support smallholder farmers, forest extractivists, and fishers, under the purview of the Ministry of Agrarian Development (MDA). In 2019, the MDA was demoted to the status of a Secretariat of Family Agriculture and Cooperativism, under the agribusiness-oriented Ministry of Agriculture, and many policies and programs were weakened or eliminated[7]. Family farms lack access to many other forms of credit available to large scale farmers.

A technical focus on commercial crop specialization by credit, extension, and research agencies in the Brazilian Amazon induced many family

farmers to concentrate on production of an ever-smaller number of products, mostly commercial. In 2017, 93% of family-based production focused on 5 products (cassava, soybeans, corn, sugar cane, and pineapple), competing with larger growers for which much more generous credit lines were available.

The family-based crops sector in the Brazilian Amazon declined substantially from 1995 to 2017, with GVP reduced to one fifth of its initial value and employment dropping by two-thirds. Production shifted mostly to family-based livestock due to its low labor demand and other advantages[8,9], while most workers moved into urban sectors or wage employment.

Family-based versus large-scale livestock enterprises Livestock ranching has been a widespread activity in the Amazon since the 17th and 18th centuries, but expanded from the 1960s onward due to road construction, subsidies, land transfers, new pasture technologies, and credit policies implemented by the military governments and retained by all subsequent governments[10,11]. The cattle herd in the region almost doubled, from 28.3 million heads in 2006 to 52 million in 2017[3], with 28% belonging to smallholder livestock and 48% to extensive commercial ranching. Products (beef and dairy) grew from 48% to 77% of the value of the small farm production sector during the same period. Family-based livestock enterprises are much more diversified production systems than wage-based livestock, have a higher density of cattle per hectare, and are oriented more towards self-consumption, local, and national economies.

Commercial ranching establishments more than doubled in the Brazilian Amazon from 1995 to 2017, while their GVP increased more than five-fold. Returns grew almost four-fold, from USD 67.2 per ha in 1995, to USD 244.4 per ha in 2017. However, cattle ranches remain among the lowest of all production systems in land-us e intensity[12], reflecting the potential to capture various institutional rents, land speculation, and money laundering (see Chapter 14). Ranching establishments are also heavily involved in timber extraction to finance pasture production.

Wage-based cropping production The commercial agriculture sector, dominated in the Brazilian Amazon by the soy-corn agro-industrial annual cropping system, is largely export-oriented. The expansion and modernization of Brazilian agriculture was promoted by the government through supportive research, monetary, and agricultural policies, and by providing credit to farmers at below market interest rates. Governments also financed infrastructure, including the building of roads and waterways, logistical centers, ports, and storage infrastructure, as well as equipment[13]. Between 1995 and 2017, large-scale cropping growth reached 9.2% annually, raising the Amazonian GVP from USD 1.2 billion to 8.1 billion, and dominating Brazil's foreign exchange.

This rapid growth led to increased demand for deforested land. To meet this need, 7.2 million ha of deforested land from extensive cattle and 0.7 million from commercial plantations shifted to commercial crops, in addition to 5.2 million ha already in operation.

Soy is associated with the emergence of "Agrocities", as new businesses are established to provide farm and management services and sell non-agricultural goods and services to farm and agribusiness employees[13,14]. This exacerbates inequality[14–19] since many of the benefits of "agrocities" accrue to landowning elites at the expense of migrant

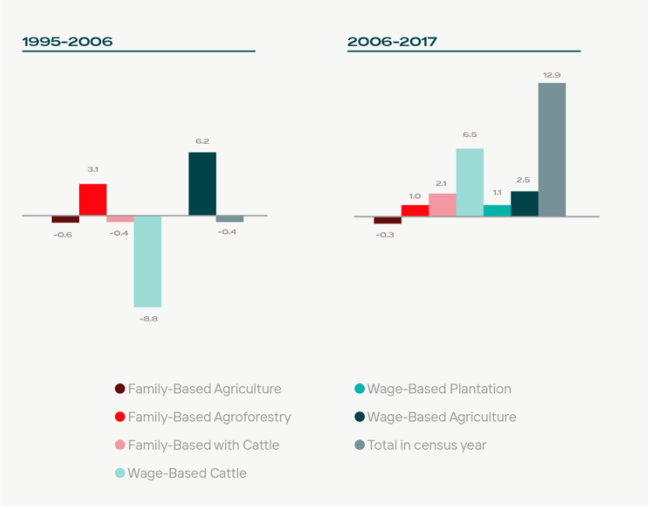

Figure 15.2 Dynamics of appropriation of public lands in the agrarian sector of the Amazon by production trajectory (PT) (millions of hectares of appropriated land in the period). Source: IBGE, Agricultural Censuses 1995, 2006, and 2017.

labor from other regions, relative disinvestment in alternative economies, and aggravation of socio-ecological conflicts[20].

Ultimately, the degree of integration and fluidity between different land use types is constricted by land use lock-ins (path-dependencies), entry costs, forms of capital scarcity, and cultural dimensions. As described in Chapter 14, past practices provide a great deal of rigidity to future transformations, by requiring "big push" policies and large upfront investments[21].

Plantations for rubber, oil palm, timber, and other global commodities The expansion of commercial plantations has not taken place as fast or as widely as soy in Brazil, but it is quickly becoming a major form of land occupation in Amazonia. The palm oil sector plays a role in driving direct deforestation, particularly in the lower Amazon, and more recently in the Western Amazon, especially Peru, Ecuador, and Colombia. In Brazil, monocrop tree plantations and their economic contributions have declined in recent years. In 2017, monocrop plantations produced 94% of the 659,800 tons of palm oil and 92% of the 124 million bay-coconut fruits, currently the most common Amazonian plantation crops.

Homogenous açaí plantations started to expand in the Amazon during the past decade. From 2015 to 2019, the area planted with açaí in Brazil's Northern region (mostly Pará) expanded from 136,312 ha to 194,405 ha[22]. The most important açaí planters were family-based agroforestry, with 64% of the total. The best-managed açaí agroforestry areas can have equivalent productivity, and comparable density of clumps/stems/ha, to more recent larger açaí plantations. Its value on a per hectare basis is often greater than soy[23].

Large-scale appropriation of public resources and reduced employment Between 2006 and 2017, with the exception of family-based agriculture, all production systems in the Brazilian Amazon incorporated new land, totaling 12.9 million ha. Of those, commercial extensive cattle added 6.5 million ha; wage-based soy 2.5 million; and wage-based plantations 1.1 million. This resulted largely from widespread mechanisms of informal, usually illicit, appropriation of public lands in the region,

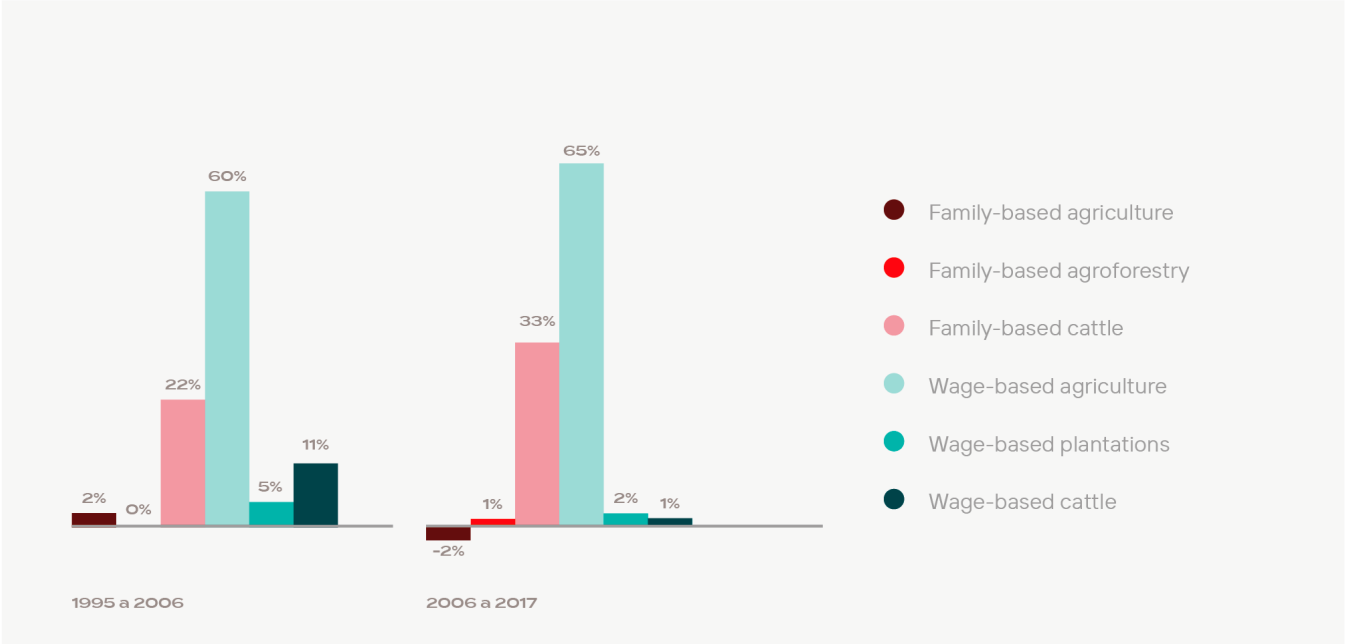

Figure 15.3 Trajectories of the contributions of different production systems to total net CO_2 emission of the agrarian economy within the Brazilian Amazon, 1995-2006 and 2006-2017: % of total. Source: IBGE, Agricultural Censuses 1995, 2006 and 2017[12].

generally covered with primary forest (Figure 15.2).

This process reinforced the profound inequality of access to vital resources in Brazilian society, as 78% of new lands were incorporated into the assets of the 12.5% of establishments that already held 76% of all the land. This were associated with shifts and reductions in employment in the agrarian sector, and had significant repercussions for the livelihood possibilities of Amazonian communities, with many family-based enterprises shifting to work in urban employment, mining, infrastructure, and clandestine economies.

Intensification and deforestation Intensification of large commercial agriculture and ranching became a driver of the further expansion of these large-scale commercial production systems. However, intensification also increases political and economic incentives for further expansion of agricultural production and ranching, if it enhances productivity and profits, known as the "Jevons paradox". In addition to deforestation, intensification of agricultural production occurs through increased mechanization and application of agrochemicals, and can exacerbate ecosystem degradation through *inter alia* pollution of soils and waters, biodiversity loss, and soil erosion[20]. Deforest-ed area grew from 37.2 million hectares in 1995 to 57.8 million hectares in 2017, mostly due to commercial cattle and agribusiness cropping.

Carbon emissions and sinks, and land degradation Forest degradation accounts for 87.3% of the carbon lost in Panamazonia as a whole[24], a result of logging, fire, edge effects, and tree death during droughts. The proportion of total contributions of emissions from commercial cattle grew between one period (1995-2006) and the next (2006-2017), from 60% to 65%, while large commercial agriculture fell from 11% to 1% (Figure 15.3). The systematic cooperation between these two production systems explains these results, which should be read in aggregate (i.e., for a total of 66% in 2017), as land cleared for cattle ranching is typically turned over to soy production as pastures become degraded after just a few years. The contribution of family-based cattle to CO_2 emissions also grew from 22% to 33% in this same period.

Over the same period, family-based agriculture turned into a CO_2 sink, commercial plantations reduced their contribution from 5% to 2% of CO_2 total net emissions, and family-based agroforestry continued to contribute virtually no CO_2 emissions through the whole period. This is because these production systems do not rely upon or drive further deforestation, and even increase the organic content of soils, capturing CO_2 from the atmosphere and transforming it into plant nutrients, although over time cleared areas can release more carbon than native forests.

Predatory versus sustainable commercial production systems Cattle ranching and commercial agricultural enterprises have been the preferred recipients of favorable policies, institutions, and political support, securing the greatest access to development credit and official technical assistance[25–27]. In addition, the expansion of road systems, storage infrastructure, and an array of other agricultural services combined provide them a competitive advantage that has proved overwhelming; in 2017 they represented 77% of the rural economy in the Amazon.

Volatility of family-based production net income and vulnerability Family-based cattle followed the trend among the wage-based production systems, doubling its net income per family worker and being strongly supported with credit capital, which represented 25% of its total GVP in 2017. Family-based agriculture and agroforestry had the lowest access to credit and technical assistance. After experiencing strong growth, the net income per family worker in family-based agriculture and agroforestry decreased severely for the former and stagnated for the latter. The income volatility of family-based agriculture produced a crisis, heightened by land tensions, and manifested in the transformation of over half a million family farmers into urban or rural wage workers, reducing their role in local supply. The income stagnation of more sustainable family-based agroforestry indicates its capacity to expand and to improve the living conditions of those involved is limited.

Adaptation to climate change and urbanization In much of the Amazon region, the rural populations' economy and way of life have been based on polyvalent strategies, which allows them to persist

and adapt even under unfavorable conditions, and provides important alternatives for future strategies to support more sustainable production systems[28,29]. Climate variability is changing the timing, frequency, and intensity of extreme hydro-climatic events. In order to adapt, Amazonians are increasingly planting in uplands (*terra firme*), on suspended platforms, or flood-tolerant varieties to attract and harvest fish. They are also engaging in collective action to control fire during land clearing[30,31].

In all Amazonian countries, producers are responding to the constraints and opportunities produced by urban expansion by shifting among market-oriented and subsistence-oriented cultivation[30]; from manual to mechanical food processing systems[23]; integrating seeds that are sold in the markets to local seeds systems[30,32,33]; and direct selling to distributors with contracts mediated by social networks and cell phones[32].

Fisheries development The expansion of modern commercial fisheries greatly increased pressure on floodplain lake fisheries, mobilizing floodplain communities to implement collective agreements to regulate local fishing activity[34,35]. Lake fisheries with effective management agreements can be 60% more productive than unmanaged lakes[36]. In Amazonas State (Brazil), the total catch of managed pirarucu increased from 20 tons in 2003 to more than 2,600 tons in 2019[37,38]. With adequate government support and technical assistance, this community-based management system could be extended to the entire Amazon floodplain[6], to the benefit of both rural and urban families. Progress has been made in managing floodplain fisheries, but there has been minimal progress in sustainably managing stocks of long-distance migratory catfish[39,40]. Aquaculture may hold the potential to provide an alternative to cattle production, helping diversify local incomes and rural and urban food supplies, while reducing the land footprint of animal-source foods[38].

Integrating local and scientific knowledges Indigenous peoples and local communities' place-based ecological knowledge integrates both traditional and modern knowledge to produce, manage, and conserve plant, animal, and other biological resources[41,42]. Amazonians have successfully developed networks to collectively manage fire use, lake fisheries, processing plants, and marketing, to the benefit of linked rural and urban communities in the Amazon, strengthening regional economies.

Increased urbanization can translate into stronger demand for locally produced goods of multiple types, if it is accompanied by effective supports for peri-urban, urban, and regional small farm agricultural systems. A ST&I strategy with participation by smallholder producers could further enhance these initiatives and support the development of diverse, local production systems that provide both rural and urban employment and economic opportunities for Amazonian populations while reducing deforestation, greenhouse gas emissions, and other environmental threats.

Conclusions Supportive, pro-growth policies regarding land tenure, agricultural credit, and technical assistance, as well as the expansion of roads, waterways, and other infrastructure, have favored the rapid expansion of agribusiness and its increasing appropriation of public lands, especially by cattle ranching and soy enterprises, with increasingly negative social and environmental consequences. These transformations have empowered agribusiness and speculative interests and undermined the ability of local communities to defend their own interests and practices, which are more attuned to the sustainability of the Amazon's resource base and the wellbeing of Amazonian peoples. The findings in this chapter point to the need to re-orient development to support small-scale, diverse production systems that provide employment and economic dynamism for local communities, building on the rich biodiversity and local knowledge that supports many promising initiatives to adapt those systems to climate change and growing urbanization in the region, focused on improving forestry, agroforestry, and fishing systems managed by local communities.

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