



INNOVATIONS FOR SUCCESSFUL SOCIETIES

CONTROLLING DEFORESTATION IN THE BRAZILIAN AMAZON: ALTA FLORESTA WORKS TOWARD SUSTAINABILITY, 2008–2013

SYNOPSIS

In the early 2000s, the municipality of Alta Floresta was part of Brazil’s Arc of Fire, a curving frontier of communities whose residents were clearing old-growth forests in the Amazon region so they could graze livestock, harvest timber, or cultivate crops. In 2008, the federal government cracked down on deforestation and pressured local governments to implement national environmental regulations. It created a blacklist of municipalities that were the worst violators of deforestation laws. Alta Floresta, as one of the 36 municipalities on the list, was thrust into an unfavorable national spotlight, cut off from access to rural agricultural credit, and its ranchers embargoed from selling their cattle to slaughterhouses. To get off the list, the municipality had to convince the owners of 80% of privately held land—more than 2,500 owners in all—to register their property, map property boundaries, declare the extent of deforestation, and agree to restore any illegally degraded or deforested areas within 10 years. Making compliance feasible for local ranchers meant that the municipal government had to promote more efficient agricultural production and provide opportunities for alternative livelihoods. This approach protected land set aside for restoration and reduced the economic need for future deforestation. In 2012, Alta Floresta became the third municipality in Brazil to earn removal from the blacklist.

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INTRODUCTION

Maria Izaura Dias Alfonso had just been elected mayor of Alta Floresta when, in 2005, Brazil’s federal environmental police came to the municipality for the first time, raiding farms and timber businesses on land illegally cleared of trees. The crackdown was part of a new effort to better enforce Brazil’s deforestation laws. “The police came overnight, arresting people—the

farmers, the timber business owners,” Izaura said. “It was a radical operation, and all our economic activity stopped. Then I took office and asked myself, ‘What am I going to do?’”

Deforestation in Alta Floresta had as long a history as the town itself. In the 1970s, Brazil’s government, then a military dictatorship, tried to defuse land conflicts by offering people forested parcels in exchange for their labor in

cutting the trees and investing in production. Located in the northern part of the state of Mato Grosso, Alta Floresta was one of the areas included in the policy. Small-holder cattle ranching and logging dominated Alta Floresta's economy, except for a brief gold rush in the 1980s. Federal laws on the books in those years required rural landowners in the Amazon region to reserve 50 to 80% of their property as original forest—depending on the requirements at the time of purchase—in exchange for authorization to develop the remaining land. However, because supervision was minimal, enforcement was lax, and agricultural land was valuable, many landowners expanded their productive area by clearing portions of their legally mandated forest reserves.

Throughout the state's history, many Mato Grosso politicians owned farms, ranches, or timber businesses or otherwise benefited from those industries. Blairo Maggi, governor of Mato Grosso from 2003 to 2010, whose family owned Brazil's largest soy producer, encouraged further land clearing during his first few years in office. In 2005, Mato Grosso's rapid deforestation and Maggi's business activities attracted worldwide concern, earning Maggi the Golden Chainsaw award from international environmental organization Greenpeace as "the Brazilian person who most contributed to Amazon destruction."

Although Brazil had strong forest-protection laws on paper for decades, enforcement was haphazard and rarely reached remote municipalities like Alta Floresta. In 2004, a shift in federal policy brought an end to lax enforcement and casual disregard of environmental laws. Pres. Luiz Inácio Lula da Silva's administration unveiled the Plan for the Prevention and Control of Deforestation in the Legal Amazon (*Plano de Prevenção e Controle do Desmatamento na Amazônia Legal*), a multitiered strategy to combat deforestation in the Amazon. Lula's program brought together 13 government

ministries, along with the federal police and military, to coordinate forest preservation. The plan added 640,000 square kilometers of protected areas and strengthened law enforcement on both public and private lands.

The plan harnessed technology to target offenders. The Ministry of the Environment, the Brazilian Institute of Environmental and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, or IBAMA)—Brazil's environmental enforcement agency—and the National Institute of Space Research began using Brazil's satellite network to identify and monitor deforestation in even the remotest areas of the Amazon.

The satellite images enabled IBAMA and the police to pinpoint where and when people were cutting trees illegally. The new system represented a vast improvement in both timeliness and accuracy over the government's past reliance on reports by individuals. Focusing mainly on large-scale illegal deforestation, IBAMA agents and federal police stepped up raids, confiscated equipment, froze assets, and arrested or fined violators. From 2004 to 2007, the rate of deforestation in the Amazon region dropped by 59%.

The Brazilian government's initial top-down efforts enjoyed significant success in curbing illegal deforestation, but rising prices for agricultural commodities increased the incentive for farmers to clear forests for production. At the end of 2007, the federal government tried a new strategy that aimed to fix the problem at the local level by pressuring municipalities to enforce national priorities. Enabled by a presidential decree, the Ministry of the Environment published a list of 36 municipalities that together were generating more than 50% of the total deforestation in the Amazon, even though those municipalities accounted for only 6% of private land.¹ Alta Floresta was one of the offenders.

THE CHALLENGE

The federal government cracked down on Alta Floresta and the other 35 municipalities, creating strong incentives to curb local deforestation and get off the blacklist. As long as a municipality remained on the list, its residents faced increased law enforcement scrutiny, restrictions on credit, and difficulty selling what they produced.

Almost immediately following publication of the blacklist, IBAMA, the federal police, and the army increased their raids on ranches and timber businesses in the targeted municipalities and stepped up enforcement of environmental laws as part of an operation called Arc of Fire, named after the curving frontier of communities pushing into the boundaries of Amazon forests. The Arc of Fire operation focused on an entire municipality rather than individual landholdings identified through the satellite-photo system. The Ministry of the Environment embargoed properties that were in violation of environmental laws, barring owners from selling goods produced on those properties.

The presidential decree also had implications for municipal access to credit. It required owners of rural land to submit updated maps, land-use descriptions, and geocoding coordinates to the National Institute for Colonization and Agrarian Reform (Instituto Nacional de Colonização e Reforma Agrária, or INCRA), the federal government agency responsible for registration of rural property and management of public lands. Landowners who refused to comply had their rural property registration certificates revoked, effectively blocking both their access to government agricultural credit and their right to sell land legally. The decree also forbade official federal credit agencies from approving credit of any kind for all properties and businesses under embargo.

In February 2008, Brazil's central bank further tightened access to credit for properties within the 36 blacklisted municipalities by

requiring official banks and credit cooperatives to demand both a rural property registration certificate and a rural environmental registration (*cadastro ambiental rural*, or CAR) from all applicants for government-subsidized agricultural credit. In Mato Grosso, the CAR system required mapping of property boundaries, declaration of the extent of both legal and illegal deforestation, and formal plans to restore any illegally degraded or deforested areas within 10 years.

That tightening of credit was a significant inducement for property owners to cooperate. Many Brazilian farmers relied on the rural credit program, which met an estimated third of the financial need of the country's agricultural sector in 2008.²

Many ranchers and farmers in Alta Floresta were in danger of also losing business income as long as the municipality remained on the blacklist, because the presidential decree also restricted credit for those who bought, transported, or sold goods produced by embargoed properties. IBAMA argued that it held the legal authority to bring charges against any slaughterhouse, supermarket chain, or other business that bought meat or soy from an area illegally deforested after 2008 as an accessory to that deforestation. Larger slaughterhouses and supermarket chains began to refuse cattle and crops from municipalities on the blacklist and, as the private sector developed its own monitoring systems, from any landholdings that showed signs of illegal deforestation.

To get off the blacklist, the Ministry of the Environment required that at least 80% of the privately owned land within a municipality's boundaries be registered under the CAR system and that annual deforestation within those boundaries be less than 60% of the average annual deforestation rate from 2004 to 2006. If a municipality achieved that dual goal, the federal government promised priority access to credit and federal programs for sustainable

development. If it did not, the penalties for individual landowners and the municipal government would remain in place, and the local economy would suffer.

Alta Floresta, like other municipalities on the blacklist, had a collective-action problem: the community as a whole would benefit from the municipality's exiting the list, thereby lifting commercial restrictions and heightened law enforcement scrutiny, but each property owner would have to bear significant costs. Individual landowners had to register their properties, own up to past illegal deforestation, and commit to restoring their legal reserves. The way the CAR system was initially designed, each individual landowner had to hire a certified engineer to sign off on each property map and geocoded coordinates. Each landowner also had to hire an engineer to certify formal plans for the restoration of degraded areas and take formal responsibility for the plans' completion. The municipal government estimated that without support, this process would cost each landowner about 4,000 reais (US\$1,822 in 2008). Few in Alta Floresta had the financial resources to meet CAR requirements without government help. And without a guarantee of registration by all rural property owners in the municipality, individual landowners had an incentive to free-ride on the compliance of others.

To induce property owners to go along, the municipal government had to devise a strategy that took local circumstances into account. Unlike some municipalities on the list, where a few large landowners dominated local economies, Alta Floresta was the home of many *smallholders*, and Izaura's administration would have to persuade 2,500 to 2,800 citizens to register their properties. The sheer number made solving the collective-action problem more difficult than if there were only a few *big* businesses with much to gain from getting off the blacklist.

In addition, because their properties were

relatively small, many of Alta Floresta's landowners relied less on subsidized credit than larger operations and did not feel the pinch of credit restrictions as sharply.³ As a result, they had less incentive to cooperate fully and quickly with the municipality's efforts.

But there were also reasons for property owners to care about rates of deforestation. An environmental assessment conducted in mid 2008 revealed the damage that past practices had inflicted on the community. About half of Alta Floresta's original forest cover from the 1970s had disappeared by the time the municipality landed on the blacklist. Of the deforested land, 59% was being actively used for agriculture and pasture, and 22% had been degraded and lay idle, primarily as overgrazed pastureland or bare soil.⁴ The assessment indicated that in keeping with regional trends, many private landowners had not maintained the 50 to 80% forest reserves as required by law.

Deforestation also had affected the water supply. Federal environmental laws designated riverbanks, watersheds, and a 30-meter radius around springs to be "areas of permanent preservation." To avoid erosion and pollution, property owners were not permitted to cut trees in those areas or use the land for agriculture. Alta Floresta contained 116,000 hectares of such designated land—equivalent to about 13% of the municipality's area. The 2008 environmental assessment found that 42% of the permanent-preservation land was degraded either partially or completely. Of the 6,454 springs, only 49% were fully preserved—meaning, the water was uncontaminated by agricultural activities, and the surrounding vegetation was intact, preventing erosion. The rest was contaminated or, at best, partially deforested.

FRAMING A RESPONSE

Izaura, who was reelected mayor in late 2008, decided to make getting Alta Floresta off

the blacklist the priority of her second and final term. She and many of her constituents strongly felt the scrutiny of national media attention. “It was a question of honor,” she said. “We were seen by the entire country as bad people. From that point on, everybody realized we had to take action.”

Shortly after releasing the list, the Ministry of the Environment convened the mayors of the affected municipalities in the capital city of Brasilia to discuss ways of meeting the terms of its policies. The ministry recommended that each mayor create a municipal secretariat of the environment to manage local efforts to achieve the ministry’s benchmarks and get the municipality off the list.

Izaura turned to her secretary of education from her previous term, Irene Duarte, to become Alta Floresta’s first secretary of the environment. The mayor set two goals for the new secretary: one immediate and one long-term. The first was to get the municipality off the ministry’s list, and the second, to build environmental concerns into Alta Floresta’s future development strategy. Duarte hesitated at first, because she had little background in environmental policy, but Izaura persuaded her to take the position. Duarte said, “She told me that an educator was exactly what she needed: a teacher to help raise awareness.”

When she started her job, Duarte had only three people on her staff and no technological infrastructure. She first focused on building alliances. For technical support, she reached out to the state-based nongovernmental organization (NGO) that had conducted some of the initial environmental assessments—the Mato Grosso-based Center of Life Institute (Instituto Centro de Vida, or ICV), whose mission was to help reconcile agricultural production and forest conservation. Duarte had been with the ICV several years earlier and knew the organization had mapping and other technical resources that would support her

work. The ICV’s founder, Sérgio Guimarães, introduced Duarte to key officials at the Ministry of the Environment, the Mato Grosso State Secretariat of the Environment, and INCRA.

Later, Duarte visited other municipalities in the Amazon region that were making progress toward getting off the environmental blacklist. In Paragominas, in the state of Pará, the municipal government had worked with the ICV and Brazilian NGO Imazon on the development of a local system to analyze satellite images of deforestation. Technicians from Paragominas helped Duarte and her team learn how to use this kind of data in Alta Floresta. (In April 2010, Paragominas became the first municipality to be removed from the list.) Duarte also relied heavily on the ICV for maps and other information the municipality did not have.

Any strategy to win compliance with the law would have to (1) build trust and understanding in a community suspicious of environmental initiatives, (2) help reduce the costs of compliance with environmental rules, (3) show property owners how to change their practices, and (4) mobilize public pressure that would prevent holdouts from blocking the collective effort to get off the blacklist. Even though Alta Floresta needed only 80% of privately owned land to be registered under the CAR system, Duarte decided to push for 100% of property owners to complete the CAR process. ICV executive director Laurent Micol recalled that Duarte told him, “We want to have everyone in this municipality registered so that we can start a new development model. She already had a vision of what could come next after achieving environmental compliance.”

Duarte’s unwavering vision was important in winning public support. “It was courageous because at that time, you could have a negative reaction and say, ‘This blacklist is horrible, and the federal government is being unfair,’ but the

attitude was the opposite,” Micol said. “Her attitude was that this blacklist is a problem, but it reveals a problem we have, and we need to create a new story for ourselves.”

Understanding the importance of building a working relationship with property owners, Duarte also met with the Alta Floresta Rural Union, which represented many local ranchers and farmers. Although the Rural Union had often clashed with previous NGO-led efforts to implement environmental agendas, union president Celso Bevilaqua knew that the ranchers and farmers he represented would have to change how they operated in order to stay in business. “We were completely stuck,” he said. “There was the Arc of Fire operation to stop the timber business and stop deforestation, and we had enormous financial losses.”

Not only did Bevilaqua agree to work with Duarte to reach ranchers and farmers but he also offered Duarte temporary access to computers and office space. The Rural Union offices became the secretariat’s home for seven months until space in city hall was ready.

According to Izaura, support from the federal government was weak, and follow-through was poor. When blacklisted municipalities complained that they lacked the resources to meet requirements, the Ministry of the Environment launched a program called Operation Green Arc to provide support. A federal team came to Alta Floresta in late 2009 to broker an agreement under which the state and federal governments would support Alta Floresta not only in getting off the list but also in developing production chains that would reduce deforestation pressure and promote sustainable economic development.

Much of the promised support never materialized, however. “During the Arc of Fire, they sent thousands of cars, trucks, helicopters, and planes; it was this whole operation,” Izaura said. “With the Green Arc, they sent one truck—a small one actually—and that was it.

The federal government came here and created all this turmoil and then just left.”

Duarte quickly realized that funding was a priority both to hire staff and equip the municipal environmental secretariat and to implement specific projects. “Right from the beginning, we knew that the municipality’s financial resources were limited because most of it would go to payroll, education, and health, and very little would go to the environmental agenda,” she said.

Lowering the cost of compliance was important for winning private sector support. The registration process as it was originally designed required landowners to hire engineers to sign off on both their declarations of the condition of their properties and their formal plans to restore any illegally deforested or degraded areas. The expense was prohibitive for Alta Floresta’s smallholders. Duarte realized that the secretariat could help reduce those costs and make the registration process more efficient by hiring a small team of engineers that would serve the entire municipality.

Duarte approached the Amazon Fund—a project of the Brazilian Development Bank that funded work to prevent deforestation and promote preservation—for a grant to help Alta Floresta implement an environmental agenda. With the help of the ICV, Duarte drafted a proposal for an umbrella project called Olhos D’Água da Amazônia or Source of the Water of the Amazon. The project would have several parts. First, Duarte and her team would focus on helping landowners complete the CAR process, hiring engineers on behalf of the municipality and assembling a team to process the data and paperwork. Then Duarte and the team outlined a plan to hold seminars and workshops that would help landowners understand how to most effectively restore their land.

Second, Duarte proposed to use the CAR process to resolve the issue of deteriorating

water resources in Alta Floresta by mobilizing landowners to restore areas around springs and riverbanks that were designated for permanent preservation. Because water was a public resource, Duarte proposed to partially subsidize the cost of those restorations.

Third, out of concern about the longer-term prospects for environmentally sustainable economic development, Duarte proposed to build demonstration units that would educate local producers about new pasture-management and agroforestry practices. As part of the project design process, Duarte pledged to build partnerships with the State University of Mato Grosso; INCRA; the government-owned Brazilian Agricultural Research Corporation; the Avina Foundation, which funded sustainable development projects in Latin America; and others. “Small producers get only a very small profit from their activities, and with the investment they would have to make to recover the area and then make a living on that smaller area, it would be very difficult,” said Valdemar Gamba, municipal secretary of agriculture. “That was the biggest challenge.”

Fourth, Duarte wanted to develop the environmental secretariat’s capacity to monitor registrations, individual landowners’ restoration of their own reserves over the 10-year timeline, and progress in restoring water systems.

Duarte decided to focus first on the smaller landowners, saving the larger landowners for last, in contrast to certain other municipalities on the list, which targeted large landowners first in an effort to quickly reach the 80% benchmark. Smaller producers had greater need for municipal support, and Duarte wanted to make clear from the beginning that the process was an initiative of the entire community.

The municipal government also thought that getting the majority of the community on board first might make it easier to persuade larger landowners to join the effort. “We thought that by convincing most of the population, we’d

find it easier to get to the larger producers and say, ‘We’re on the blacklist just because of you, so are you going to do something about it or not?’” Gamba said.

GETTING DOWN TO WORK

While she waited for the Amazon Fund’s review of Alta Floresta’s grant application, Duarte began to build support for registration within the community. Although she had not originally planned on waiting long, the Amazon Fund’s nearly yearlong delay gave Duarte and her partners time to build knowledge and trust among residents of Alta Floresta’s rural communities.

Laying the groundwork and securing buy-in

Initially, Duarte focused on meeting with communities in the municipality to explain Alta Floresta’s situation and landowners’ responsibilities in the registration process. She enlisted Rural Union president Bevilaqua, the ICV staff, and Gamba—himself a prominent rancher in the region—to join her. Together they attended more than 60 meetings in rural communities to persuade area landowners to participate in the process. Micol, the ICV executive director, said Duarte’s straightforward, sincere approach helped her earn the trust of those she encountered: “She speaks from the heart, and people like her and believe her.” When Duarte walked into meetings, Micol recalled, she would say, “It’s very simple. We do this registry, we leave the list, and then we start a new story for Alta Floresta.”

Many producers initially feared reporting the level of deforestation on their properties, especially if they had not maintained their legally required forest reserves. Even though the CAR process allowed a reduction in penalties or even amnesty for illegal deforestation before 2008—as long as the landowner met restoration targets thereafter—many landowners believed

the information would be used against them. The presence of both Alta Floresta's secretary of agriculture and the leader of the Rural Union helped assuage those fears. "As a member of the government and a producer in the region, I bridged a gap between communities and the government," Gamba said. "I helped address the fear the community felt when someone mentioned the word *environment*."

In 2009, changes at the state level also helped Alta Floresta's cause. As part of a broader effort to counter his administration's poor reputation on environmental protection, the governor of Mato Grosso launched a program to facilitate the CAR process and other environmental licensing. As part of that effort, the state government persuaded the state farmers and ranchers unions to declare support for the CAR system. Representatives of the livestock breeders association visited Alta Floresta to encourage cattle ranchers to participate.

In Alta Floresta, many lingering doubts about the seriousness of the environmental problem disappeared in 2010, when the Amazon region as a whole experienced a severe drought, underscoring the vulnerability of water systems in the area. "That was another shock! How can we lack water in the Amazon?" Izaura said. "We have 3,000 springs, but it was true: we had a drought." Even though the problem was not directly linked to degraded springs, it helped many residents realize the need to restore and protect springs and riverbanks.

Setting up monitoring, mapping, and engineering capacity

In August 2010, the Amazon Fund approved the proposal Duarte had submitted on behalf of the municipality. The fund supported the activities of the Olhos D'Água da Amazônia project to the tune of 2,781,340 reals (approximately US\$1.5 million at the time), with support to begin in early 2011. Duarte

hired as project coordinator Jose Alesandro Rodrigues, a specialist in environmental engineering who had worked with the Ministry of the Environment.

Once the team had secured funding, the first step was to build a database of municipal geographic information that would support the CAR registration process. To complete the registration paperwork and help landowners plan any required restoration, the secretariat needed satellite maps; topographical maps; exact locations of rivers, springs, and watersheds; information on property boundaries; identification of landowners; and knowledge of access routes, among other things. Because some landowners in the area had never obtained official property titles or had theirs revoked by INCRA as part of the blacklist, the team also began to geocode property boundaries and help landowners apply or reapply for their rural property registration certificates. The certificate required a more precise measurement of property boundaries than the CAR application did.

Recognizing the need to monitor forest restoration and threats to springs and rivers over time, Alta Floresta's environmental secretariat worked with the ICV to integrate the CAR database with a monitoring system. Matching satellite images obtained from the National Institute for Space Research with the geocoded data and local maps, the secretariat and the ICV built an internal GIS platform and trained employees to use GIS mapping techniques. GIS, short for *geographic information system*, enables users to visualize and analyze data to reveal relationships, patterns, and trends.

Initially, the process of mapping and geocoding of properties, which required physical presence on each property, was inefficient and slow, as secretariat staff waited for individual property owners to grant them access. Duarte and Alesandro divided the team—comprising both newly hired secretariat staff and student

volunteers from the local campus of the state university—into four geographic sectors. Each team began working with community leaders to identify owners of multiple properties and geocode the boundaries of multiple properties at once rather than waiting to make appointments with individual landowners or hoping to find them at home.

The secretariat staff fed the data on property boundaries; topography; presence of streams, ponds, and springs; and level of deforestation into what they called the Integrated System for Monitoring and Environmental Licensing, a tool used at the state level in both Mato Grosso and Pará and disseminated to municipal governments. The computer software could then automatically generate plans for recovery of degraded areas.

Registering properties under the environmental laws

Because the CAR process was initially designed to handle individual registrations rather than a municipality-wide effort, Duarte and Alesandro approached the Mato Grosso State Secretariat of the Environment for support in adapting the process to fit Alta Floresta's needs. For example, the state secretariat required that each landowner travel to the capital of Cuiabá—more than 11 hours by car or an expensive plane ride away—to sign the registration in person. Duarte received permission for officials of the municipality to witness the individual signatures and then forward the registrations to the state capital. Duarte and Alesandro also negotiated lower fees for owners of smaller properties.

As property registrations began, the database and the earlier work to build partnerships and mobilize landowners around the cause quickly paid off. “We started doing the CARs, and we would get 40 people, 50 people, 60 people in line every day,” Duarte said. After team members had mapped the property boundaries and used satellite imaging to

determine the level of deforestation and whether the property had areas of permanent preservation related to springs or rivers, they held most of the data a landowner needed to complete a CAR. Using the state's software system, staff technicians could call up data on an individual property when the owner arrived to complete the CAR and could generate individual restoration plans for owners whose property had more than one hectare of land that needed to be recovered. (Owners of properties that had less than one hectare for recovery were not required to submit formal restoration plans.) The secretariat staff would then forward the registration packet to the state environmental secretariat, which had 60 days to review the application and determine whether it met the requirements to issue a CAR.

Staff from the Alta Floresta environmental secretariat were available during the first year to make site visits as requested and to advise on restoration. They would then visit a property annually to prepare for the state environmental secretariat a technical monitoring report on the progress of planned restoration.

Helping landowners meet their commitments

After registering their properties, landowners still needed technical support to complete any required restoration work. Many degraded springs and riverbanks were in pasturelands, subject to heavy grazing and damaging fertilizers. Brazil's Forest Code at the time required property owners to fence off and preserve all land within 30 meters of springs and riverbanks. Recognizing that protection of the water supply was a public good, the municipal secretariat provided subsidies and technical assistance through the Amazon Fund-supported Guardians (Olhos D'Água da Amazônia) project. The project furnished landowners with 50% of the required fencing materials, supplied seedlings, and provided information about the types of plants needed to restore the land and

about fertilizers safe for use in or near preservation areas. The secretariat also began a small-scale program of payment for environmental services, offering landowners with springs and rivers a token amount of money in exchange for preservation and public recognition of their service.

The team combined seminars on how to restore permanent-preservation areas with education aimed at mitigating the economic losses that resulted from setting aside those pieces of land. The team brought in experts to teach producers how to both restore degraded springs and implement rotational grazing techniques, which few producers in Alta Floresta had used prior to the project. In rotational grazing, livestock are moved periodically among partitioned pasture areas. The process was more efficient and productive because it avoided overgrazing and allowed feed vegetation to regenerate, enabling cattle ranchers to offset reduced grazing land. “The [rotational] technology gave producers a reason to take their cattle away from the riverbanks and springs,” Alesandro said.

Duarte and her team reached out to the federal government’s Brazilian Agricultural Research Corporation to provide support for landowners who wanted to implement rotational pasture systems. “With the implementation of pasture management, we expect to increase productivity to a level at which we can avoid deforestation and add to the producers’ income,” Alesandro said. “Cattle raising here is the driving force of the local economy. Because it was impossible to change that driving force—the pastures—we invested in improvements.”

While working with landowners to improve their existing operations, the secretariat team also encouraged economic diversification. Team members offered workshops on alternative sources of income, such as agroforestry, beekeeping, and fish farming. Some of those activities could be implemented on permanent-

preservation land without harming watersheds and alongside reforestation in the legal reserves. Banana plants, for example, could help reforestation efforts and also provide a cash crop.

The secretariat worked with NGO partners to provide hives and equipment for those who wanted to try beekeeping—in the hope that early adopters could bring other landowners over to the activity. “We’re still in the implementation phase,” Alesandro said. “It’s going to take five to seven years before we have a culture of these bee farms. We’re just trying to encourage a different type of productive chain.”

Duarte and her team recognized that ranchers in the community would respond best to visible results. The secretariat identified 20 ranchers distributed geographically throughout the municipality who were willing to have their land serve as demonstration units in exchange for help in implementing various new agricultural techniques. With technical support from the Brazilian Agricultural Research Corporation, team members worked closely with some of the 20 landowners to implement rotational grazing. The secretariat trained others in beekeeping, and several demonstration units focused on restoration of streams and springs. The secretariat encouraged other ranchers and farmers in Alta Floresta to visit the demonstration sites in various stages so they could learn both the process of implementation and its effects.

Alesandro said those demonstration units had a spillover effect, especially in terms of rotational grazing. “The neighboring producers are trying to copy the technology and expand the system, and the big-business people are now taking their own initiative to adopt the technology,” he said. “We believe that in 6 to 10 years, this technology is going to be spread across the municipality, and those who try to go back to the old ways are going to find it economically unfeasible.”

OVERCOMING OBSTACLES

Duarte and her team continued to register properties throughout 2011 and 2012, focusing primarily on owners of small properties. When discussing her strategy with the ICV, Duarte had said, “Let’s focus on small properties because they are people who need the municipality’s help in order to do the registry,” Micol recalled. “Large properties can do it by themselves, so they don’t need us. They have to do it. Small properties need us.”

Duarte had expected larger producers to comply because they faced greater costs from restricted credit and other penalties. She and her team had also expected the momentum and social pressure of smallholder registrations to help bring larger producers on board. However, in December 2012, near the end of her term, it became apparent that owners of larger properties were continuing to resist registration. Without them, Alta Floresta could not reach the target of 80% participation needed to get off the state blacklist. “They had this mind-set that the CAR wasn’t necessary, that it was just an environmental fad,” Alesandro said.

Puzzled by the recalcitrance of the large landowners—but dedicated to winning them over—Izaura and Duarte visited several of them for informal coffee chats. “We would question them: ‘If everybody is doing it, why aren’t you doing it? Why aren’t you joining the cause?’” Duarte recalled. “We discovered all of the myths that these producers believed: that if they did the CAR and showed what they had done to the land, how much they had deforested, they would be at the mercy of IBAMA and [the State Secretariat of the Environment], that they would be exposed to all these institutions. [Izaura] would laugh and say, ‘You are not well-informed about the purpose of all these efforts.’”

Some large landowners’ resistance reflected uncertainty about national environmental regulations. In 2010, Brazil’s federal legislature began negotiating potential changes to the

Forest Code. Producers’ unions at the state and federal levels demanded reductions in the required legal reserves from 80% to 50% of a property. Some ranchers and farmers expected a relaxation of the environmental regime, encouraged by state-level unions’ withdrawal of support for the CAR process. “[The Mato Grosso state-level unions] said, ‘Stop doing the CAR, because we are going to change the rules, so you should do it later,’” Micol said.

Izaura ultimately had to talk tough. “She said to them, ‘I don’t want to be the one to give your coordinates and all the data I already have on your property to IBAMA,’” Duarte said. It was a difficult choice for the mayor. “IBAMA is more or less like the devil [to ranchers in Alta Floresta]; they fear it,” Micol said. “It took quite some convincing to say, ‘OK, we’re going to request an intervention from IBAMA,’ but it was the only way to finish this work.” Izaura’s decision to invoke the threat of action by Brazil’s environmental enforcement agency enabled her to overcome the general collective-action problem.

Changes in the federal Forest Code ultimately did create a minor problem for Duarte and the secretariat when the revisions reduced the preservation requirement for springs and riverbanks to a distance of 15 meters from the original 30 meters. “We started this campaign by asking people, ‘Do you want water in the municipality?’” Duarte said. “And they always said yes. So we said, ‘If you *need* water, if you *want* water, we have to ask the academicians the radius, the distance to protect, and not follow the government. Fifteen meters is just too small a radius.” Many municipality residents agreed on a case-by-case basis to keep the larger protective distance.

ASSESSING RESULTS

In June 2012, Alta Floresta achieved its primary goal: the Ministry of the Environment’s removal of the municipality from its blacklist. By

then the municipality had registered more than 2,800 rural properties, or 82% of the municipality, under the CAR system and had completed geocoding for more than 3,350 properties. The environmental secretariat also had completed the precise boundary mapping necessary for rural property registration certificates on 1,220 properties. The municipal environmental secretariat and property owners were in the process of reforesting more than 1,700 hectares of land, exceeding the original Olhos D'Água da Amazônia target of 1,200 hectares.⁵

According to the Amazon Fund, Duarte, her team, and partner institutions had provided technical assistance for 5,600 producers, 1,720 of whom had been trained in agroforestry techniques. They estimated that nearly 11,000 people directly benefited from the project, out of a total population of approximately 50,000.

As part of its efforts to improve producer productivity, the secretariat created 20 demonstration units across the municipality for both grassland management techniques and agroforestry. On those properties, producers could graze three cows per hectare of pasture, up from one cow originally. The ICV's pasture-management project achieved similar results.

The trend in deforestation in Alta Floresta from 2002 through 2012 (see Table 1) indicates that the federal government's law-enforcement-based approach in the municipality, which began in 2005, had a greater impact on deforestation within Alta Floresta than the blacklist policy, which began in 2008. Annual deforestation rates dropped by 169.5 square kilometers from 2004 through the end of 2007, and then by an additional 59.8 square kilometers after Alta Floresta was placed on the blacklist. The trend in Alta Floresta reflects the broader pattern across states in the Amazon region. The strong increase in enforcement of environmental laws from 2004 to 2007 contributed more to the overall decrease in

deforestation rates than the policy of targeting municipalities. That said, that the blacklist, combined with strong federal-level monitoring and enforcement, may have helped stave off renewed deforestation during the 2010 drought, by reducing pressure to clear new land.

Furthermore, preliminary analysis by the Climate Policy Initiative-Rio de Janeiro indicated that increased law enforcement scrutiny of blacklisted municipalities had a greater effect on deforestation rates than those municipalities' individual policy responses. "We're seeing through the data that priority municipalities reduce deforestation, but once you take into account the increase in federal monitoring and law enforcement in those municipalities, the effect of priority municipalities' policies is not very high," said executive director Juliano Assunção.

Alta Floresta and its producers regained access to credit and legitimate supply chains for their cattle and other products, but Duarte said the federal government had not followed

Table 1 Deforestation in Alta Floresta, 2002-2012

Year	Annual Deforestation (in <i>km</i> ²)
2002	132.6
2003	126.2
2004	230.9
2005	124.9
2006	97.1
2007	61.4
2008	15.3
2009	7.2
2010	3.0
2011	5.8
2012	1.6

Source: Projeto Olhos d'Água da Amazônia Report, Amazon Fund, as measured by the National Institute for Space Research

through on other initial promises of benefits for leaving the list. “The federal government was very radical in the beginning with this command-and-control policy, and we took action,” Duarte said. “We had this political vision—we’ve changed the situation, our status—but now the government is lenient. There are municipalities that are still on the list, that don’t have this political will, that are not taking any action; and the government is now overlooking the situation. We haven’t seen any results from the Green Arc program. The government is not as strong as it was in the beginning of this program.”

Many of Alta Floresta’s projects required outside technical support and relied heavily on funding from the Brazilian Development Bank through its Amazon Fund. To continue the secretariat’s work on monitoring landowners’ progress in restoring degraded land and on bringing more-efficient and environmentally sustainable production to Alta Floresta, Duarte and her team drafted a proposal to the Amazon Fund for a second phase of the Olhos D’Água da Amazônia project. Approved after Duarte left office in mid 2013, the second phase of the project expanded the preservation targets of the initial project and aimed to implement pasture management, fish farming, bee farming, and agroforestry on larger scales across the municipality. The Amazon Fund pledged 7,182,970 reals (US\$3.04 million at the time) over 30 months beginning in September 2013 to make Duarte’s dream of a “sustainable municipality” a reality.

REFLECTIONS

Alta Floresta’s experience illustrates (1) how a national-level government can shape incentives for local governments to make combatting deforestation a policy priority, (2) the importance of a clear and concrete policy map from the federal government to achieve that goal, and (3) how local governments can

help area ranchers and farmers make forest conservation economically sustainable over time.

Simply looking at short-term outcomes, the federal government’s first wave of law enforcement and monitoring-based policies from 2004 to 2007—known in environmental policy circles as command-and-control policies—had a greater impact on Amazon region deforestation rates themselves than the municipal blacklist. The blacklist, however, passed responsibility for environmental issues and compliance to municipal government, making it the local government’s responsibility to determine both how to get municipal landowners to meet environmental licensing standards in the short term and how to make meeting those standards economically feasible for the municipality in the long run. Though federal environmental law enforcement first came to Alta Floresta in 2005—with severe economic consequences for many area businesses—until the federal government devolved responsibility to the municipality and set a clear objective to exit the blacklist, the town took no steps to change its model of production.

By placing Alta Floresta on the list, the federal government shifted responsibility to the municipality not only to stop deforestation and restore degraded land but also to figure out how to remain economically viable once deforestation was off the table. By making the supply chain of slaughterhouses, supermarkets, and transportation companies, among others, responsible for the environmental practices of its sources, the federal government also made environmental sustainability a necessary part of business calculations. Rethinking the relationship between agriculture and the environment and changing production models was essential for a sustainable solution to deforestation.

“We had enormous financial losses from the Arc of Fire operation,” said Celso Bevilaqua, head of the Alta Floresta Rural Union, which

represented many area ranchers and farmers. “But looking on the bright side, it also contributed to the adaptation of the region to the new requirements that had to be met. From that point on, we had to be more sustainable. We had to work on cattle-ranching processes that were sustainable and on agricultural practices that were sustainable, and we had to recover and restore the area that had been destroyed and preserve the areas that are still there.”

The use of the rural environmental registration (*cadastro ambiental rural*, or CAR) provided a framework to (1) help landowners understand their responsibilities under Brazil’s environmental laws, (2) monitor individual compliance, and 3) begin systematic restoration of illegally deforested private land, riverbanks, and springs. “Now it’s easy for us to talk to producers and have them understand that the environmental side is also part of their business,” said Jose Alesandro Rodrigues, who served as project coordinator.

“We made the productive chain a strong part of the environmental conversation,” said Irene Duarte, Alta Floresta’s first secretary of the environment. “The production segment and the environmentalists had their backs to each other, but now that they’re in conversation, things were made possible.”

The Olhos D’Água da Amazônia project and the CAR system also set forth concrete goals that united the municipality’s producers with local nongovernmental organizations (NGOs) and environmentalists. Previously NGOs and producers had been at odds; “now they are able to introduce and implement their interests together,” Bevilaqua said. “Bringing agriculture and the forest together makes preservation with new technology much more productive.”

Without the ability to reduce costs and offer other assistance whereby landowners could complete the CAR process, Duarte and her

team likely would not have been able to solve their collective-action problem. To that end, Alta Floresta’s municipal government relied heavily on local, state, and national NGOs and federal government institutions for financial support, strategic guidance, and technical expertise.

Alta Floresta also benefited from favorable external conditions. Compared with some of the other municipalities on the list, Alta Floresta’s relatively short history of settlement meant it had mostly clear and well-documented land tenure, sparing it the often conflict-ridden process of determining legal ownership before a property could be registered. The timing of the 2010 water crisis also underscored the otherwise abstract long-term environmental consequences of continued deforestation.

Alta Floresta’s success in persuading rural property owners to complete the CAR process, begin restoration of their legal reserves, preserve watersheds, and explore alternative methods of production relied heavily on the stability of federal environmental law enforcement. The credit restrictions, the raids, and the threat of future consequences were essential to motivate both the municipal government and individual landowners to participate in the process. When federal policy appeared unstable, as Brazil’s national legislature began considering changes to the federal Forest Code, Duarte had difficulty persuading larger landowners to participate in the CAR—despite the fact that they had more to gain from renewed access to credit than their smaller-scale counterparts. Were the threat of law-enforcement raids ultimately not credible, Duarte and the municipal secretariat would likely have been unable to persuade many landowners to participate.

The strength of federal environmental law enforcement could easily wane under a new presidential administration. If that happened, it would take with it certain short-term gains against deforestation due simply to the threat of

punishment. Pressure from Arc of Fire operations and the blacklist galvanized producers to complete the CAR process, but as that pressure disappeared, so did the environmental secretariat's momentum in completing registrations. In 2014, the municipality's CAR registrations remained around 85% of all privately held land—well short of Duarte's 100% target. Duarte said it was likely due to (1) changing priorities in a new mayoral administration, (2) technical problems, and (3) resistance from the remaining landowners, but waning federal enforcement played a role. "One reason is the inefficiency of the Ministry of the Environment, because all they have to do is come here and fine people who aren't doing it," she said. "They have all the data."

Changing how producers operated in Alta Floresta, however, had the potential to stabilize a lower-deforestation equilibrium. Such stability, though, would require widespread adoption of rotational pasture-management systems or alternative livelihoods. In 2014, the municipality had not yet reached that goal.

In mid 2014, efforts to increase productivity on existing pasture land or develop alternative sources of income such as agroforestry, bee farms, and fish farms were limited to a few properties in Alta Floresta. The Center of Life Institute (Instituto Centro de Vida, or ICV) had begun a second project in the municipality to encourage adoption of rotational pasture and other more-efficient cattle-raising techniques, after demonstration units had become able to increase stocking rates from one cow per hectare to three. The municipal government was uncertain whether all area

producers would adopt a rotational pasture system. As long as it had degraded pasture to restore or until it could expand economically through increased productivity and donors willing to subsidize new technology, the municipality could offset limits on economic expansion through continued deforestation. It was unclear how the municipality would cope once it reached the limits to yield expansion on its already cleared land.

Before Duarte left office, she hoped to persuade residents of Alta Floresta to pledge to implement a Green Municipality program, which would commit the municipality to a sustainable development strategy. Ultimately, the effort failed when producers became skeptical about whether the program would be friendly to their interests. "It was this idea of having a sustainable municipality," she said. "This is a dream of mine, and I feed that dream. The environmental work has been done. Now we would require a change in the way we produce things, apply sustainable cattle-raising practices, and diversify agricultural production on an ecological basis: using sanitation and instituting better solid-waste treatment. If we have a plan covering what the city could be like in 20 years and if there is this agenda, if future administrations follow this agenda, I think it's possible."

When Duarte left municipal government at the end of 2012, she joined the ICV. As of mid 2014, she was working to make a sustainable municipality program a reality across the Amazon region.

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