

How jaguars are actually stolen: big cat conservation and the green extractivism nexus in the Yucatán Peninsula, Mexico

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Abstract

This article explores the seemingly unlikely intersection of jaguar conservation and green extractivism in the Yucatán Peninsula, Mexico. The 'green' or environmental aspect of jaguar conservation, we argue, is largely manufactured, employing the qualities of ecosystems to market and advance forms of 'place-based' extraction. Analyzing jaguar conservation programs through green extractivism not only shows problems related to market-based conservation schemes, but how these conservation projects advance spatial legibility of resources and political control over territories for public and private actors, aiding capitalist and extractive trajectories. Drawing on fieldwork in Laguna Om, an *ejido*—rural community—in the south of the Peninsula, the article reveals how an entanglement of market-based instruments (MBIs), voluntary carbon markets, NGOs, corporate financing, environmental policy, and technological developments continue to consume ecosystems into circuits of capitalist control and accumulation. Finally, the article demonstrates, jaguar conservation serves to greenwash traditional extractive and infrastructural development projects, such as Tren Maya. Digitalized and market-based forms of conservation, moreover, reduce ecosystems to units of accounting that are fit for trade in international markets, advancing the capture and accumulation of value through conservation, enacting a process of green extractivism.

Keywords: Mexico, Jaguar conservation, megaprojects, infrastructure, colonization, climate change

Resumé

Cet article explore l'intersection apparemment improbable de la conservation des jaguars et de l'extractivisme vert dans la péninsule du Yucatán, au Mexique. L'aspect "vert" ou environnemental de la conservation du jaguar est, selon nous, largement fabriqué, utilisant les qualités des écosystèmes pour commercialiser et promouvoir des formes d'extraction "basées sur le lieu." L'analyse des programmes de conservation du jaguar à travers l'extractivisme vert ne montre pas seulement les problèmes liés aux plans de conservation basés sur le marché, mais aussi comment ces projets de conservation favorisent la lisibilité spatiale des ressources et le contrôle politique des territoires pour les acteurs publics et privés, ce qui favorise les trajectoires capitalistes et extractives. S'appuyant sur un travail de terrain à Laguna Om, un *ejido* (communauté rurale) dans le sud de la péninsule, l'article révèle comment un enchevêtrement d'instruments basés sur le marché (MBI), de marchés volontaires du carbone, d'ONG, de financements d'entreprises, de politiques environnementales et de développements technologiques continue de consommer les écosystèmes dans des circuits de contrôle et d'accumulation capitalistes. Enfin, l'article démontre que la conservation du jaguar sert à blanchir les projets traditionnels d'extraction et de développement d'infrastructures, tels que le Tren Maya. Les formes de conservation numérisées et basées sur le marché réduisent en outre les écosystèmes à des unités comptables adaptées au commerce sur les

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marchés internationaux, favorisant la capture et l'accumulation de valeur par le biais de la conservation, mettant en œuvre un processus d'extractivisme vert.

Mots-clés: Mexique, conservation des jaguars, mégaprojets, colonisation des infrastructures, changement climatique

Resumen

Este artículo explora la aparentemente improbable intersección entre la conservación del jaguar y el extractivismo verde en la Península de Yucatán, México. El aspecto "verde" o medioambiental de la conservación del jaguar, argumentamos, es en gran medida fabricado, empleando las cualidades de los ecosistemas para comercializar y promover formas de extracción "basadas en el lugar." El análisis de los programas de conservación del jaguar a través del extractivismo verde no sólo muestra los problemas relacionados con los esquemas de conservación basados en el mercado, sino cómo estos proyectos promueven la legibilidad espacial de los recursos y el control político sobre los territorios para los actores públicos y privados, continuando las trayectorias capitalistas y extractivas. Basándose en trabajo de campo realizado en Laguna Om, un *ejido* del sur de la Península, el artículo revela cómo una maraña de instrumentos de mercado, mercados voluntarios de carbono, ONG, financiación empresarial, política medioambiental y avances tecnológicos siguen introduciendo ecosistemas a circuitos de control y acumulación capitalista. Por último, el artículo demuestra que la conservación del jaguar sirve para maquillar de verde los proyectos tradicionales de desarrollo extractivo y e infraestructura, como el Tren Maya. Además, las formas de conservación digitalizadas y basadas en el mercado reducen los ecosistemas a unidades contables aptas para el comercio en los mercados internacionales, lo que fomenta la captura y acumulación de valor a través de la conservación e impulsa un proceso de extractivismo verde.

Palabras Clave: México, conservación del jaguar, megaproyectos, colonización por infraestructura, cambio climático

1. Introduction

"They are taking the jaguars, God dammit! That is the truth!"² exclaimed an *ejidatario* during a chat in his backyard. He was certain biologists working on jaguar conservation were also capturing jaguars (*Panthera onca*), transporting them out of the *ejido* and, presumably, selling them for a profit. Rumors spread with detail: the conservationists, rumors said, had supposedly accomplished jaguar theft with a helicopter and a cage. Someone had seen a cage on the side of the road. Others claimed biologists had sedated the big cats and put them in the back of a pickup truck. There were apparently 'credible sources' that saw everything. People used the reduction of jaguar populations to reinforce these beliefs. "They are taking them, that's for sure. Why else would they give no information about their dealings in the forest? When someone refuses to tell you what they are up to, you know something is wrong," said another *Ejidatario*.³ Rumors circulating, dividing, confusing, and intensifying political tensions were in full effect (e.g., rumorologia). These conspiracy theories were frequent, voiced in different settings and by different people. In Laguna Om, an *ejido* located in the state of Quintana Roo on the Yucatán Peninsula, Mexico, it was a popular conversation topic. And although the rumors signal a profound distrust of scientists, capturing the animals is highly unlikely. The residents, however, were onto something: the big cats *are* being sold. The jaguars are counted, marketed, and traded in a way that does not require helipads and cages, but instead blockchain, digital applications and companies willing to integrate them into their environmental remediation schemes.

This article explores the seemingly unlikely intersection of jaguar conservation and green extractivism. We define green extractivism broadly – as the various quantitative sectoral expansions and the qualitative intensification of political control, nature commodification, marketization & kinetic (or vital) energy extraction in the name of being "green," "clean," "renewable" and "sustainable." Said differently, green extractivism advances capital accumulation and state control by wedding extractivism to 'green' claims. The 'green' or environmental aspect, we argue, is largely manufactured, or it means employing the qualities of ecosystems to market them and advance vital, symbolic or forms of 'place-based' extraction. Analyzing jaguar conservation programs through green extractivism not only illustrate problems that result

² Field notes, 16-09-2021.

³ Field notes, 19-10-2021.

from market-based conservation schemes, but how these conservation projects advance the spatial legibility of resources and political control over territories for public and private actors. They aid capitalist and extractive trajectories. The case below demonstrates how jaguar conservation advances green extractivism by interacting with voluntary carbon markets, and how it becomes an accomplice of greening large-scale and explicitly extractive projects, like the Tren Maya rail project.

The article draws on fieldwork conducted between September 2020 and January 2021 in Laguna Om, an *ejido* – rural community – of 3,650 people in southeast Mexico. Field work, moreover, was also complemented by follow up and online interviews carried out at a distance until February 2022. Laguna Om is located 50 km from the border with Belize and almost adjacent to the Calakmul Biosphere Reserve (CBR), a region that is home to the largest remaining jaguar population in the country (Figure 1, 2; Ponce & Ceballos 2017). Despite recent studies recording an increase in jaguar numbers the big cats have been pushed into isolated forest areas, jeopardizing the long-term viability of the species. There are around 4,800 in Mexico (Ceballos *et al.* 2021) threatened by habitat loss and fragmentation, retaliatory killing by locals, reduced abundance of their natural prey, and diseases transmitted by domestic animals (Ceballos *et al.* 2021). Laguna Om has a total territory of 84,998 hectares, 35,000 of which are registered, since 2019, as a Voluntary Conservation Area (VCA) (Sosetec 2018) (Figure 3). Together with neighboring *ejido* Nuevo Bécál, which also has a VCA, it makes up the largest community-owned jungle massif in the Yucatán Peninsula. Laguna Om's main population center is Nicolas Bravo, a village that sits on the federal highway that crosses the Peninsula from east to west. The highway serves as the main infrastructural axis in the region and Tren Maya is planned to run parallel to it.



Figure 1: Map of Mexico marking the Yucatán Peninsula. Source: Google Maps

Fieldwork in Laguna Om region employed participant observation, and informal and semi-structured interviews. Participant observation took place within the *ejido* assembly, and at carbon credit and forest management project information meetings. This included participating in community surveillance trips to the *ejido's* forest area, to an ecology field research station, and with agricultural and communal work dedicated to the maintenance of public spaces (*fajinas*). Participation also took place in more intimate settings such as at religious events, rendezvous at local eateries (*fondas*), baseball games, Alcoholics Anonymous meetings, and casual gatherings in participants' homes. Informal chats in these places resulted in over one hundred informal interviews. Field notes were recorded chronologically, first jotted in notebooks and then re-written on computer files, encrypted, and uploaded to a secure server. Informal

interviews were complemented with sixteen semi-structured interviews, which were carried out with two members of local governing bodies, three local conservation groups, an academic/researcher born in Laguna Om, three current and former employees of jaguar conservation programs, three cattle ranchers affected by jaguar predation, a local youth leader, and three external conservation experts. Interviews were audio recorded and transcribed for thematic analysis if permission was granted, or recorded in writing. The anonymity of research participants is maintained throughout the text by providing a general description (woman, man, civil servant) or pseudonyms for research participants.



Figure 2. Planned route for Tren Maya and federal conservation areas in the Yucatán Peninsula. Sources: GeoComunes and Rosa Luxemburg Stiftung 2021, modified by the authors

The next section provides an overview of political ecology literature on the intersection of conservation and extractive development schemes. It defines and explores the concepts of green extractivism and infrastructural colonization, to illustrate how extractive development projects become a colonizing force that subsumes ecosystems into circuits of capitalist control and accumulation. The article continues by presenting the history and structure of Mexican rural collectives known as *ejidos*, reviewing the history of land tenure in the Yucatán Peninsula. We contextualize the arrival of the Tren Maya megaproject into the area, which integrates jaguar conservation into its larger politico-economic project. Next, we show how jaguar conservation schemes operating in Laguna Om advance extractive processes in two key instances. In their current form, jaguar conservation programs operating in the *ejido* are employed to advance the extraction of resources and value, extending to aiding infrastructural expansion in the area.⁴ Simultaneously, market-based conservation schemes, such as voluntary carbon markets, and their

⁴ Other programs in the region, for example, in the adjacent Calakmul Biosphere Reserve, are carried out by organizations this article does not review and may be structured differently.

interaction with blockchain technology reinforces a type of green extractivism that hinges on making habitats and jaguars legible for value capture and exploitation.

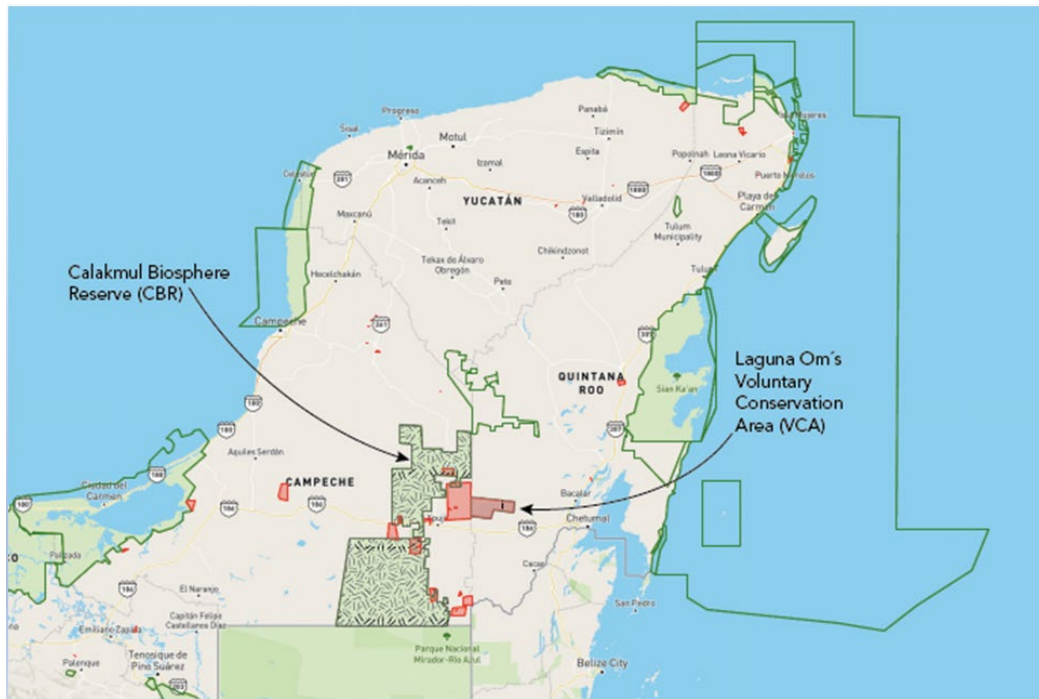


Figure 3: Conservation areas in the Yucatán Peninsula, highlighting the Calakmul Biosphere Reserve and Laguna Om's Voluntary Conservation Area (VCA). Semarnat (2022), modified by the authors.

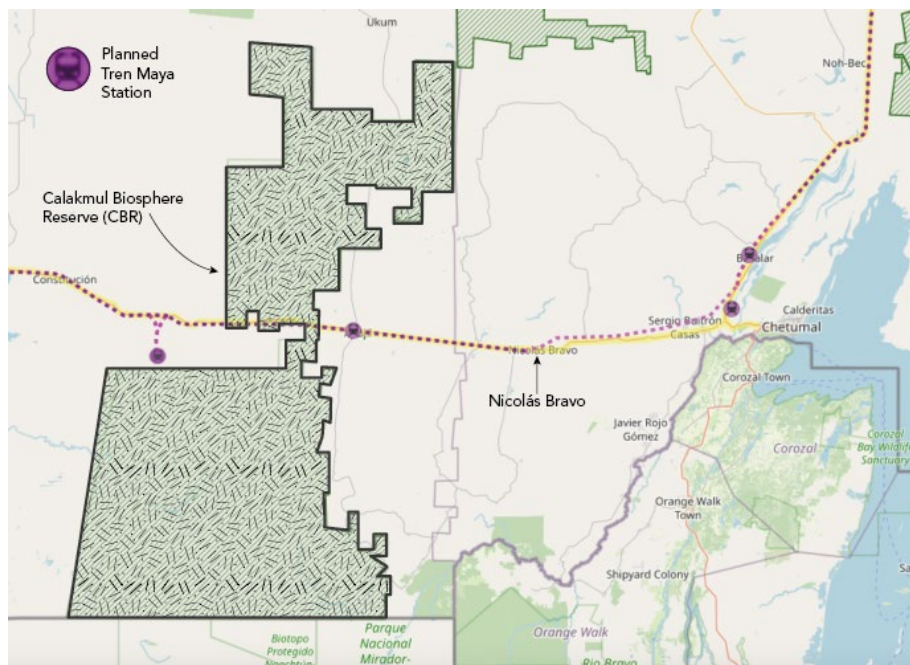


Figure 4: Close up to the Tren Maya rail route in the area of study. The dotted line marks the projected train tracks, running parallel to the existing federal highway (yellow). GeoComunes and Rosa Luxemburg Stiftung 2021, modified by the authors

2. Laguna Om: Land privatization, jaguars & Tren Maya

Today, approximately 52% of Mexico — including around 70% of waterways and 80% of forest areas — belongs to *ejidos* (Cámara de Diputados 2015). An outcome of the land redistribution process that started after the 1910 Mexican Revolution, *ejidos* emerged as communally held land governed by agrarian communities (Candelas-Ramírez 2019). Within these communities, each individual *ejidatario* has the right to a plot of land — 100 hectares in the case of Laguna Om — where they can grow crops or carry out any other economic activity permitted by the community's internal law. Communal work known as *fajinas* is done collectively for the benefit of the entire community (Torres-Mazuera 2014). *Ejidatarios* have voting rights in the Assembly, the center of communal authority within the *ejido*, where all land management decisions are collectively made. Landholders also vote every three years to elect the local *comisario* (e.g., the secretariat, and the treasurer) and council. Together they form the *comisariado*, the main representative body of the *ejido*, and are in charge of negotiating policies with agrarian authorities, mediating conflicts with neighboring *ejidos*, procuring and negotiating cash transfers with state and federal governments, and administering monetary support coming to the *ejido* via government programs.

The territory of Laguna Om is divided into two main areas: agricultural land and the Permanent Forest Area (see Figure 5). The first is composed of parcels for individual economic use, an urban area, and other allocated plots, such as a communal greenhouse, a cemetery, and other collective structures. Following a forestry policy package that began in 1983, the Permanent Forest Area, 35,000 hectares of jungle, is an area that must maintain tree cover to be eligible for state-certified wood extraction (Macario 2020). There are 485 *ejidatarios* in Laguna Om. Forestry activities are collectively managed, which means the income derived from wood and other byproducts is evenly distributed among all *ejidatarios*. Also, Laguna Om and other *ejidos* that share similar conditions have close relationships with the National Forestry Commission (Conafor), which dictates rules for forestry activities, selectively permitting logging, and managing subsidies for sustainable resource management and other environmentally related activities.

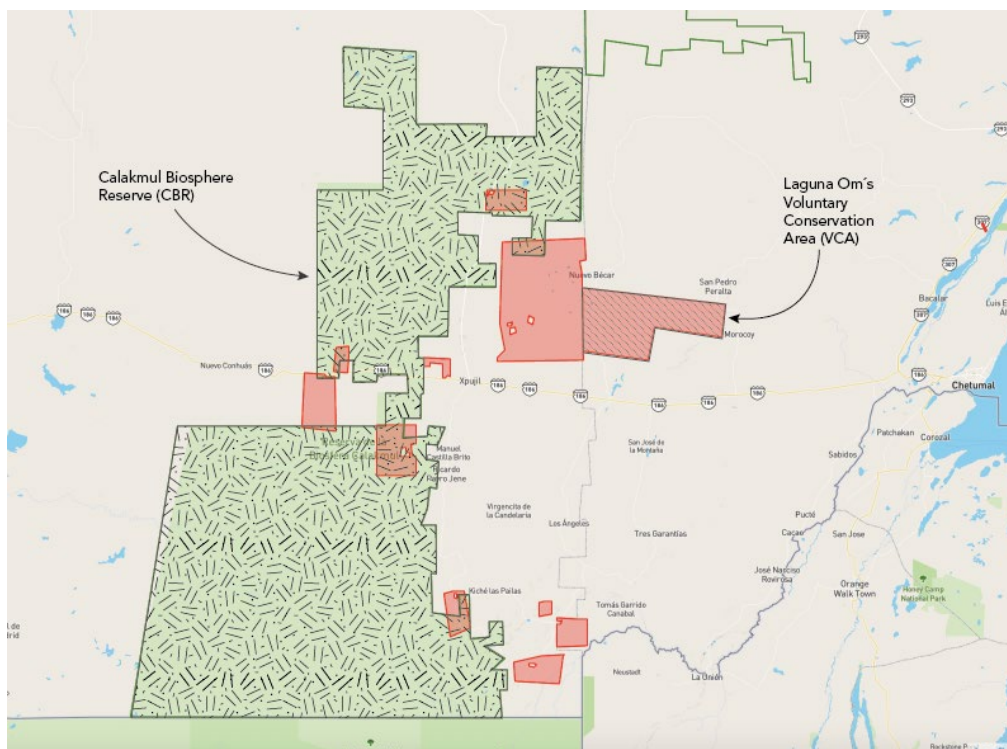


Figure 5: Close up to the Calakmul Biosphere Reserve and Laguan Om's VCA. Semarnat (2022), modified by the authors

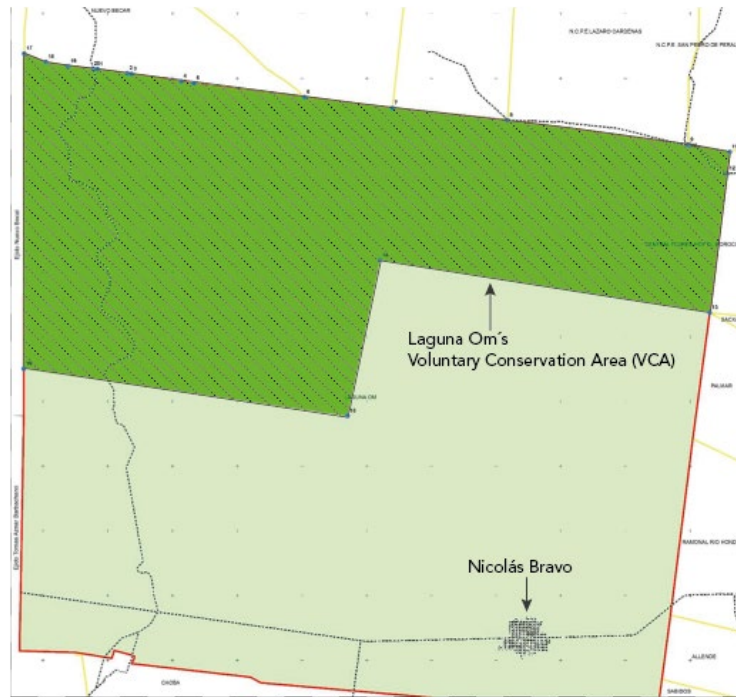


Figure 6: Polygon of the *ejido* Laguna Om, including its VCA, agricultural land (light green) and its main population center, Nicolás Bravo. Sosetec 2018, modified by the authors

Forestry was the primary economic activity in Laguna Om from the 1970s to the early 2000s (Macario 2020). In the 1970s, "the natural abundance of precious woods in Laguna Om's jungle allowed the processing of up to 3,000 m³ per year during the 1980s, creating a flow of cash that made the population prosper" (Macario 2020, 9). However, in 2009, after decades of overexploitation, the *ejido* decided to halt all forestry activities and allow timber species to recover. The forest had lost most of its commercially valuable trees and revenue from timber extraction had plummeted – that year, each *ejidatario* received a meagre US\$75 from timber sales (Macario 2020). Forestry restarted in 2020, and now Conafor aims to ramp up timber production in the region via a program that allows forest *ejidos* to access growing subsidies as they increase logging volumes.

Although cattle ranching is currently the main source of income in the *ejido*, there are only about 80 ranchers in the community (Macario 2020). Three ranchers have modern machinery like tractors, irrigation systems, and employ milking machinery. About a dozen more have a medium level of mechanization, while the rest practice small-scale herding (Macario 2020). The main economic activity after cattle ranching is small business activity – anything from rustic eateries to modest hairdressing shops – followed by the transportation sector as well as a sugar cane plantation controlled by a small group of *ejidatarios* (Macario 2020). According to interviews, many more make a living as *jornaleros*, day laborers, who work for low-paid daily wages on farms or forage for thatching hay. Others work in nearby cities, such as the state capital Chetumal, accessed by the federal highway, or are employed irregularly in the tourist and construction industries. Laguna Om and other neighboring *ejido* also use the tropical forest landscape for diverse purposes, including traditional agroecological farming (e.g., the *milpa* crop system), subsistence hunting, extraction of rubber (*Manilkara zapota*) and small-scale fishing in lagoons and streams (Ramírez & Ibarra 2015).

Neoliberalization, conservation, and megaprojects in Laguna Om

Starting in 1982, the national government pursued a series of market-oriented policies that reached a high point in 1992, when the government of President Salinas de Gortari modified Article 27 of the constitution to allow the privatization of *ejidos* (Osborne 2013; Stephen 1994). Through the Program for

Certification of *Ejido* Land Rights (PROCEDE),⁵ communal land, held for over fifty years, could subsequently be divided into parcels, converted into private property, and then sold, rented, or traded. The strategy aimed at encouraging investments to generate economic growth by putting rural areas in the hands of the free market (Barsimantov *et al.* 2009). As markets became liberalized, policies supporting agrarian production, such as Procampo, were reduced and refitted for poverty alleviation, creating rural societies highly dependent on government subsidies (Peña-Azcona *et al.* 2021; Merino-Pérez 2004). When the North American Free Trade Agreement (NAFTA) was signed in 1994, Mexican farmers were practically devoid of state support and had to compete with highly industrialized and subsidized North American farmers. Consequently, Canadian wood inundated the market, as did cheaper crops from the US. Rural income declined and food dependency skyrocketed (Merino-Pérez, 2004; Audrey *et al.* 2003). In Laguna Om, government support for growing corn and beans disappeared, with state-guaranteed minimum crop prices. Imported maize made its way to local markets, slashing the competitive capacity of local producers and even the need to continue traditional slash and burn agriculture for subsistence (Macario 2020). Even household-scale production declined as convenience stores began to offer packaged foods (Macario 2020).

Conservation also took on an economic logic. The federal government, in 1996, modified the General Law of Ecological Equilibrium (LGEEPA), allowing "...community landowners and *ejidos* to freely associate with private capitals to preserve natural resources when their mutual interests converged" (Peña-Azcona *et al.* 2021, 114). This led to the creation of Voluntary Conservation Areas (VCA), community reserves that, on paper, permitted "indigenous peoples, social organizations, and other public or private associations to freely allocate land for ecosystem and biodiversity conservation." Other supplementary mechanisms such as Payments for Ecosystem Services (PES) further encouraged the flow of private capital towards conservation and allowed corporations to (theoretically) compensate for their environmental damage (García-Frapolli 2015). This allowed a marriage between private, but also public, capital and conservation (Peña-Azcona *et al.* 2021), turning costly international environmental commitments into an economic opportunity.

Privatization of *ejido* land has been the cornerstone of development in the Yucatán Peninsula. Starting in 1992, an intricate network of powerful private investors and civil servants drove a process of dispossession that, according to Gabriela Torres-Mazuera (2021, 4), aimed to "capture communally owned land at a low price and by any means, legal or illegal." Until 2019, some 355,304 hectares had been parceled and appropriated by government and private actors, enabling real estate, agro-industrial, energy, infrastructure, and tourist growth in the region (Torres-Mazuera 2021, 4). The so-called sustainable development plans for Quintana Roo resulted in severe ecological impacts. Recreational tourism, aquaculture, port activities, and wastewater discharge from growing urban settlements and hotel zones have severely damaged underground aquifers (Maldonado *et al.* 2010). Coastal landscape transformation due to tourist development has extensively deteriorated coral reefs and other underwater ecosystems (Rioja-Nieto & Álvarez-Filip 2019). Soy monocultures caused widespread deforestation (Torres-Mazuera 2021). Between 2011 and 2018, Quintana Roo had the highest deforestation rate in the country, losing 90,326 hectares of tropical forest, primarily in the area close to the border with Belize, due to agribusiness expansion (CCMSS 2019). Sustainable development activities have poorly demonstrated their capacity for creating ecological sustainability.

President Andrés Manuel López Obrador (AMLO) extended this trajectory of land privatization and capitalist development in southern Mexico by promoting ambitious megaproject corridors in Oaxaca and the Yucatan. In the Yucatán Peninsula, the government and private investors are building the Tren Maya, a 1,500 km passenger and freight railway line that will connect five states and "detonate sustainable development" (Gobierno de México n.d.) by promoting solar projects, agroindustry, tourism, and real estate development (Sánchez *et al.* 2019). The project aims to reshape social land tenure (GeoComunes *et al.*, 2020), activate financial instruments for property development (González 2020), assimilate predominantly Indigenous territories into 'eco' tourism plans (Moya-Aguilar 2020), and "incentivize economic development in areas and regions that are not yet integrated to economic and tourist circuits" (Grupo de Análisis Ambiental 2020; see also Tornel 2023, *this issue*). The Federal Government, furthermore, enacts this sustainability by integrating jaguar conservation into the Tren Maya project.

⁵ Programa de Certificación de Derechos Ejidales y Titulación de Solares.

State developers claim that not only will the train avoid fragmenting jaguar habitat, a major threat to the species (Roques *et al.* 2016), but it will mitigate the project's impacts by reconnecting the landscape through wildlife crossings and the expansion of protected areas (Rangel 2022). The National Alliance for Jaguar Conservation (ANCJ n.d.), a coalition of academics, NGOs, government agencies, and private investors that attempt to articulate "large-scale sustained actions" to save the jaguar from extinction, has cooperated with the state National Tourism Fund (FONATUR) to develop environmental mitigation strategies. Further, The Group of Technical and Operative Assistance (GATO) will run a "biocultural and scientific project" that aims to reintroduce rescued jaguars to their habitat using seven special environmental management units located along the railway line (Gobierno de México n.d.). Overall, the national government maintains that Tren Maya improves, if not 'corrects,' the "environmental irresponsibility" of previous administrations and puts sustainability at the forefront of development strategies (Fonatur 2021). Jaguar conservation actors, among them the ANCJ, see the train as an opportunity to organize development, minimize damage, and capitalize on the so-called "unprecedented interest" in environmental conservation from the federal government (Rangel 2022). The train's pledge to sustainability largely rests on saving the last Mexican jaguars. Critical researchers, however, have argued that the train endangers the most important jaguar population in the country (Dominguez 2019), highlighting the countless harms that infrastructure, land-use change, and urban expansion will have on the species (Marín & Cafaggi 2020). These criticisms remain ignored, instead further promoting neoliberal jaguar and other conservation schemes.

Other compensatory strategies have been deployed to 'mitigate' Tren Maya's environmental impacts. Payments for Ecosystem Services (PES) and Voluntary Conservation Areas (VCA) are promoted by the Ministry for the Environment and Natural Resources (Semarnat) and subsidiary agencies to propel "community participation, development, territorial reordering, and conservation" along the railway line (Quadratín 2021). Simultaneously, carbon credits are booming in the area, impelled by Tren Maya development (Vázquez 2021) and by a global carbon market that reached an all-time high in 2021 (Ecosystem Marketplace 2021). Although carbon credits are not new in the region, recent years have seen more *ejidos* entering offset agreements (Castro 2020b). In 2021, Laguna Om signed an agreement with Toroto, a Mexican nature-based solutions company, for the certification and commercialization of carbon credits in their community reserve — 35,000 hectares of dense jungle. Other schemes such as wetlands banking and 'blue carbon' offsets are planned to accompany the construction of the train to mitigate its impact. Infrastructure development is thus entangled with conservation strategies, which seek "the proliferation of green economy projects" along the tracks of Tren Maya, such as "renewable energy, ecotourism, organic farming and carbon capture" (Comisión Asuntos Frontera Sur 2019, 46). Other programs such as Sembrando Vida, a reforestation and rural development scheme, are also active in the region. Sandoval (2020) shows how Sembrando Vida is deployed along the Tren Maya route to encourage consent for infrastructure among rural communities. And while Sembrando Vida is active in Laguna Om, it is not a conservation program. It is enacted separately from jaguar conservation and, unlike Tren Maya, does not attempt to integrate jaguar conservation into its plans. Green economy projects and jaguar conservation strategies, nonetheless, are designed to offset the harms resulting from new infrastructure, thus enabling and justifying the expansion of so-called sustainable megaprojects that, as we will see, further threaten jaguars, their habitats, and corresponding existences that share the jungle with them.

3. The political ecology of green extractivism

Jaguars are undergoing a commodification process to integrate—and extract—they into financial circuits. This process is intimately related to politics of land control, infrastructural development, and digital and green extraction, which remain enduring topics within political ecology. The 'neoliberal natures' literature reveals how conservation enclosures rely on the myth of "pristine nature" (Dunlap & Fairhead 2014), viewing all humans as separate from nature and as a degrading force. While this myth has been debunked (Fairhead & Leach 1996; Sullivan, 2006; Erickson, 2008), this perspective has justified protectionist, or 'fortress', conservation initiatives predicated on dispossessing Indigenous inhabitants from their land and further militarizing landscapes and generating socio-ecological insecurity (Brockington & Duffy, 2010; Büscher & Fletcher, 2018; Verweijen & Marijnen 2018; Marijnen *et al.* 2021). This protectionist conservation approach, under substantial criticism, led to various community-based strategies seeking to integrate local inhabitants into conservation projects, eco-tourism schemes and, overall, capitalist accumulation strategies predicated on "selling nature to save it" (McAfee 1999; Fairhead *et al.* 2012;

Cavanagh & Benjaminsen 2017). Payments for ecosystem services (PES), Reduced Emissions from Deforestation and Forest Degradation (REDD+) and other market-based instruments (MBIs) are emblems of this approach and have resulted in slower long-term dispossession through enclosure, territorial restrictions, underemployment, uneven benefit sharing and, overall, displacing socio-ecological traditions in favor of capitalist developmental pathways (Benjaminsen & Bryceson 2012; Dunlap & Sullivan 2020). Market-based instruments render nature legible to global trade by recasting it as a collection of marketable services, thus integrating biodiversity, forests, watersheds, and fauna into transnational capitalist circuits to overcome capitalism's environmental damage while satisfying its need for constant expansion (Büscher *et al.* 2012; Sullivan, 2017). Conservation, Büscher & Fletcher (2015, 283) argue, is so integral to the world economy that it potentially ushered in "a new 'phase of capitalism' as a whole, imbued with a productive form of power that shapes new joint environmental and accumulation possibilities." The literature on neoliberal natures demonstrates how conservation affirms state territorialization and economic accumulation by applying economic and financial schemes over forests, animals and, when they are included, people.

This work can be read as a branch of green extractivism research, as it documents the extraction of value and capital accumulation from ecosystems. Few authors, however, explicitly frame neoliberal conservation and natural capital markets this way. Rosaleen Duffy (2002), according to Büscher & Davidov (2013, 6),⁶ conceptualizes ecotourism as a form of resource extraction. Drawing on Marx, Duffy (2015, 532) explains that "capitalist production requires extraction of surplus from labor and nature," which she reveals is exactly what nature-based tourism accomplishes with varying intensities. Ecological Marxist James O'Connor (1988, 8), whose research inspired neoliberal natures research, reminded us: "over time, capital seeks to capitalize everything and everybody." While this resonates with ideas of "total extractivism" (Dunlap & Jakobsen 2020), Büscher & Fletcher (2015, 292) describe how conservation in particular is organized as a "strategy of capital accumulation along the same lines as commodity extraction and industrial processing." Enclosing, commodifying, placing an economic value and integrating so-called ecosystem services into economic and financial networks emerges as a form of "place-based extractivism." Place-based extractivism, unlike an open-pit mine, does not physically exterminate an ecosystem. Instead, ecosystems are disciplined, counted, managed and/or mined to generate value and accumulate capital. "[E]xtraction does not have to be deterritorialized," as Büscher & Davidov (2013, 6) explain, "resources are often literally extracted from local eco-social context when they are redefined within frames of power, discipline, and control that strictly curtail and re-regulate other uses and/or access." This place-based extraction, Büscher & Davidov (2013, 8) continue, "is no coincidence but a fairly logical extension of trying to squeeze more value out of every inch of planet Earth and its inhabitants."

While conservation is expressed as green extractivism, it also remains intimately connected to conventional extractivism. Büscher & Davidov demonstrate the "ecotourism-extraction nexus," which positions ecotourism as a tool for mining companies to "maximize profits by combining two lucrative development industries" (2013, 2). Political ecologists have been instrumental in debunking (green capitalist) offsetting schemes attempting to justify uranium mining (Sullivan 2013b), coal mining (Brock 2020), ilmenite mining (Seagle 2012; Huff & Orengo 2020), hydroelectric dams (Marijnen & Schouten 2019) and many other schemes claiming to be 'green' and ecologically sustainable (Büscher & Davidov 2013; Le Billion 2021). Meanwhile, Philippe Le Billion (2021) provides an instructive four-point conservation-mining typology that shows how conservation and mining companies are further attempting to "green," "decarbonize" and promote ethical—and effective—businesses by deploying digital technologies in their operations. Digital technologies—and specifically blockchain—have further emerged as industry solutions in conventional and green industries. So-called transparency initiatives, Le Billion & Spiegel (2022, 771) show, "intentionally" hide and exacerbate "economic exploitation, inequalities, physical and psychological toll, and racialization" as well as ecological impacts "for the sake of legitimacy of the schemes, but also to maintain hegemonic power in the mineral supply chains themselves." Filipe Calvão & Matthew Archer (2021, 2) call this "digital extraction," which "attunes us to the way digital technologies are deployed to extract value in global supply chains, often under the guise of sustainability, ethical trade, or transparency." Blockchain, and other digital technologies, are increasingly popular in conservation industries to track and register carbon credits and other initiatives. And as we show below,

⁶ The term, according to a word search, is used twice not specific to resource extractivism.

digital extraction is merging with jaguar conservation to issue a new form of green—or environmentally minded—extraction by *tokenizing* the species.

Blockchain, Pete Howson and colleagues (2019, 1) explain, "is a distributed and immutable electronic database – a ledger of every transaction that has ever taken place on a network, stored as cryptographically secured blocks, strung together in a chain." The chains and 'blocks' of data are created by 'mining' the blocks, with computer calculations applying complex mathematical formulas to turn them into a 'hash' (Howson *et al.* 2019; Stuit *et al.* 2022). "Every block contains its own hash as well as the hash of the previous block," explain Stuit *et al.* (2022, 13). "If the data in a block are altered, the hash is altered because it no longer represents the data that was originally entered." This alteration becomes visible to everyone, which promotes data transparency that appeals to the market-based conservation initiatives, including carbon credit schemes, which depend on creating trust in an intangible product. Stuit *et al.* (2022, 15) identifies approximately seven conservation initiatives employing blockchain technologies, such as fund-raising initiatives; investment businesses; digital market environments or platforms; carbon offsetting services; transparent information sharing, and more. Stuit *et al.* (2022) encourage researchers to keep an open mind on how blockchain could potentially aid positive transformations for people on the ground or, even, support degrowth values (Howson 2021). Each of the reviewed blockchain cases, Stuit *et al.* (2022: 20) conclude "will require new forms of commodification and surveillance that will extend practices of neoliberal environmental management and conservation."

The application of blockchain to conservation, described in more detail below, raises issues related to the energy, land and material requirements necessary to employ this technology. Green neoliberalism, in essence, is constructing new green infrastructures to develop a natural capital asset class (Hildyard 2016; Sullivan 2013a, 2017), which relies on energy intensive data centers (Bresnihan & Brodie, 2021; Sovacool *et al.*, 2022) and other political and economic infrastructures (Rosales, 2021; Rosales *et al.*, 2023). Nicolas Hildyard (2016) reminds us that developing natural capital infrastructure is, in fact, an extractive process, which, then, becomes an asset class in itself (see Calvão & Archer 2021; Rosales *et al.*, 2023). Natural capital, related to conservation or other markets, represents a multilayered form of green extractivism: constructing and operating natural capital infrastructure and capital flows. This greening of market and conventional infrastructure has only intensified over the years, as China's Belt and Road initiative and Andrés Manuel López Obrador's (AMLO) megaprojects in Mexico demonstrate (e.g., Tren Maya, and the Interoceanic Corridor). Such schemes have grown in number, intensified by low-carbon infrastructures and so-called "natural infrastructure" schemes that generate income through PES and related nature marketization programs (Hildyard 2016, 41: See Sullivan 2013a, 2017). Ecological marketization retains numerous and multilayered impacts across multiple sites.

Natural capital assets, alongside low-carbon infrastructures and various decarbonization schemes, remain another pillar of green extractivism. Political ecologists have acknowledged the force of "environmental standardization" that ports and industrial corridors impose (Carse & Lewis 2017) or, similarly, the "infrastructural colonization" of ecosystems and people with the arrival of energy infrastructure (Dunlap & Correa-Arce 2022). Infrastructural colonization is the coercive application, by various means, to enact various degrees of "disciplinary transformation of plants, animals, water and people, altering existing land relationships [and] creating new prohibitions" on the relationships within habitats in general (Dunlap & Correa-Arce 2022, 461). This conceptualizes megaprojects as a colonizing force, engaging in social warfare to achieve social pacification and acceptance of industrial infrastructure, thereby constructing an extractive apparatus to advance political control and resource extractivism. Green extractivism remains an extension and an outcome of infrastructural colonization.

The intersection of jaguar conservation and Tren Maya in the Yucatan reveals the formation of different green and conventional infrastructure classes. Concerned with the protection of large charismatic carnivores, which are "good surrogates for biodiversity conservation" due to their ability to influence conservation priorities and policy at multiple scales (Ceballos *et al.* 2021, 2), market-based jaguar conservation helps fashion Tren Maya as a "sustainable development project." In parallel, it creates new opportunities for green extraction through blockchain and tokenizing technologies. In these developments, the political ecology of infrastructure, conservation, and green place-based and digital extraction remains intimate with the elements morphing together. The lines between extractivism and green extractivism are blurring, intensifying value extraction and capital accumulation. By examining the particularities of jaguar

conservation and Tren Maya, we now turn to see how this process of (slow) infrastructural colonization and (green) extractivism unfolds.

4. Conserving along the tracks

Already under construction, Tren Maya is scheduled for completion by the end of 2023. Employing conservation offset strategies to mitigate its harmful ecological outcomes is crucial to complementing the 1,500 km of train tracks and making the train as 'green' as possible. By following a logic of 'destroy here, compensate elsewhere,' the tracks connect an intricate network of alliances, discourses, subsidies, incentives, and influences that pass the responsibility of protecting the environment down to rural communities while permitting further infrastructural expansion, capital accumulation and, consequently, resource extractivism from the region.

Jaguar ecology research becomes central to this conservation-offset strategy. In Laguna Om, jaguar ecology studies begin at the Palmas field research station, an encampment used by ecologists from the National Autonomous University of Mexico (UNAM) and the National Alliance for Jaguar Conservation (ANJC), whose activities entail setting up camera traps and capturing jaguars to fit them with GPS tracking collars. Their work has provided crucial data to develop a National Jaguar Conservation Strategy, which Gerardo Ceballos and colleagues describe as constructing a "roadmap for short, mid, and long-term goals and actions to promote conservation of the jaguar and its habitat in Mexico" (2016, 9). Camera trap research is also part of the pioneering National Jaguar Census (Ceballos *et al.* 2021), which is the first country-wide effort to determine the status of the big cat population in Mexico.

The work done in the Palmas field station has two main sources of funding. The first is Amigos de Calakmul, a Mexican NGO ran by members of the National Alliance for Jaguar Conservation (ANJC) that pays a yearly amount of approximately US\$20,000 to the *ejido*⁷ for the use of their land for conservation and research projects. The second source is Fundación Telmex-Telcel, the non-profit organization of one of the largest telecommunication corporations in the country, owned by the former world's richest man Carlos Slim. In alliance with WWF, the Foundation provides the necessary resources for studying jaguar ecology. Scientists get much-needed money for camera traps, logistics, and other expenses inherent to field research, while donors can put their logos on books, conferences, and documentaries about the majestic jaguar (see Ceballos *et al.* 2016).

The Foundation advertises its commitment to the preservation of big cats in a way that resonates with WWF's (2021) decade-long strategy to create a continental jaguar corridor. Fundación Telmex-Telcel is in turn part of Grupo Carso, a massive conglomerate that counts among its enterprises the construction behemoth Operadora Cicsa. In 2018, Operadora Cicsa received a US\$900 million government contract for the construction of Tren Maya's Section 2 (Gobierno de México 2020). Mining, oil and gas, and commercial retail are also part of Grupo Carso's portfolio that funds Fundación Telmex-Telcel. The eco-tourism, transportation infrastructure, extraction and conservation nexus is revealed. The same company that will make millions from an ecologically questionable project also invests, via their philanthropic foundation, in conservation to develop 'jaguar offsets' and to maintain a green public image. Moreover, representatives of both ANJC and Amigos de Calakmul have signed a contract with the Tren Maya state developers worth close to US\$500,000⁸ (Castro 2020a). It is to design and build wildlife crossings that, they assure the public, will reconnect already fragmented landscapes. Furthermore, the ANJC has cooperated closely with Fonatur in the development of environmental mitigation strategies for Tren Maya and is frequently cited by state promoters of the railway as proof of multidisciplinary cooperation and genuine environmental concerns,⁹ exemplifying another classic industry-environment 'win-win-win' so frequently claimed by green economic projects.

⁷ According to multiple interviews, this money is used at the discretion of the *comisariado* and not distributed to the rest of *ejidatarios*.

⁸ ANJC had originally published on their website a press release that clarified their position and addressed a possible conflict of interest. It has since been removed.

⁹ Members of the ANJC have stated they are not either in favour of or opposed to the train, and are rather part of an independent and voluntary assessment council (Lozano 2018). Nonetheless, state agencies promoting the train have repeatedly mentioned the ANJC as "allies" that legitimize their environmental concerns (Fonatur, n.d.).

WWF and its partners play a more central role in guiding the jaguar conservation agenda in line with capitalist interests. In 2018, representatives of ANCJ and WWF Mexico attended the Jaguar 2030 High-Level Forum at the UN headquarters in New York. They signed the Jaguar 2030 New York Statement, which recommends integrating jaguar conservation into public development policies "for achieving national sustainable development goals" and "incentivizing private financing" via "payments for ecosystem services, subsidy reform, green bonds, and sustainable commodity production" (ANCJ 2018, 8). This market-based approach dictates how jaguar conservation instruments are employed to create a natural capital asset class, further integrating biodiversity into the circuits of global capitalism, and justifying the construction of Tren Maya.

PES programs managed by the National Forestry Commission (Conafor), part of the Ministry of Environment and Natural Resources (Semarnat), illustrate this process. Conafor runs a permanent PES scheme targeted at *ejidos* in highly biodiverse areas across the country. The agency, however, has limited resources and prioritizes *ejidos* with iconic species. The picture of a jaguar on the official government website indicates the species they favor. "Conafor has very little money. So, who do they give priority to? To the [*ejidos*] that we say have jaguars," says a member of the ANCJ.¹⁰ Conafor incentivizes organizations and private firms to co-fund PES through the Concurrent Funds mechanism by coupling investments with public funds for jaguar conservation to "link local communities to international biodiversity and carbon markets" (Conafor 2011). "Global Terra, Amigos de Calakmul, WWF, and Global Conservation," explains a Semarnat officer, "are some of the organizations that are currently supporting jaguar conservation" through these public-private funding mechanisms.¹¹ Simultaneously, Conafor's (2021) Operation Rules indicate how PES funds should go to *ejidos* that intersect with Tren Maya. These communities receive money for 'conserving' territories that the railroad will impact, or as compensation for being displaced by Tren Maya (Semarnat 2021). Thus, by establishing conditions that give *ejidos* more chances of receiving PES, territories having jaguars *and* zoned for Tren Maya are designated priority areas for Conafor. PES, we are told, are protecting big cats and compensating the unavoidable environmental harms Tren Maya will produce.

Voluntary Conservation Areas (VCAs) follow a similar logic of damage mitigation. In 2019, officers of the Calakmul Biosphere Reserve (CBR) worked with representatives of the *ejido* Laguna Om to establish a VCA in its territory. They aimed to integrate Laguna Om's into what they called a Jaguar Landscape (*Paisaje Jaguar*), a wildlife corridor for jaguars. Other government agencies are now working with *ejidos* on the Tren Maya route to establish similar VCAs (Bote 2022). The ANCJ itself recommends brokering new VCAs to protect the felines' habitat along the tracks (Lozano 2018). Meanwhile, according to senior officers of the CBR, people are assured that VCAs "safeguard [*ejidos*' territories] against any form of land-use change [and prevent] selling land for urbanization" by allowing communities to autonomously manage their natural resources.¹²

As mentioned earlier, the opening of *ejidos* to the free market in the early 1990s made rural communities vulnerable to land dispossession (Peña-Azcona *et al.*, 2021). This justified the creation of the VCA mechanism which, on paper, turned conservation into a tool for communities to "protect [their] territories from development projects and public infrastructure" (Semarnat n.d). Tren Maya developers, on the other hand, are now using VCAs not to stop, but instead to enable and offset the impacts of infrastructure projects that will usurp communal land (GeoComunes *et al.*, 2020; Tornel 2023). Fonatur, for example, created instruments such as the Trust Funds for Infrastructure and Real Estate (FIBRA) in an attempt to integrate *ejidos* into financial markets, boost capital investments on *ejido* land, and create 19 'development poles' — also labeled "urban-industrial corridors" — around some of Tren Maya's main stations (González 2020, 81). And while Fonatur assures it does not intend to privatize communal land (Paredes 2019), Indigenous activists claim that FIBRA initiatives are attempting "to legalize dispossession by renting land to private investment projects" (González 2020, 80). The reality of FIBRA, however, remains uncertain, which is compounded by the Mexican government's Superior Auditor of the Federation (ASF 2023) acknowledging procedural and financial issues related to the Tren Maya project. Tren Maya is initiating

¹⁰ Interview 6.2, 28-12-2021

¹¹ Interview 13, 03-02-2022

¹² Interview 13, 03-02-2022

industrial development in *ejidos* by employing VCAs that are intended to protect these land tenure regimes and ecosystems from degrading infrastructural development.

Moreover, Tren Maya will connect other industrial-extractive projects, including the new Dos Bocas refinery, the extractive and manufacturing Corredor Transistmico in Oaxaca, and the Southeastern Basin, where 80% of Mexican oil reserves are located (Geocomunes 2021). Tren Maya, the Geocomunes (2021, 42) collective explains, will "facilitate the extraction and commercialization of resources such as oil, minerals, land, and biodiversity" and will export processed and raw materials "to Asian, North American, and European markets" through maritime ports. The train is also part of the Integral Development Plan for Central America, written by the Economic Commission for Latin America (ECLA), which aims to funnel investments into "electricity grids, oil pipelines, roads and railroads" as a strategy to mitigate undocumented immigration (Castillo 2019). Furthermore, "the train will consolidate the extractive model" in the region, explain Madrid & Fernández (2020, 9), "detonating a process of expulsion of rural populations from their territories and facilitating large capital's access to land, natural resources [and] cheap labor." And while some rural collectives in the area have opposed this process, Dunlap & Correa-Arce (2022) draw attention to how infrastructure projects and their environmental mitigation schemes combine coercion and social 'enchancements' to manufacture consent or, at the least, acquiescence, for development plans.

The multiple sustainable development promises of the train – including profits from ecotourism in the VCA – generate enthusiasm for it by the people in Laguna Om. "It is my dream to work in Tren Maya," said a young man who is training to become a tourist guide. "Once the train arrives, it will boost development in the *ejido*. That is why I am studying, preparing. I don't want to be left out."¹³ The sentiment was widely shared in the village. The VCA, many hope, will attract a growing number of tourists arriving on the railway. There are also expectations that the train will bring jobs and other economic opportunities, a narrative vigorously promoted by the federal government (see for example Olivares & Jiménez 2022).¹⁴ At a meeting between Laguna Om's *ejido* leaders, a representative from Conafor apologized for the absence of a senior officer. This Conafor officer had missed the meeting because he was negotiating land for a new airport related to the Tren Maya project. "He is very sorry he cannot be here today," explained the Conafor representative, "but this is good for [the other *ejido*], it will greatly help the development of their community."¹⁵ The *ejido comisario* and his team are also vigorously negotiating with the National Army, in charge of building the rail section that will go through the community to get funding for a new public clinic and state-owned bank. In private meetings, the *comisariado* assured during an interview and subsequent talks,¹⁶ that he had guaranteed army officials that Laguna Om was willing to donate around a dozen hectares of land to build a train station and a military base. Building a military base is part of a strategy to increase armed forces presence close to the southern border, where undocumented migration, drug trafficking, and Zapatista activity create unease for the federal government (Paredes 2019; Tourliere 2021). Giving up a small piece of land, however, appears worth it for the funds, social development and opportunities that the train claims to bring. "What's important is that all the projects we have – the clinic, the train, the bank, the carbon credits – become an investment for the *ejido*," said the *comisario*.¹⁷ This infrastructural enchantment (Harvey & Knox, 2012; Kallianos *et al.* 2023), even if the promises of social development will be met, ignores the socio-ecological impact created by the project in favor of modernist development.

The promises made by Tren Maya, likewise, play into existing economic *ejido* conflicts and debts. Tren Maya enters into a four-decade-old, multi-million-dollar debt owed to the *ejido* by the federal Ministry of Communications and Transport (SCT). Ever since communal land was expropriated for the Chetumal-Escárcega federal highway, more than 30 years ago, residents have not received the promised compensation. The federal government is offering the *ejido* 25 million pesos (US\$1.46m), but the *ejido* is fighting to receive 120 million pesos (US\$7m), which they claim reflects the actual market value of the land. Tren Maya will soon run parallel to the federal highway, and while negotiations around the highway debt are still unresolved, Fonatur has absorbed the debt and is now the federal agency in charge of building

¹³ Field notes, 30-09-2021

¹⁴ Field notes, 08-09-2021; Interview 1 09-09-21; Interview 2, 14-09-21; Field notes, 23-09-21

¹⁵ Field notes, Conafor information meeting, 11-09-2021

¹⁶ Interview 1, 09-09-21; Field notes, 21-09-21

¹⁷ Interview 1, 09-09-2021

Tren Maya. Fonatur is currently bundling together the payment for the historic debt with payments for new land that will need to be expropriated for building the last stages of Tren Maya. Claiming to finally settle a debt that was acquired by the previous administrations, Fonatur seeks to secure better prices for the land that the train will need, effectively allowing the government to use unpaid debts as a bargaining chip for new infrastructure. This gives the message that if you resist or reject Tren Maya, you will not see any money.

Just as has happened with the federal highway, building the train tracks will require expropriating communal land. Although it is still unclear how many hectares will be sold to the government, people are speculating about the amount they will make from the operation. Walking around Nicolás Bravo, one can hear neighbors excitedly talking about the money – when will it come and how much. A common estimate is that each *ejidatario* will get \$200,000 MXN (approximately US\$10,000), which in this context is a considerable amount of money. And it is already being spent. Trusting that the payment from Tren Maya will come soon, some people are buying goods now, promising to pay for them when they get their share.¹⁸ These arrangements do not usually go as planned. Senior *ejidatarios* remember similar processes happening with the previous Federal Highway project and the high-voltage power line that runs parallel to it. *Ejidatarios*, hoping for future payment, acquired debt, typically financed by some of the wealthier community members. When creditors demanded to be paid, debtors had no alternative but to settle the score with their land.¹⁹ Thus, some community members ended up landless. Meanwhile, other members accumulated a lot more than the 100 hectares they were originally entitled to under agrarian law. Devoid of land, people then cling to their *ejidatario* status to keep receiving subsidies from social development programs.²⁰

Anxious talks around the payment from Tren Maya were commonplace. And while many were optimistic about the train and hoped for economic development, others remained skeptical. "Uy, no! I will wait for it [Tren Maya] sitting [because it is uncertain it will materialize]. If it happens, I don't think it will happen soon. I can't hear the *golondrinas* [birds that are a symbol of victory or celebration] just yet," said an *ejidatario* in his fifties to emphasize his skepticism. The 'I won't believe it until I see it' sentiments were shared by many. Two years later, in March 2023, *ejidatarios* who had originally appeared positive about the railroad were using social media to actively oppose construction, alluding to the continued marginalization of local communities and the ecological degradation it will generate.²¹ Laguna Om is not only witnessing a collision of conservation and mega-infrastructure development, but also the enchanting and anticipatory effects of infrastructural development that have less than satisfactory histories in the region and beyond (Franquesa, 2018; Dunlap, 2019; Dunlap & Correa-Arce, 2022; Kallianos *et al.*, 2023). Infrastructural promise—real, imagined or never arriving—is instrumental for organizing extractive projects, which blend into greening extractivism when they intersect with jaguar conservation, eco-tourism and low-carbon infrastructural schemes. These green-economic project, however, are a form of green extractivism themselves.

5. How to (legally) steal jaguars and ecologies

"This is the beginning of a more visible, more imposing carbon market," said the speakers of Toroto, the Mexican nature-based solutions company that in 2021 signed an agreement to develop a new carbon offsetting project in Laguna Om. Toroto was founded in 2019 with the mission to eliminate greenhouse gases from the atmosphere through forest and land management schemes. They work with businesses, organizations, and rural communities to develop offsetting projects and sell carbon credits.²² During the presentation at a leisure center near Nicolás Bravo, Toroto employees explained the mechanics of the proposed project to the *ejidatarios* of Laguna Om. With the aid of a screen showing what looked like a geo-

¹⁸ Field notes, 10-09-21

¹⁹ Interview 15, 10-09-21; Field notes, 15-10-21

²⁰ Interview 15, 10-09-21; Field notes, 29-09-21; Field notes, 15-10-21; Interview 4.2, 21-10-21

²¹ See for example:

<https://www.facebook.com/davidrene.dzulramirez.1/posts/pfbid0nUz7zxF3XMewoawQ8gBnypRpbpcEYCAbpcCsYrKKM1wybX1LDxbornSXvbQM6jSNI> and <https://www.facebook.com/davidrene.dzulramirez.1/posts/pfbid034YyHisYvT7PjvWcsvQoAvvnKmNTYz64mDbBfc8QuzjpFo3EJ8pTMP27Eue8tCKAI>

²² See <https://toroto.com/about>

positioning app — a map of the forest covered by a grid of polygons resembling a beehive — they explained how a new digital platform, which they call the "Carbon Credit Meta-Register," would facilitate selling offsets around the globe:

Carbon credits used to be a simple PDF with a weird number on them. There wasn't any way to prove that that credit actually existed [...] Now, each of these polygons represents one carbon credit. Now anyone can click on one or a hundred to buy them via a technology called blockchain, which is un-hackable, the future of banking. Anyway, now I [as a buyer] can know exactly where to find what I bought.²³

They clicked on one of the mosaics on the map. A secondary display with folder icons appeared on the left side of the screen: "Here, you will be able to see folders with the fauna in the area. You will see if we capture certain biodiversity with camera traps, what are the Sustainable Development Goals we are contributing towards, and so on."²⁴ Thanks to this cutting-edge technology, jaguars will soon feature as part of carbon credit deals, making them more attractive for buyers in a competitive market.

Ultimately, the buyer—any company sourcing carbon credits in the voluntary market— will choose from many carbon credits that are essentially the same, but maybe they will decide to buy here [in Laguna Om] because they feel a connection with jaguars. Since this project is not only sequestering carbon but is also conserving jaguar habitat, the price of the bonds will increase.²⁵

During a previous meeting among the *comisarios* of six neighboring *ejidos* and representatives of the National Forestry Commission (Conafor), who gathered to talk about the rules of state-led forestry projects, there had been a discussion about carbon offsets. "Currently they are using us for free. The oxygen our trees are producing is being consumed by developed countries which are not paying a dime,"²⁶ said a Laguna Om representative. Moreover, he reported that the deal his *ejido* had accepted was better than one brokered with his neighbors. Laguna Om's community forest has 35,000 hectares of tropical forest. According to Toroto, each hectare had the potential for issuing between two and four credits. While the average carbon credit price oscillates between US\$3 and US\$6 per ton (Hamrik & Gallant 2018), Toroto assured the *comisario* of Laguna Om that, given the right market conditions, the *ejido* could sell credits for as much as US\$50.²⁷ These prospects were appealing and were endorsed by Conafor. "You can see all the relevant information on their website, it is very transparent. This is one of the companies we recommend working with," said a representative from Conafor.²⁸ This was not a minor statement. Government approval is influential in the *ejido*. "It gives you confidence. If a government institution analyses [the company] and says they are ok, then it means they are one of the good ones," said one of the *ejidatarios* that attended the forestry project meeting.²⁹

Multiple things are happening here that allow us to see how MBIs deployed for jaguar conservation become a form of (green) digital extraction (Calvão & Archer 2021). Toroto aspires to make carbon credits more *tangible* by employing blockchain technology that, in essence, provides certainty of a unique electronic transaction (Stuit *et al.* 2022). This means that their 'Carbon Credit Meta-Register' will offer buyers of carbon credits a digital proof of ownership that eliminates double counting, a common issue with these certificates (Broekhoff *et al.* 2019). Moreover, blockchain's electronic trail (Stuit *et al.* 2022) is supposed to create an auditable link between the credit and the place where the ton of CO₂e it represents

²³ Field notes, Toroto information meeting, day 1, 05-10-2021

²⁴ Field notes, Toroto information meeting, day 1, 05-10-2021

²⁵ Field notes, Toroto information meeting, day 1, 05-10-2021

²⁶ Field notes, Conafor information meeting, 11-09-2021

²⁷ Interview 1.3, 27-10-2021. Toroto operatives admitted in private conversations that no community in Mexico had sold a carbon credit for more than 10 USD.

²⁸ Field notes, Conafor information meeting, 11-09-2021

²⁹ Interview 2, 14-09-2021

was ostensibly sequestered. In other words, Toroto is trying to convince buyers that they are purchasing something 'real' and enhancing the transparency of their environmental commodity. After all, the existence of offsets depends on technologies and accounting methodologies that provide buyers with confidence that physical tons of carbon dioxide are actually being captured somewhere (Cavanagh & Benjaminsen 2014; Sullivan, 2017; Dunlap, 2023; Broekhoff *et al.* 2019).

Now, blockchain technologies will also offer proof that real jaguars exist in the carbon-absorbing forest. Jaguars, in the process, are being *abstracted* to be sold on global markets. As with other digital schemes (see Sullivan 2018; Stuit *et al.* 2022), no actual jaguars are for sale. Rather, jaguars are being *tokenized*—fabricating electronic representations of jaguars through unique blockchain-based transactions. Then, conscientious buyers who want to prevent the extinction of big cats are encouraged to purchase jaguar tokens that 'add value' to carbon credits and increase their price. These tokens, we are told, help ensure the survival of the species by directing funds to communities that are tasked with protecting their habitats. The existence of jaguars, once free, is transformed into a commodity to be bought, sold, preserved and employed to justify Tren Maya infrastructural expansion. Token buyers can then freely re-sell their carbon offset with jaguar tokens attached for turning a profit, akin to any other stock.³⁰

Equally concerning, and in need of further research, are the energy-intensive realities related to mining, mineral processing and manufacturing supply webs to create digital infrastructures and devices (Rosales, 2021; Dunlap, 2023). These are compounded by the required energy to operate digital infrastructures (Bresnihan & Brodie, 2021; Sovacool *et al.*, 2022; Hook *et al.*, 2020). Data centers, the physical internet infrastructure housing routers, switches, firewalls, storage systems (e.g., "clouds"), servers, and application-delivery controllers, retain an enormous ecological impact. Data cloud providers are expected to grow 300-600%+ in the coming years, which includes, for example, an anticipated "500 MW power consumption in core European markets and another 600 MW in secondary markets" (Upham *et al.*, 2022, 2). The intensive energy use, alongside attempts at branding these data centers "green," has led to the construction of entire wind parks to power datacenters at the expense of local social ecologies (Bresnihan & Brodie, 2021). There, moreover, is a rapid turnover of data center equipment that, according to Sovacool and colleagues (2022, 23), "dispose of their information technology equipment every 3-5 years, creating a turnover of servers, monitors, data communication equipment, and cooling systems, much of which ends up in landfills." Data centers rely on raw material extractivism, heavy chemicals for manufacturing, which includes ecosystemic impacts (Bresnihan & Brodie, 2021; Sovacool *et al.*, 2022; Hanaček *et al.*, 2022; Dunlap, 2023). This damage is extensive and, in this case, stresses the anti-ecological turn in conservation that relies on indirect green extractivism to produce market-based conservation schemes. In order to understand the socioecological impact of jaguar conservation, we must understand its rippling effects that employing block-chain and other digital technologies generate through their extractive supply-webs.

Money flowing from MBIs is then presented as the primary reason why jaguars and other species are preserved. Such reasoning is central to the offsetting industry. As a Toroto representative put it:

No one used to pay for this [carbon sequestration]. It was something done for free by the forest. Now, we're opening a new cash flow for the *ejido* [...]. The project also contributes to changing mentalities. It's not the same to take care of something because you know it gives you money. You can teach your children that conservation is important not only for benefits that are hard to see, it also provides [money].³¹

Toroto's business model depends on advancing capitalist logics into jaguars and their habitats. The more entrenched this logic becomes, the more *ejidos* will join carbon offsetting programs, often in very disadvantageous conditions. The *comisariado* of Laguna Om, for example, knew about carbon project developers in nearby *ejidos* taking up to 75% of the profits related to carbon offsetting deals, by far a worse

³⁰ Certain rules apply to the life cycle of carbon credits, including the issuance, selling, reselling, and retiring of the bonds. For more on the complex dynamics of carbon offsetting, see Broekhoff *et al.* (2019).

³¹ Field notes, Toroto information meeting, day 1, 05-10-2021.

deal than the one Laguna Om entered with Toroto.³² Laguna Om had also been close to signing a similar deal for a project lead by the World Resources Institute. However, their agreement with Toroto, the *comisariado* assured, stipulated that the *ejido* would keep around 70% of net profits, which would be used for community development. Toroto offered Laguna Om other benefits too, like certifying the already well-preserved community forest for carbon credit issuance, something other carbon offset project developers refused to do.³³

Meanwhile, some nearby *ejidos* wanted out of their carbon offsetting agreements but could not rescind their contracts and remained tied to rules that restricted the use of their forest.³⁴ Jaguar conservationists, members of the National Alliance for Jaguar Conservation (ANCJ) had also tried to pressure Laguna Om into signing a carbon offset deal that would forbid all forestry activities within the *ejido*. The *comisariado* then considered expelling these conservationists—who work in the Palmas field station—from Laguna Om. In the end, however, the *comisariado* decided to let them stay to keep the yearly fee they charge to allow jaguar researchers. "If we don't let them stay, who else is going to give us that money?" said Laguna Om's *comisario*.³⁵

6. Conclusion

This article has discussed the intersection between jaguar conservation and Tren Maya megaproject. It reviewed the structure of Mexican rural collectives known as *ejidos* and reviewed the history of land tenure in the Yucatán Peninsula to insert Tren Maya into a wider political-economic context. This entailed discussing how jaguar conservation in its current form aids infrastructural expansion, territorial control, and resource extraction in the area. The article has provided an overview of how jaguar conservation advances the commodification and tokenization of jaguars in order to integrate them into processes of capital accumulation. We conceptualized market-based jaguar conservation as a form of green extractivism that can be observed in two key instances. First, jaguar conservation serves to greenwash traditional extractive and infrastructural development projects, as with Tren Maya, intended to advance capital accumulation and state territorial control. Jaguar conservation, thus, becomes an accomplice to *greening extractivism*. Secondly, digitalized and market-based forms of conservation reduce ecosystems to units of accounting that are fit for trade in international carbon markets, advancing the capture and accumulation of value through conservation. Conservation, in this case, becomes a process of green extractivism itself.

Innovations like the tokenization of jaguars through blockchain technology attempt to fuel the global carbon market by raising the price of green bonds and streamlining how corporations, mainly located in the Global North, claim to compensate for polluting elsewhere. Jaguars have emerged as another tool to justify extractive development, pollution, capital accumulation and, overall, they reinforce financial, technological and statist politico-military trajectories. Blockchain technology is supercharging this process by guaranteeing unique ownership of carbon credits and, thanks to jaguar ecology science, attaching jaguar tokens that elevate the market price of the credits. This process not only assigns the life of jaguars a monetary value, but it also pits ecosystems and different non-human existences against each other, creating a necropolitics where some charismatic species are considered valuable and worthy of protection while others are sacrificed.

Meanwhile, the valuation of ecosystems exclusively in monetary terms also depends on further exploitation of rural communities to incentivize the sale of their resources and transform jaguars into marketing instruments. Using material poverty, and modernist desires, to advance conservation agendas has been criticized as "poverty-pushed market-based environmentalism" (Dunlap & Sullivan, 2020, 563), a strategy to expand land control, extractivism and marginal social development by greening market operations.

³² Interview 1, 09-09-2021; Field notes, Conafor information meeting, 11-09-2021; Journalists have also documented disadvantageous carbon offsetting deals in the region. See: <https://www.elfinanciero.com.mx/bloomberg-businessweek/2022/06/30/trabajaron-dos-anos-y-bp-solo-les-pago-40-dolares>

³³ The World Resources Institute (WRI) had reportedly declined to certify the community forest for carbon offsetting, arguing that it was already protected under other land management schemes.

³⁴ Interview 1, 09-09-2021; Field notes, Conafor information meeting, 11-09-2021.

³⁵ Interview 1.2, 28-11-2021.

From trees to jaguars, governments and industry are organizing the *tokenization* of ecosystems to signify or provide evidence of taking action to mitigate biodiversity loss and climate change. This superficial—*token*—arrangement justifies maintaining the same contested and deleterious extractive activities. In the end, marketizing and digitalizing conservation schemes do not offer guarantees that jaguar conservation will be successful. On the contrary, jaguar conservation's integration into the global economic markets promotes green extractivism directly (through jaguar commodification and value extraction) and indirectly (through material and energy intensive digitalization). Currently, the literature on conservation digitalization ignores the material and energy costs of producing and integrating these applications into conservation initiatives. Understanding the extractive realities of digital infrastructures and trading platforms and their connection to conservation remains a profound research gap, requiring immediate investigation to reveal the accumulative and extensive multi-scalar socioecological realities of market and digitally based conservation initiatives.

Meanwhile, jaguar conservation is used to justify conventional extractivism by greening the large Tren Maya project. While jaguar habitat is eroded by the train, conservation programs organize green credentials for capitalist accumulation projects (e.g., ecotourism, industrial agriculture, low-carbon infrastructures, conventional resource extraction). Tren Maya also deploys a two-pronged strategy that simultaneously alienates communal land and employs Voluntary Conservation Areas to pass the responsibility of offsetting or 'mitigating' environmental harms of infrastructure to rural communities in exchange for monetary compensation, especially those that coexist with charismatic species.

Infrastructural colonization manifests in multiple forms and sites: classical infrastructural land domination and an intensification of psychosocial colonization via digital infrastructures such as blockchain, trading platforms, financial trading and the digital devices they require. Along with supply-web research, the psychosocial impact of integrating digital applications and trading systems into conservation initiatives deserves further research and theorization. By expropriating land or encouraging *ejidos* to join trust funds that seek to financialize and commodify their territories, facilitating real estate development and urbanization, we are seeing how land regularization and market integration schemes are the seeds of conventional and 'green' extractive development.

In the end, the only thing 'green' is the extraction of ecosystems and the fabrication and certification of "sustainability." While not a new concern, there needs to be new relational and material standards for what actually constitutes socioecological sustainability. Otherwise, ecological standards will progressively degrade as (uneven) economic growth continues and extractive industries and digital technologies become ubiquitous in our ecosystems and our daily lives.

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