Territorializing spatial data: Controlling land through One Map projects in Indonesia and Myanmar

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ABSTRACT

Once confined to paper, national cartographic projects increasingly play out through spatial data infrastructures such as software programs and smartphones. Across the Global South, foreign donor-funded digital platforms emphasize transparency, accountability and data sharing while echoing colonial projects that consolidated state-based territorial knowledge. This article brings political geography scholarship on state and counter-mapping together with new work on the political ecology of data to highlight a contemporary dimension of territorialization, one in which state actors seek to consolidate and authorize national geospatial information onto digital platforms. We call attention to the role of data infrastructures in contemporary resource control, arguing that territorializing data both extends state territorialization onto digital platforms and, paradoxically, provides new avenues for non-state actors to claim land. Drawing on interviews, document review, and long-term fieldwork, we compare the origins, institutionalization and realization of Indonesia and Myanmar's 'One Map' projects. Both projects aimed to create a government-managed online spatial data platform, building on national mapping and management traditions while responding to new international incentives, such as climate change mitigation in Indonesia and good democratic governance in Myanmar. While both projects encountered technical difficulties and evolved during implementation, different national histories and political trajectories resulted in the embrace and expansion of the program in Indonesia but reluctant participation and eventual crisis in Myanmar. Together, these cases show how spatial data infrastructures can both extend state control over space and offer opportunities for contesting or reimagining land and nation, even as such infrastructures remain embedded in local power relations.

1. Introduction

State mapping is an old project, one intimately tied to nation-making. Scholars have long been interested in what happens when the dream of the single, authoritative map meets the reality of contradictory sources, imperfect information, and contested boundaries (Harley, 1989; Crampton, 2009; Winichakul, 1997; Craib, 2004). Contemporary digital tools–from Esri to Google Earth–have heightened aspirations for complete geographic knowledge, even as 'smart earth' technologies are increasingly used to measure pollution, track deforestation, and promote good environmental governance (Gabrys, 2020; Bakker & Ritts, 2018; Adams, 2019). Underlying these shifts are *data infrastructures*, or the hardware (sensors, smartphones, internet cables) and software

(algorithms, models, standards) that enable the production, circulation, and analysis of data used for environmental governance (Goldstein & Nost, 2022; Nost & Goldstein, 2022). Today, geospatial data infrastructures are being built and used by a wide variety of actors, from activists to municipal governments to entrepreneurs, to map claims, services, and business opportunities. Such efforts are often linked to broader efforts to promote transparency and accountability through data (Turnhout et al., 2014; Levy & Johns, 2016; Ananny & Crawford, 2017). But while digital platforms raise new possibilities of data-sharing and public participation, they remain embedded in longer national histories and uneven global relationships of development and expertise (Boucquey et al., 2019; Sullivan, 2020).

This article argues that what we call territorializing data–the process

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of bringing geospatial information onto digital platforms under state control–is increasingly important to contemporary efforts to govern land and resources. We do so by analyzing two distinct programs in Southeast Asia that aimed to systematize national approaches to geospatial data, improving quality, availability, and transparency across multiple government agencies and with the public. Both projects involved a wide range of initiatives including donor funding and foreign technical assistance for data creation, organization and sharing, which were ultimately aimed at improving land and resource measurement and management. These activities erected a specific type of data infrastructure, one aimed at the creation of an open-access, government-controlled online spatial data platform on land and resources. The common goal of using digital tools to consolidate, synchronize, and access spatial data from multiple sources is captured in the shared title of the separate initiatives: 'One Map.'[1]

These initiatives played out differently in two countries often categorized as rich in resources and poor in governance. In both the island nation of Indonesia and the mainland Myanmar, historical mapping practices were tied to colonial efforts to manage natural resources, particularly for teak and other hardwoods (Peluso, 1992; Bryant, 1997), as well as rubber, coffee, and sugar. Over the twentieth century, maps were implicated in the development and extraction of new resource commodities, including oil palm and pulpwood in Indonesia and oil and gas, minerals, and timber in Myanmar. In the 2000s, international development agencies and the Indonesian state positioned the country's tropical forests as central to mitigating climate change through conservation, spurring demand for authoritative and accessible maps that could help protect land rights, establish carbon markets, and provide certainty to foreign investors (Goldstein, 2020; Astuti & McGregor, 2015). In Myanmar, similar attempts to coordinate spatial data were part of good governance efforts during the democratic turn from 2011 to 2021, including the creation of new policies to map and manage land after decades of injustice under military dictatorship (Suhardiman et al., 2019; McCarthy, 2018; Mark, 2016). Despite similar goals, the programs took different trajectories. Indonesia's decades of democracy, community-based natural resource management, and indigenous mapping initiatives set the stage for a wider engagement with the platform than in authoritarian Myanmar. Indonesia's government structure and relationships with international donors channeled hundreds of millions of dollars into the metastasizing One Map, while Myanmar's program remained comparatively small and was not embraced either by top officials or civil society. Territorializing data is not monolithic: both programs extended state efforts to map and control land within a contemporary turn towards good governance through data, even as they played out in relation to distinct, contested histories of resource governance.

Together, the cases demonstrate how territorializing data both extends state control onto digital platforms and provides new avenues for non-state actors to claim land. While longer negotiations between state and non-state actors at the local, national, and international levels over forests, mineral resources, and territory shaped the One Map projects, these ambitious contemporary ventures also demand new types of institutions and authority to produce, consolidate, and evaluate contradicting or missing information. As Jessica Lehman (2016) notes in the case of the global ocean and its digital doppelganger, new technologies and the network of knowledge relations that surround them are central to shifting forms of earth systems governance. By paradoxically centralizing control and enabling participation, digital platforms and the data infrastructures that support them rework contested geographies of land and resource control.

We approach our analysis with a combined three decades of research

into land and resources in Myanmar and Indonesia, including observation of both One Map programs. To understand the Indonesian case, we draw on Fisher's interviews with key government agencies and international organizations involved in One Map conducted in 2011 and 2014–2019, as well as on archival research and participant observation in national and regional forums, summits, and an indigenous land rights congress. We contextualize these findings within Fisher and Goldstein's separate long-term ethnographic work in Indonesia. To understand Myanmar's OneMap program, we draw on Faxon and Hunt's interviews with government officials, Myanmar activists and international experts involved in the project conducted between 2017–9, as well as on these authors' review of key program documents. Our analysis is also informed by these authors' work with local civil society since 2013, in particular Hunt's work with OneMap Myanmar. To contextualize our study, we draw on Faxon's long-term ethnographic research on land politics and agrarian change in Myanmar, as well as on Faxon and Goldstein's interviews for a previous project on data infrastructures for environmental governance. Land and resource governance are politically sensitive in both countries, and particularly in Myanmar since the 2021 military coup. To protect our research subjects, we rely primarily on publicly available information that was confirmed and elaborated in our interviews and long-term participant observation.

In the analysis that follows, we bring together work in political geography with emergent literature on the political ecology of data to extend theorization of territorialization to spatial data platforms. Next, we situate the One Map projects within respective histories of state and participatory mapping. We then turn to the origins of the two projects at the 2007 United Nations Conference of the Parties (COP) climate change meeting in Bali, Indonesia, and in 2010–4 discussions in Myanmar over a new National Land Use Policy. We discuss how both programs were institutionalized and briefly highlight emergent challenges, contestations, and effects before assessing their similarities and divergent trajectories. We conclude with reflecting on how data infrastructures have both intensified the dream of total geospatial knowledge and provided a new terrain of struggle for the global control of land and resources.

2. From territorializing land to territorializing data

Political geography has long been concerned with the relationship between cartographic projects and state power. In Southeast Asia, national histories of mapping were intertwined with administration, rent-seeking and violence in ways that shaped state territorialization of land and resources through colonial, cold war and contemporary periods (Peluso & Vandergeest, 2001, 2011, 2020; Vandergeest & Peluso, 1995). Throughout the region, map-making has been intimately linked to the articulation of nationhood (Winichakul, 1997) and to the politics of legibility (Scott, 1998) and eligibility (Walker, 2015). While counter-mapping can provide tools of resistance (Peluso, 1995), inscription techniques, such as maps, are also key to rendering land amenable to investment (Goldstein & Yates, 2017; Le Billon & Sommerville, 2017; Fogelman & Bassett, 2017; Nalepa, Gianotti, & Bauer, 2016). Digital maps, apps, and platforms have proliferated in the past decade as more of the world's population comes online. From Laos to Singapore, Southeast Asia hosts an increasing number of projects that aim to consolidate geospatial data and share digital maps, many of which see spatial data as a tool for shaping prosperous, equitable, and sustainable development.[2] Yet recent shifts in the power relations between state and non-state actors articulate through data infrastructures

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[1] Myanmar's program is referred to by a one-word title while Indonesia's uses two. Here, we refer to 'OneMap' when discussing Myanmar specifically, and 'One Map' when referring to Indonesia or both programs.

[2] Examples of national programs include Lao Decide (http://www.decide.la/en/) and Singapore OneMap (https://www.onemap.gov.sg/home/) and well as One Map Thailand. These exist alongside regional initiatives such as SERVIR-Mekong (https://servir.adpc.net/) a data-for-development initiative funded by USAID and NASA that aims to link 'space to village' across Cambodia, Thailand, Vietnam, Laos and Myanmar.

in ways that, we argue, position spatial data as a new site of territorialization itself.

Spatial data infrastructures such as One Map extend territorialization of land and resources in two new directions. First, spatial data opens up new networks of territorialization. Classic accounts of territorialization, or the process of claiming and controlling land or other resources for economic and/or political ends undertaken usually, but not exclusively, by states (Agnew, 2005; Elden, 2010), have highlighted the role of paper maps and documents (Bluwstein & Lund, 2018; Hull, 2012). Digital technologies provide new avenues for circulation, visualization and connection (Rose, 2016) as well as powerful tools for governing space (Ash et al., 2018; Alvarez-León & Rosen, 2020). Building on this work, our focus here is not only on the representational power of spatial data, but also on the new geographies of control enabled by digital platforms and the data infrastructures that support them.

Increased interest in spatial data can be situated within a global context in which "good governance" is enacted through programs that promote accountability, transparency and sustainability through digital tools (Goldstein & Faxon, 2022; Calvão & Archer, 2021). Data infrastructures themselves are also an increasingly common site of contested environmental politics as actors recognize that control over data infrastructures can translate into access and control over resources (Nost & Goldstein, 2022). New work in the political ecology of data highlights that while "the underlying assumption is that more comprehensive and higher quality data will lead to more effective environmental governance" (Bakker & Ritts, 2018), this is not always the case (Gabrys, 2016), in part because "infrastructuring" data is not merely technical work but also requires managing "institutional and fiscal 'friction'", or barriers to data integration and maintenance (Nost, 2022: 3). Such friction is evident in both Indonesia and Myanmar, where issues of data quantity and quality are only a part of the challenge of managing and acting upon environmental information. Constructing data infrastructures, and negotiating data frictions, thus expands the terrain of resource governance.

Second, state-centric One Map initiatives highlight how data infrastructures that seek to consolidate state control over land and resources can, paradoxically, broaden participation by non-state actors. While bounding and controlling territory is central to state-formation (Reeves, 2014), it is not monopolized by the state (Ballvé, 2012; Rasmussen & Lund, 2018; Yeh, 2013). Rather, the entanglement of different territorial practices enacted by diverse actors at multiple scales make territory (Anthias, 2017; Byrne et al., 2016). In Vietnam, for instance, missing maps undermine government authority and breed mistrust, opening up contested spaces of 'cartographic action' in the context of urban development (Harms, 2020). These examples serve to highlight not only the entwined processes of resource- and state-making, but also the state's role in facilitating extraction and redevelopment by non-state actors (Bridge, 2014). The role of non-state actors in territorialization processes, and their importance, has shifted over time. Peluso and Vandergeest (2020) emphasize the central role of actors such as the UN FAO, domestic counter insurgencies and international conservation agencies in different historical moments within a longer co-production of political forests in Southeast Asia. Amid an influx of non-state actors into green neoliberalism (Devine & Baca, 2020) and a rise in "hybrid governance" over environments (Miller, Middleton, Rigg, & Taylor, 2019), cartographic platforms such as One Map provide a way for states to reassert control over national development, even as they invite non-state actors to participate in building spatial data infrastructures and use publicly accessible data to bolster their own land and resource claims.

While critical data studies and digital geography have focused on the relationship between data and capital, less has been said about the potential for data infrastructures to reshape the role of the state (Sadowski, 2019; Srnicek, 2017; Zuboff, 2019; Dalton et al., 2016). Yet as Leszczynski (2012) argues, shifts in national cartographic projects, or the production, circulation, and representation of geographic information,

illuminate how the neoliberal state's role in data provisioning is not, in most cases, eviscerated but rather re-positioned to support market-based regimes of spatial data governance. If the 'modernist' era of spatial data collection and mapping (Goodchild, 2009) was marked by "authoritative production of 'the map' by the state … corporations, non-state actors, and private citizens are now performing and fulfilling functions that were long the exclusive preserve of state mapping organizations" (Leszczynski, 2012, 78). Geo-visual representations can allow civil society groups to document environmental change and crime, directing public attention and donor funds to their causes and providing benchmark monitoring (Elwood & Leszczynski, 2012). The rise of non-state actors in environmental and spatial data collection, assembly, and use highlights the ways that data is becoming central to uneven "power struggles around informational governance" (Mol, 2016, 511). The shape of these struggles, in turn, reflect political-institutional contexts (Rajão & Hayes, 2009), including those that arise from postcolonial and authoritarian histories (Goldstein & Faxon, 2022). In this context, the vision of One Map as a single, national spatial data platform reasserts the ideology of state knowledge and control, even as it opens up new ways of contesting state boundaries on the ground and online. The practices and politics of building spatial data infrastructures are structured by longer national traditions of territorialization, to which we now turn.

3. Histories of map-based territorialization in Indonesia and Myanmar

Colonial and authoritarian histories of state territorialization and counter-mapping shape contemporary data infrastructures. Both Indonesia and Myanmar's One Map platforms digitized and incorporated colonial maps, but Dutch and British influences are not merely cartographic: colonial economic and political priorities shaped both boundaries on the ground and the representations and institutions responsible for geospatial knowledge (Anderson, 1983; Tagliacozzo, 2004). In both countries, a key mapping objective was to determine the location and encourage production and extraction of valuable environmental commodities. Long after independence, colonial priorities remain inscribed in state maps. Under Indonesia's New Order authoritarian regime (1966–1998), and Myanmar's successive military juntas (1962–2011), maps were associated with decades of military domination. Indonesia's ongoing democracy since the New Order has seen the rise of counter-mapping, particularly as a strategy to defend customary land rights. In Myanmar, however, military brutality and control of information, as well as national isolation, meant a paucity of reliable data and less-established practices of data-sharing and counter-mapping.

3.1. State mapping and counter-mapping in Indonesia

Colonial Dutch territorial administration underwent three phases in the East Indies, which set the foundation for land management in contemporary Indonesia. From 1602 to 1815, the first modern corporation, the Dutch East India Company (VOC), acted with impunity to monopolize the spice trade, though land control was limited to port regions. During a second phase from 1815 to 1870, the Dutch 'culture system' expanded territorialization through agricultural production, requiring farmers to produce cash crops for the export market. While mapping enabled Dutch colonists to oversee land and labor, a cadaster was not prioritized since colonial governance emphasized extorting production quotas from plot-level farm production. In 1870, increasing attention to poverty ushered in a process of reterritorialization on which current land administration systems are based. The first was the *domein verklaring* that identified 'underutilized' lands for plantation development (Berenschot and Dhiaulhaq, 2020). Simultaneously, land reforms established cadastral systems that created two administrative categories: state forest and lands listed for all other uses (van der Eng, 2016). This was the basis for the modern political forest in Indonesia, which initiated laws about mapping, surveys, and designation into categories

of production, conservation, and protected forests (Peluso & Vandergeest, 2001). Throughout the New Order authoritarian regime (1966–1998), national technocrats expanded the Forest Estate through military-backed surveys, which divided up areas for timber, plantations, mineral extraction, and conservation (Peluso, 1995). The 1987 state forest maps, called the Consensus Forest Land Use Plan, translated to a legacy that still accounts for 126 million hectares of the Forest Estate, two-thirds of Indonesia's total territory. This meant that people across Indonesia found themselves inhabiting state lands and under threat of repossession and eviction (Barr et al., 2006).

As part of global Indigenous movements that began in the 1970s, activists in Indonesia made the case for defending rural community land rights with the justification that those closer to forest resources have greater incentive to protect it (Brosius et al., 1998; van der Muur et al., 2019). These movements were empowered by mapping technologies, which employed tools of the state to make claims to land and resources (Harwell, 2000). From the 1990s, claims made through spatial technologies underscored by international discursive and material support for Indigenous and forest-dwelling communities, were at times powerful enough to supersede local and national administrative authorities (Tsing, 1999). The end of the New Order regime in 1998 catalyzed political reforms premised on regional autonomy and democratic decentralization, buttressed by the growing influence of civil society. As the country transitioned towards democratic decentralization, reforms facilitated spatial data-sharing across national and sub-national departments (Harwell, 2000; Kimura, 2013; Wibowo & Giessen, 2015). The forestry law was renewed in 1999 and involved civil society-driven deliberations introducing categories of "social forestry" (Fisher et al., 2019). At that time, although rarely formalized in practice, communities could legally claim land certificates based on Indigenous land rights (Fisher et al., 2017). As populist bureaucrats held increasing influence, the state committed to certify 12.7 million hectares of social forestry and Indigenous forest land (Afiff & Rachman, 2019). Maps were a fundamental dimension of this dynamic, whereby NGOs continue to work with communities to spatially claim land rights, particularly to contest dispossession by the state or large concessionaires (Radjawali et al., 2017; Rye & Kurniawan, 2017).

3.2. Military territorialization in Myanmar

Like the Dutch in Indonesia, the British made mapping a major initiative in colonial Burma. In the 19th century, the British gained control of what is today Myanmar and intensified teak and rice exports. They then divided Upper and Lower Burma from the Frontier Areas, lightly governing the ethnic minority hilly areas while establishing village boundaries and tax systems for Burma Proper. Delineating state forests to facilitate commercial timber was a top cartographic priority. The British brought German forestry techniques used in British India to plan growth and harvest, gazetting forests and excluding local swidden cultivators or relegating them to coerced labor (Bryant, 1997). Despite the conflict that accompanied colonial surveys and their topographic errors, paper copies of the so-called one-inch base maps remained the most common administrative tools throughout the 20th century. After independence in 1948, Myanmar's military regimes made few attempts to update the increasingly outdated British maps. From 1962 through 2011, successive juntas governed by the gun and placed little priority on bookkeeping (Callahan, 2003). There was a high level of secrecy with almost no public release of official information during these decades, even as military-connected elites grabbed land and resources with impunity. Colonial land use categories, such as the designation 'wasteland,' were employed as counterinsurgency strategies, and would resurface as the category of 'Vacant, Fallow and Virgin Land' in contemporary laws and maps (Ferguson, 2014).

While Ethnic Armed Organizations mapped their territorial claims and ethnic minority groups produced charismatic images of homelands, there was little tradition of civil society counter-mapping being used vis-à-vis the military government. While Indonesians connected with global movements that harnessed participatory mapping in the 1970s, Myanmar remained isolated from these international activist networks for decades. When Myanmar's military initiated 'discipline-flourishing democracy' in the early 2000s, geospatial data were incomplete, inaccurate, and contradictory. Colonial village, forest, and district boundaries remained on paper maps in government offices, but they no longer reflected actual land uses or administrative practice on the ground (Faxon, 2021). At the national level, different departments used different data sets, coordinate systems, and projections. The military regime had made new national 1:50,000 scale digital topographic maps in 2008 based on 2005 aerial photography, but while this dataset remained under nominal control of the Survey Department, in practice, military authorization was required. Even when civilian departments had access to the updated topographic maps, many continued to use the colonial one-inch maps because they contained both more familiar and more granular forest and administrative boundaries. Data sharing between departments required high-level approval, data was typically kept on a single person's computer, and only a few offices had trained GIS technicians. The first attempt at geospatial data consolidation came in the wake of 2008's Cyclone Nargis, when the UNDP created the Myanmar Information Management Unit and began digitizing maps to coordinate humanitarian response. The project immediately ran into cartographic errors, conflicting borders, and incomplete and contradictory village lists, foreshadowing challenges with the future OneMap.

4. Developing one map

Indonesia and Myanmar's One Map programs were rolled out amid global optimism about the role digital technology could play in solving seemingly intractable problems. Both programs were supported by Western donors and conceived, in part, in response to international priorities for good governance and transparent investment. At the same time, these nascent data infrastructures were linked to national institutional reform projects. The need to reconcile divergent maps and datasets crystalized existing tensions between ministries charged with resource management. In Indonesia, the need to monitor forestry projects for climate change mitigation spurred conversations about a single authoritative map. The initiative gained momentum in part because of its potential to save costs and consolidate authority; in 2011, a new law merged mapping authority into a single unit that would lead the One Map process. In contrast, data infrastructures were imagined not as a solution to international environmental problems in Myanmar but rather within a national project of post-authoritarian land reform. Myanmar's OneMap was tightly linked with the development of the 2016 National Land Use Policy. While the Policy provided guidance on improved data management in the context of broader land governance priorities, Myanmar's program lacked the legal mandate, administrative structures, and financial backing of Indonesia's One Map.

4.1. Climate change, REDD+, and the Geospatial Information Agency in Indonesia

Indonesia's One Map was conceptualized and funded within international efforts at climate change mitigation in the late 2000s. The notion of a market-based climate mitigation mechanism through tropical forest conservation, Reducing Emissions from Deforestation and Degradation (REDD+), was introduced at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) meeting in Bali in 2007. As hosts, Indonesian government representatives were particularly attracted to the notion that REDD + could redirect significant global financing to Indonesia. This was further bolstered by the Norwegian government's US$1 billion investment in REDD+ in Indonesia, which consolidated international development initiatives around preparation for a green economy (Astuti & McGregor, 2015). One of the key demands in this process was for a monitoring,

reporting, and verification (MRV) carbon accounting system, which necessitated an authoritative national mapping process. Preparation authority was vested in a small but influential team in the President's office: the Unit for Development Monitoring and Oversight (UKP4), which was tasked with coordinating ministries to address mapping prerequisites. This Unit established a REDD + Taskforce, and subsequently became the REDD + Agency. Amid rising international interest in REDD+ in the early 2010s, the mapping process generated broad interest.

Early on, the "One Map Initiative'' was part of a broader movement by the President's top advisors to strip away authority from the Ministry of Forestry and achieve key reforms on transparency and accountability (Wibowo & Giessen, 2015; Hein, 2019). Focusing on governance reforms internally, and driven by carbon investment momentum internationally, UKP4 highlighted costs, overlapping jurisdictional mandates, and planning inefficiencies associated with competing mapping initiatives conducted across various ministries. Such concerns facilitated the passage of a new law (4/2011) that stripped mapping authority away from the powerful ministries and consolidating it into the Geospatial Information Agency (BIG). According to *Reformasi Weekly*'s legal analysis:

> The new law … seeks to ensure that no inconsistencies and conflicting references affect the use of geospatial data in Indonesia, to prevent legal uncertainties, misunderstandings about regional or international boundaries, or confusion about forestry and mining areas … The new entity will be the sole regulator of surveying and map-making activities, and it will also be the sole operator responsible for producing [Thematic Geospatial information] … BOTTOM LINE: The new law promises to fill critical needs for better map data, for the benefit of conservation, disaster management, planning and investment. (O'Rourke, 2011)

This new institutional set-up for mapping–framed around mitigating climate change with a subtext of attracting international investment, and the promise of transparency for civil society–led to the convergence of numerous entities interested in the idea of one authoritative map. As the then-Director of Indonesia's Participatory Mapping Network and head of Indonesia's Ancestral Domain Registration Agency argued, it was not only the forestry sector that would benefit from consolidated spatial data and a single map, but the mining and plantation sectors as well (Down to Earth, 2012).

4.2. Good land governance in Myanmar's democratic transition

OneMap Myanmar was born out of a broader land governance program closely associated with democratic reforms of the early 2010s. During Thein Sein's presidency (2011–16), land took centerstage in efforts to develop the country, resolve conflicts, and attract investment (Suhardiman et al., 2019). While illegal logging and deforestation was a growing concern (FAO, 2016), Myanmar's OneMap was not initiated as a climate change or forest management solution. Rather, its origins were linked to the National Land Use Policy.

The Policy was developed through an unprecedented, if limited, consultative process and aimed to outline an equitable system of land management (Faxon, 2017). Conversations about the need for accurate maps and centralized land data management had already begun when the Land Use Allocation and Scrutinizing Committee began to discuss the Policy in November 2012. At the public launch of the consultation period in October 2014, the GIS unit of the Forest Department presented the OneMap Myanmar concept. While the idea was yet to be incorporated into the Policy itself, the presentation noted the challenges faced by government departments in even understanding what data existed, let alone obtaining specific datasets. The objective of OneMap was to act as a centralized "repository and access point for verified government spatial information"; information was to be made "transparent and available to the public," and was needed to help "fulfill the mandate" of the Policy.[3] The 2016 Policy contained a chapter on data management that called for a digital, centralized land map system to facilitate data sharing and deliver equal access to accurate information. Crucially, however, the Policy was not directly implemented by the National League for Democracy (NLD) government (2016–2021). Rather, all work on the land law stopped for two years, after which the NLD government formed a National Land Use Council to kickstart the OneMap process and draft a National Land Law based on the Policy's vision.

The idea of a consolidated information system for evidence-based decision making was in-line with the period's optimism. The public embrace of economic liberalization and limited democratic reforms yielded a dramatic increase in foreign development aid for good governance. The Swiss Development Corporation took an early lead in the geospatial project as one of three international donors supporting the Policy's development. A Myanmar consultant who had helped design the project suggested the name due to the existence of such programs in neighboring Singapore and Indonesia; the catchy title stuck. Another foreign consultant, who had also worked on One Map Indonesia, emphasized that the Myanmar project was fundamentally different because it was designed by foreigners and incorporated civil society perspectives. The Myanmar project was initially conceived as an accessible data platform for verified government spatial information that would provide up-to-date information for both government users and private citizens, though accessibility and participation by non-state actors would remain a point of tension. OneMap Myanmar made strategic decisions early on not to attempt to update the cadaster or establish a single National Spatial Data Infrastructure. Such initiatives, which were eventually included in the Indonesian project, were deemed politically, technically, and economically unrealistic. Instead, OneMap Myanmar focused on sharing, consolidating, visualizing, and analyzing data for evidence-based policies through its online platform, while providing technical assistance to improve data collection methods. These goals of digitization, consolidation, and capacity-building illuminated a particular moment in Myanmar, one characterized by hope in technical fixes as vehicles for political transformation.

5. Institutionalizing data infrastructures

After launching the One Map programs, Indonesia and Myanmar's officials and technicians embarked on the difficult task of reconciling overlapping and sometimes incompatible datasets. Standardizing and building data infrastructures required not only technical expertise but also effective political structures. Indonesia initiated One Map through the 4/2011 geospatial information law and administrative initiatives to standardize databases, then realized an official One Map Policy with Jokowi's 9/2016 presidential decree. In Myanmar, OneMap was overseen by a cross-ministerial committee with little official power or technical knowledge while project and government staff conducted day-to-day operations. While both projects were accompanied by calls for transparency, clarifying boundaries was stymied not only by technical difficulties, but also by political intractability. Especially in Myanmar, a dispersed management scheme failed to address the political challenges that arose in standardizing data. As the One Map projects grew, so did their implications for non-state actors, particularly investors and activists. While both private corporations and NGOs initially embraced One Map in Indonesia, prompting a rush to map land, in Myanmar civil servants and civil society resisted data-sharing.

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[3] Presentation at October 2014 launch of National Land Use Policy "OneMap Myanmar: The Government Platform for Verified Open-Access Spatial Information" Myat Su Mon 2014: slide 4.

5.1. Institutional restructuring and the rush to map in Indonesia

Formalizing Indonesia's One Map occurred through the legal means of a forest moratorium policy as well as through the institutional mechanisms of standardizing databases (Astuti & McGregor, 2015). The first approach set out to establish a legal basis under the moratorium (Presidential Instruction 10/2011). The moratorium was closely tied to criteria set through Norway's investment, which was envisioned to attract additional REDD + financial support. The moratorium ended additional licensing in primary forests, while also integrating geospatial databases to address overlaps and discrepancies in forest categorizations in support of better management. The REDD + Agency, a unit initially under the president's office and subsequently folded into the Ministry of Environment and Forestry in 2016, sought to develop new systems to review all licenses, working with BIG and relevant ministries to agree to standard terminologies and develop a consolidated moratorium map (Seymour et al., 2020). The REDD + Agency used the example of forest cover in Papua to frame the idea of One Map, an island in which the Ministries of Environment and Forestry differed in their estimation of total forest area by 15 million hectares.

The second approach consisted of administrative initiatives aimed at unraveling the Gordian knot of land use databases and overlapping permits. Across the diversity of land uses in Indonesia, however, and the numerous institutional mandates under an ever-changing democratic decentralization framework, the REDD + Agency faced opaque data information systems and resistance across institutions. In Kalimantan, for example, straightening out overlapping boundaries would also implicate elected leadership and other prominent administrators as graft suspects. The increasing political dimensions of this undertaking ultimately meant that specific issues with clear technical responses, such as mapping the high carbon-content forest landscapes of Indonesia's peatlands, were prioritized over more complex problems, such as overlapping concession boundaries (Goldstein, 2016).

In practice, getting maps digitized and boundaries established proved challenging, particularly given unavailable and inaccurate sub-national data. The project even undertook a complicated process to clarify village boundaries (Interior Ministry Regulation 45/2016), requiring such costly stipulations that districts openly expressed their inability to comply without external assistance. While village boundary-setting was framed as participatory, the process at times produced new conflicts. An even larger task was to get data online so that corrections could be implemented in an online database. While many agencies believed in the importance of the project, they also underscored the intensive human resources and funding required for establishing and maintaining online maps.

One Map was also the site of competing priorities among state and non-state actors. On the one hand, priorities focused on reviewing mining and plantation licenses for their association with land use change, deforestation, and cases of violent dispossession. This work was complemented with real time national initiatives in a "situation room" style approach in the President's office to conduct monitoring using wall-to-wall high-resolution satellite imagery.[4] On the other hand, numerous thematic mapping initiatives emerged aimed at improvements in spatial planning, investments, and legal accountability. After the 2014 election of President Joko Widodo (popularly known as Jokowi), the One Map Policy (Presidential Regulation 9/2016) aimed at developing thematic maps to serve as sectoral references and for integrated spatial and land use maps to guide development planning. The One Map Policy website[5] frames One Map as a "solution to address development challenges and barriers resulting in conflict due to overlapping land uses." Under the regulation, led by the Coordinating

Ministry of Economic Affairs and supported by BIG, 85 thematic maps have been produced across all 34 provinces, involving 19 ministries/agencies as parties responsible for data management.

Investors and activists initially greeted Indonesia's One Map with excitement. Corporations, under the leadership of Unilever, were making commitments to climate change and good governance, viewing One Map as an accountability tool for deforestation-free commodity supply chains. They hoped One Map would also resolve issues in which middle and low-level managers notoriously redrew lines on concession maps, evicting local communities and clearing forest illegally.[6] Indigenous rights-based environmental activism grew during this period and reinterpreted One Map (Bettinger et al., 2014). Given the interests of plantation and extractive industries and amid concerns that REDD + could lead to dispossession, a coalition of international development organizations focused on consent within local communities, promoting land justice issues that they might not have otherwise; activists strategically embedded themselves in this agenda (Afiff, 2016). Activists pushed to establish an Indigenous land registration agency and created participatory maps for inclusion into One Map. At the height of attention to these issues between 2013 and 2016, social and environmental activists declared that 40 million hectares of land would be returned to local communities under *adat*, or Indigenous rights, justification (Butler, 2013).

One Map Indonesia generated outsized expectations and fostered a win-win-win narrative under a broad umbrella of environment and development issues. The first win was the environment, promising an accountability tool for tracking deforestation, plantation expansion, and forest carbon sequestration. The second win was social justice, as Indigenous land rights activists began to map ancestral territories, using the terminology of the state to form an "Agency" for Indigenous land registration. Social activists also advocated for populist land reform, which led government agencies to produce maps where forest land tenure-sharing arrangements and agrarian reform "objects" could be recognized through land certificates. The third win was for corporations, which hoped to avoid land conflict and extortion, an increasing requirement for land management tied to foreign investments (Fig. 1).

By 2021, One Map was overseen by the Coordinating Ministry of Economic Affairs and pursued the overarching institutional goal of supporting spatial data needs for development planning, which was increasingly framed as a tool for attracting international investment. Within this context, different donors and ministries work on distinct aspects of One Map. BIG pursued the establishment of a base map as an authoritative source for data coordination. The Interior Ministry sought to finalize administrative boundaries and require local governments compliance with data reporting standards. Meanwhile, Indonesia's dual land administration systems unfolded through parallel contestations, whereby the Land Agency pursued its cadaster through $200 million in World Bank financing[7] and the Forestry Ministry reinforced authority by controlling forest management and hardening boundaries. One Map attracted substantial financial support, including a $600 million investment package from the US Millennium Challenge Corporation to promote green economy with the caveat that geospatial boundaries had to be consolidated and corrected first.[8] While both the Millennium Challenge Corporation and the World Bank linked their programs to One Map, their interpretations of the program differed substantially both from each other, and from the initial imagination of a single map to

[4] April 27, 2014, presentation "REDD+ in Indonesia: Challenges and Promises," Heru Prasetyo. https://www.slideshare.net/CIFOR/redd-in-indonesia.
[5] https://satupeta.go.id/about.

[6] At the Tropical Forest Alliance Workshop on June 27, 2013, the CEO of Unilever and President Yudhoyono both highlighted government and private sector interests in spatial data transparency and accountability.
[7] World Bank, "Nearly 4.3 Million to Benefit from Indonesia's Sustainable Land Management," 19 July 2018. https://www.worldbank.org/en/news/press-release/2018/07/20/indonesia-sustainable-land-management.
[8] Millennium Challenge Corporation, "Indonesia Compact," 26 Aug 2019 https://www.mcc.gov/resources/pub-full/star-report-indonesia.
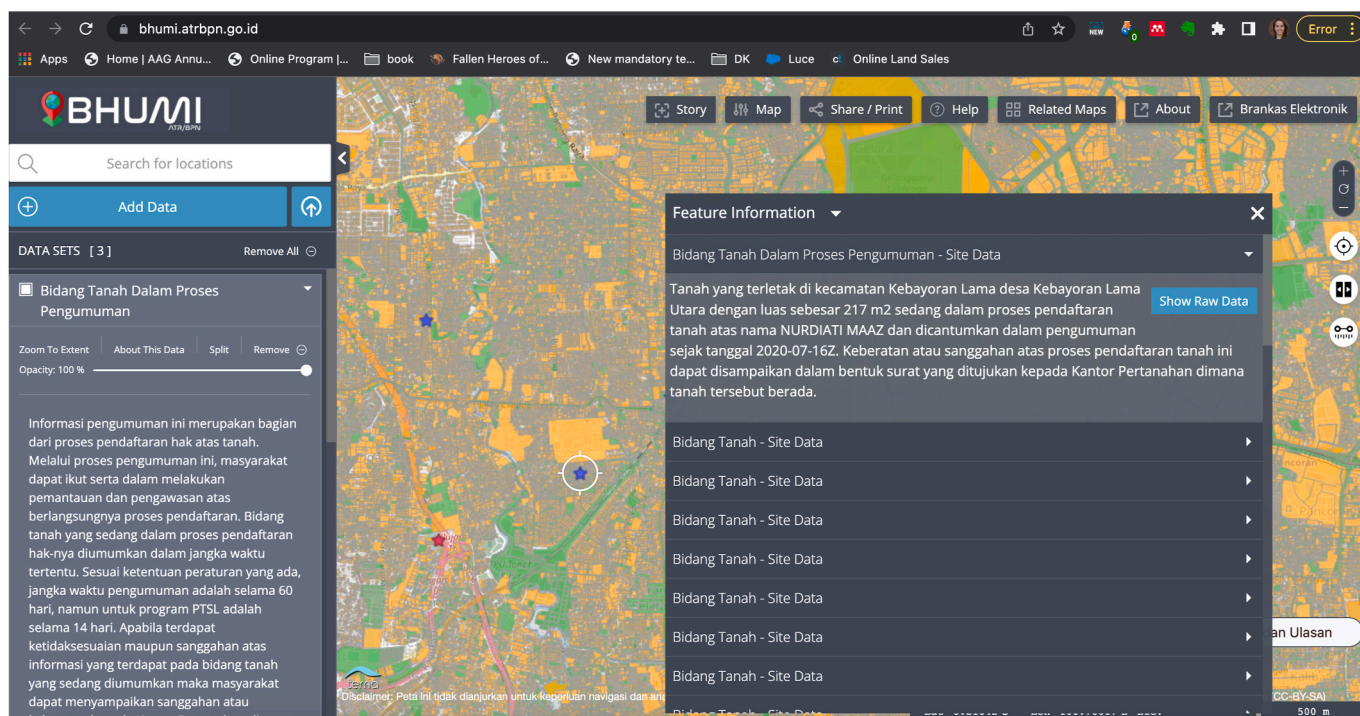
Fig. 1. Public online mapping interface featuring information on the location, size, and ongoing registration process for land parcels provides an example of World Bank-funded National Land Agency's take on One Map.

oversee all maps. Although a broad network of NGOs initially engaged, there was growing disappointment. For example, Indigenous People's networks saw initial promise in Constitutional Court provisions to reclaim land by mapping territories (Myers et al., 2017), but the actual transfer of lands stalled. Where they succeeded, cases indicate central-izing authority and elite capture (Fisher and van der Muur, 2020). Meanwhile, attempts to secure oil palm plantation data and maps are consistently ignored by the government despite a court ruling mandating they be made public, undermining the promise of conflict resolution via transparency (Jong, 2021).

5.2. Fear and reluctant data-sharing in Myanmar

OneMap Myanmar faced challenges that stemmed, in part, from a lack of government commitment, coordination and incentives for engagement. The Centre for Development and Environment (CDE) at the University of Bern, Switzerland won the tender as the technical imple-mentation agency behind OneMap Myanmar in 2015, funded by an eight year, eight million swiss franc grant from the Swiss Agency for Devel-opment Cooperation. This technical team worked closely with members of the government, but there was no centralized agency to support the project, and policies such as the Boundary Law and the draft Survey Law discussed under the NLD Government appeared to conflict with One-Map's goals by siloing data while effectively making non-government mapping initiatives illegal. A sprawling institutional apparatus gov-erned OneMap. To implement the National Land Use Policy, in early 2018 the National Land Use Council (NLUC) was established by

Presidential notification 15/2018.[9] The NLUC established four working groups, with the National Land Information Management System Establishment Working Committee overseeing the OneMap Myanmar project.[10] The working committee approved project activities, however, in practice it was the Myanmar-based CDE staff who set up the digital platform, while preparing civil servants to contribute government data. In subsequent phases, OneMap planned to set up a technical unit staffed by representatives from different government departments to carry out tasks and facilitate collaboration.

Governance through committee proved ineffective for managing dispersed participants, making crucial decisions, tackling immediate challenges and creating lasting structures. While the Forest Department was OneMap's focal ministry, it was often unclear which entities were authorized to make decisions on key issues. Meanwhile, government staff—who had no experience sharing data and often knew its weak-nesses—feared being embarrassed publicly by sharing inaccurate in-formation or admitting that basic data simply did not exist. Combating shame and fear was a major part of encouraging data-sharing. Entreating his colleagues to share across ministries, one high-ranking official speaking about OneMap likened departmental information to one's own offspring: 'you want to hold onto data … it is like our children. But your children will grow up and you need to let them go … if you don't share, people won't understand how valuable your data is!'[11]

This reluctance to share data, born in part from distrust of the gov-ernment, permeated civil society. Unlike in Indonesia, Myanmar CSOs

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[9] The high-level council was chaired by the second Vice President and included 9 Union government ministers, the chief ministers of the 14 states and regions, and the chair of the Myanmar Investment Commission.

[10] Chaired by the Vice Minister of the Ministry of Natural Resources and Environmental Conservation, this committee was envisioned to have 31 mem-bers, including 13 union level ministers, senior departmental representatives, academics and 3 civil society representatives (although these were never selected).

[11] Author fieldnotes. October 2, 2018, National Land Use Policy Forum, Naypyidaw, Myanmar.

initially viewed OneMap Myanmar with suspicion. During the 2010s, local initiatives and foreign support for participatory mapping took off across the country, but there was not an established standard for either making maps or for using them for advocacy. OneMap Myanmar sought to support and incorporate participatory maps, but while activists cooperated with OneMap to map customary land use in the Northwest and oil palm plantations in the Southeast, participation remained limited to these pilot programs. Furthermore, investors had a limited understanding of OneMap. In 2019, the government publicly announced plans to create a Digital Land Bank, a repository of state-owned parcels and buildings available for investment, and then approached OneMap for assistance. But poor record-keeping and long histories of land grabbing meant that the Land Bank risked legitimating stolen land and enriching its owners. OneMap Myanmar's team ultimately avoided the project, noting that the notion of a land 'bank' that could potentially accelerate land alienation was antithetical to OneMap's goal of data for equitable governance.

As in Indonesia, the challenge of standardizing databases was formidable. Different departments used different geospatial datum: the home-grown Myanmar 2000 was incompatible with the international WGS84 projection system. In the early days of the project, consultants with experience working in Indonesia urged the establishment of standard projections and processes to ensure data was shareable across departments. But given the challenges of institutional coordination, OneMap abandoned the idea and worked instead with individual departments. Even when datasets were under the domain of a single department, OneMap Myanmar faced major technical challenges in digitizing existing government data, for example when digitizing protected forest boundaries based on incorrect topographic data from colonial one-inch maps. Natural features such as streams that formed the basis of legal borders had often been mis-recorded or had shifted. Other issues arose when digitizing community forests, whose boundaries were based on paper maps with poor spatial data. Beyond the question of location was that of land use: preliminary analysis indicated that thousands of Community Forest certificates covered not forested but agricultural land. This exercise revealed both the challenges and the potential of OneMap: by comparing government permits with actual land uses, public geospatial data could provide evidence to guide more equitable land management. A similar project comparing official mining concession areas with actual mining sites similarly showed the platform's potential to increase public awareness and improve resource management (Fig. 2).

Yet the lack of high-level leadership on the project produced uncertainty and stymied attempts to publish geospatial information. As in Indonesia, the project faced challenges in clarifying administrative boundaries. Doing so was a top priority for many government agencies, who requested clarifications in cases where natural boundaries, like rivers, had moved over time or different departments used different boundary datasets. Setting administrative boundaries was highly politicized in the case of Special Administrative Zones, which provided a level of ethnic autonomy. Resolving disputes around township boundaries that corresponded to these Zones would determine which villages were eligible to vote for ethnic representatives and which would be governed by the central state. Without a process for determining boundaries, local ethnic civil society organizations feared making them public, especially after a OneMap collaboration produced a map that clearly revealed numerous minority villages outside the Zone's boundaries. Questions around territorial sovereignty emerged even more clearly in the case of three islands near the Thai border. In 2019, Thailand formally complained that the islands were included in Myanmar in an online geospatial platform published by OneMap and the Department of Population with the 2014 census results. OneMap checked the Government of Myanmar, colonial, and American maps and found the islands included in Myanmar's territory, but Thailand claimed the uninhabited islands. It would require diplomacy at the highest levels of the civilian government, as well as coordination with the military, to

resolve the contested claims. Without it, and to avoid an international conflict, the census platform was taken down and the issue remained officially unresolved. Without the ability to make political decisions around datasets, technical tasks were put on hold. Aspirations towards democratic processes confronted the persistence of authoritarian institutions.

6. Discussion

Indonesia and Myanmar's separate One Map programs both attempted to update a classic state project—to know and claim territory—through digital platforms for geospatial data. In both countries the vision of an online, singular spatial data platform was backed by a larger set of administrative and technical improvements that both relied on and sought to update colonial and postcolonial representations and institutions. While both countries bore the imprint of resource extraction and violence, Indonesia's longer period of democracy and rich history of counter-mapping positioned officials and activists to respond much more enthusiastically, illustrating how new data infrastructures are embedded in particular histories of territorialization. Both One Map programs were funded by foreign donors broadly interested in transparency, though they were framed around different development goals: climate change mitigation and land investment in Indonesia, and good land governance in Myanmar. Indonesia's program was far vaster than Myanmar's; backed by law, the initiative mobilized hundreds of millions of dollars into different ministry projects that ranged from agrarian reform to clarifying forest boundaries. In contrast, Myanmar's single-donor program lacked legal mandate, administrative structures, and financial backing. While its objectives originated in land and resources, as the program struggled to get buy-in it embraced narrower goals, such as publicizing census information for basic services. Both projects struggled to clarify administrative boundaries and reconcile political challenges that arose from standardizing data in a context in which many people continued to benefit from obscurity.

Like all maps, One Map was a partial representation of the territory it purported to describe. But the use of digital technologies to claim complete geospatial knowledge endowed the projects with an air of authority that both masked continued political struggles over territory, and amplified their significance. In comparison to paper maps, online platforms enable the spread, comparison, and visualization of information, inviting heightened scrutiny and broader participation. In this context, data itself has become an important site of territorialization, as symbolized in the declaration of the state's ultimate authority in the form of a singular One Map. Yet One Map was not a reflection of ground reality, but a powerful tool for organizing territory towards particular goals, whether national sovereignty, foreign investment, or indigenous claims. Rather than serving as a neutral platform for authoritative answers, the One Map platforms and the hardware, software, and institutional apparatuses that underlay them represented new terrains of struggle for persistent questions of land control, writing new chapters in a long history of attempts to govern resources.

By 2021, the platforms had taken divergent trajectories. The One Map Indonesia platform was formalized as part of a Presidential Instruction in 2016 and publicly launched in December 2018.[12] Initially envisioned as a centralizing, consolidating project with climate change mitigation goals, One Map Indonesia had rebranded itself as the more expansive 'One Map, One Data' and grown to incorporate a vast set of activities, including guiding mangrove restoration, developing reference systems for geospatial information, and producing thematic maps for national development priorities — especially investment and economic zones. The increasing role of the World Bank as well as a turn away from indigenous recognition and redistribution suggested that the project's goals were crystalizing around attracting foreign investment, a trend

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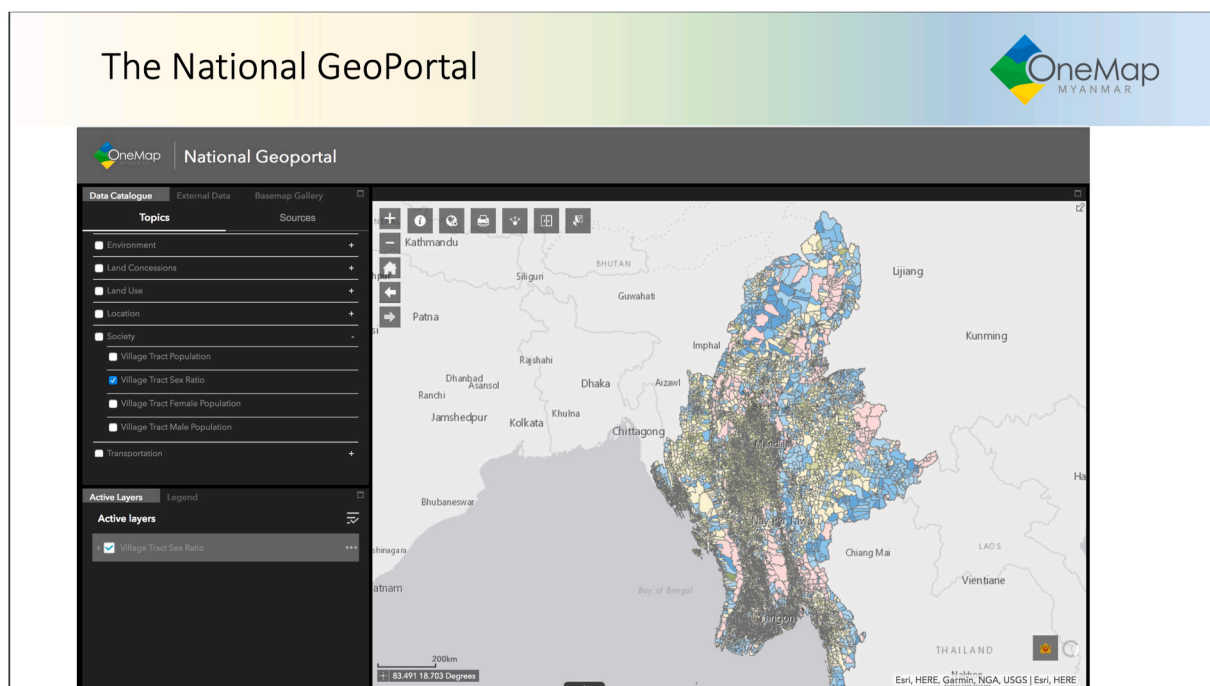
[12] https://tanahair.indonesia.go.id/portal-web/inageoportal/#/

Fig. 2. Image from a OneMap Myanmar presentation features 2014 Census data on an interface designed to include information about land concessions and use.

consistent with the shift away from populism and towards neoliberal policies that characterized President Jokowi's second term (2019–2024). In Indonesia, One Map appeared to consolidate power towards central government actors, although authority remained contested between constituent parts. The recent development of guidebooks about which data can and cannot be made public signals a decisive turn away from the early embrace of openness.

In contrast, Myanmar's program, like the country itself, was in crisis. In January 2021, almost none of its platform was publicly available, though thematic maps had been shared and a platform comparing mining concession license coordinates to actually mined areas had just been launched.[13] It seemed that the project might at last get high-level support when the State Counselor began pushing for a full release of the platform. But the military coup on February 1, 2021 and subsequent brutal crackdowns on civilians cast doubt on the future of a project conceptualized as a tool for transparency and good governance. The year that followed saw the re-imposition of sanctions and withdrawal of foreign aid, limiting the ability of foreign funders and technical experts to engage. Armed conflict erupted across Myanmar's hills and central plains, making gathering and consolidating any kind of data both difficult and dangerous, and raising the stakes of mapping.

Spatial data platforms put new pressure on the state to clarify its decisive territorial knowledge while providing openings for non-state actors to make claims. While ostensibly a digital manifestation of state sovereignty, both One Maps were shaped by priorities of international actors, whether donors, investors, or experts, who displayed different ideas about how geospatial data could improve governance and spur development. The Indonesian case illustrates the potential for grassroots engagement, for example when Indonesian groups called for Indigenous people to 'Map your lands before it gets mapped for you' and successfully lobbied to have some participatory maps incorporated into the platform. Yet even when accessible, translating data into better governance is not automatic, as Rini (Astuti et al., 2022) demonstrate by using Indonesia's One Map to visualize illegal oil palm plantations, outlining the governance dilemmas these visualizations create, and examining the

trade-offs in solutions advocated by different stakeholders. While certain non-state actors with particular expertise can advance more equitable resource governance by leveraging data infrastructures, our comparative analysis underscores the limits of this approach. In the context of Myanmar's resurgent authoritarianism, Myanmar civil society confronted what D'Ignazio and Klein (2020) dub the paradox of exposure: while being left uncounted or off the map presents problems to marginalized populations, data that heightens visibility can also increase risk. Transparency and participation quickly erode when data territorialization gives way to active state violence.

7. Conclusion

Centralized projects of geospatial management have proliferated across and beyond the Global South, echoing longstanding efforts at state territorialization through mapping even as they reflect contemporary aspirations for better governance through data. Yet digital spatial information does not report a singular, stable situation, but rather re-energizes normative and distributional contestations. In both Myanmar and Indonesia, compiling and standardizing data was not only technically challenging but also demanded adjudicating political boundaries and competing representations. Our comparison suggests that these processes will play out differently based, in part, on national traditions of territorialization and counter-mapping as well as the mandate of contemporary institutions charged with building geospatial platforms. The process of territorializing data is not monolithic, but rather dependent on existing relations of resource governance.

This insight invites further research. Future work could explore such projects in places like Singapore, Thailand, or Laos, or in comparison to national projects in the Global North, including those that come with settler-colonial histories. Contrasting our study with recent work on sea data highlights a key distinction: while terrestrial data infrastructures tend to shore up longstanding state projects, international ocean governance is emerging simultaneously with data infrastructures (Campbell et al., 2020). This suggests it is critical to consider digital platforms beyond the state, whether for the monitoring of transboundary traffic in illicit resource commodities (Faxon & Goldstein, 2022) or for the financialization of environmental data by development

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[13] https://meiti.onemapmyanmar.info/.

actors and private corporations (Duncan et al., 2022; Fairbairn & Kish, 2022). Work on territorializing data could be brought into conversation with recent studies on technologies for urban governance and critical work on participatory mapping to understand how these processes take place at multiple scales, including municipalities and indigenous territories. Similarly, while our work highlights that digitizing even basic spatial data can have big governance consequences, our argument extends to the machine learning algorithms proliferating across the international conservation and development industry. As computation becomes more complex, barriers to participation rise, potentially shoring up powerful actors' expertise while preventing grassroots involvement and obfuscating the logics that drive data infrastructures.

It is in these particular, empirical difficulties of compiling, computing and visualizing that the relationship between building data infrastructures for environmental management and consolidating state power comes into focus. 'Territorializing data' names the increasing centrality of digital platforms to contemporary land and resource governance. The term highlights how new sites of territorialization—digital platforms and spatial data—can paradoxically consolidate state control while increasing non-state participation. Data infrastructures are networks of control and spaces of contestation within longer struggles over territory.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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