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Perspective

Automating violence? The anti-politics of 'smart technology' in biodiversity conservation

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ABSTRACT

This article examines the politics of emerging partnerships among big-tech corporations, big international non-governmental organisations (BINGOs) and bilaterals that promote the uptake and implementation of 'smart technologies' in biodiversity conservation. Despite growing global recognition of Indigenous and local peoples' rights to forests, lands, and oceans as central to socially just and successful conservation, new initiatives to conserve 30% of the Earth's territory by 2030 ('30 × 30') under the United Nations' (UN) post-2020 Global Biodiversity Framework largely continue to neglect their existing customary rights and uses of biodiverse territories. The consequences of this have become evident in new global conservation partnerships that are taking a 'technological turn'. 'Smart technologies' that rely on artificial intelligence (AI) and complex hardware, such as camera traps, drones, and smartphones, enable new forms of surveillance and securitisation through and beyond conventional conservation practices. Despite their potential to exacerbate social injustices against historically marginalised groups, the situated character of smart technology impacts and outcomes often remain unquestioned by mainstream conservation actors. Our paper shows how the dominant discourses framing such technology as successful and innovative across global and local partnerships belies its potential to: 1) inflict considerable violence upon local and Indigenous peoples; and 2) neglect the main political economic drivers of biodiversity loss. Drawing on examples from Palawan Island, the Philippines, we show how these global-local governance partnerships have valorised the potential success of smart technology for biodiversity conservation in situ without considering how they may adversely impact Indigenous and local peoples' rights and livelihoods, while at the same time neglecting and depoliticising the violence of capitalist extractivist expansion.

1. Introduction

Despite the growing recognition that Indigenous knowledge and participation is central to equitable and effective conservation (Fletcher et al., 2021), emerging partnerships around 'smart technologies'[1] for global biodiversity conservation (e.g., the 30 × 30 initiative) have shown little regard for their potential negative implications for Indigenous and local peoples' rights to natural resources and livelihoods (see Dinerstein et al., 2020). Smart technologies rely on software-based artificial intelligence (AI)—the simulation of human intelligence processes through machine learning and application (Dauvergne, 2021)—and complex (precious metal based) hardware, such as camera traps, drones, or smartphones. They entail the visual monitoring and acoustic sensing, recording, recognition, web-based cataloguing, delivery, and storage of data to enable rapid and predictive capabilities in conservation (Bakker and Ritts, 2018). This global 'technological turn' has dramatically enabled the reach and impact of conservation interventions, often penetrating deep within Indigenous and local peoples' territories (Nitoslawski et al., 2021). Smart technology in conservation is enabling new forms of surveillance and securitisation through, but also well beyond, conventional protected area boundaries (Simlai and Sandbrook, 2021).

As an outcome of the logic, finance and technologies of remote warfare, state, non-state, and private sector actors have enthusiastically

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[1] Variously labelled Smart Earth, Digital Earth, the Internet of Things, cloud computing, biomonitoring, or citizen science (Bakker and Ritts, 2018).

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adopted smart technologies as powerful tools to conserve biodiversity across scale (Bakker and Ritts, 2018). Often developed in concert with big technology corporations and militaries (Duffy et al., 2019; Lunstrum, 2014), these technologies compress time and space to enhance the access to and use of large amounts of real time data from different sources and geographies (Bakker and Ritts, 2018; Simlai and Sandbrook, 2021). Proponents have suggested that these technologies offer the potential for greater transparency and availability of data for complex integration and problem solving (Bakker and Ritts, 2018), while others have documented how Indigenous and local peoples have used such tools to defend their territories (Millner, 2020; Radjawali et al., 2017). Smart technologies have thereby captured the imaginations of conservationists, scientists and activists interested in collecting, analysing, and running simulations with high-resolution imagery and other 'big data' from satellites and other sensory devices to document and respond to climate change, deforestation, and biodiversity loss (Dauvergne, 2021).

The considerable financing and provisioning of such technologies is motivating predominantly mainstream civil society, state, and corporate actors to partner up in smart governance networks to conserve global biodiversity more efficiently and effectively. As big technology (hereafter 'big tech') corporations bankroll and design smart tools, and bilaterals and big international nongovernmental organisations (BINGOs) implement them, Indigenous and local peoples are meant to support the use of such tools to generate data that ostensibly helps to protect their forests, lands and oceans (Bakker and Ritts, 2018; Nitoslawski et al., 2021; Sarkar and Chapman, 2021). In this Perspective piece, we examine both the architecture of global–local partnerships around smart technology design and adoption and how this technology's implementation may generate varied local impacts, focusing specifically on biodiversity conservation on Palawan Island, the Philippines. We show how decentralizing these technologies to national and local levels can enable the rapid monitoring, restricting and criminalizing of Indigenous and local peoples' resource access and use by those who control the technology and its local infrastructure (Sandbrook et al., 2018; Dauvergne, 2020). The Palawan case reveals the potential for many local residents to be punitively monitored and controlled by such technology, in part because their own limited resources and institutional capacity (e.g., lack of mobile connectivity and access) means they cannot grasp and use these tools to defend lands and oceans. We show how the valorisation of smart technologies through international partnerships generates its own sense of unlimited potential and success to reinforce adoption and implementation at the expense of engaging the more politically sensitive drivers of biodiversity loss. Such valorisation, we argue, thereby widens the gap between the rhetoric of success and the reality of the extractivist violence (both direct and structural[2]) driving deforestation and biodiversity loss (see also Fletcher et al., 2019).

Decades ago, James Ferguson (1994) described how planners characteristically rendered complex development problems a-political – an 'anti-politics', a matter of purely technical intervention, despite their inherently political nature. Ferguson explains that "development institutions generate their own form of discourse" and that this discourse ultimately constructs entities or issues as particular objects of knowledge (1994, xiv). He notes further that such reification —the rendering of complex, abstract phenomena into simplified entities—generates a sphere of knowledge and sentiment around a particular object that lends it legitimacy, authority, and power. As processes of reification deepen, the more particular objects, events and interventions are simplified, the more they are invested in politically and legitimated, and the more they are rendered a-political and unquestioned. As we show, this holds true for the adoption of smart-technology in public-private partnerships involving biodiversity conservation. As smart technology is valorised, the associated tools, programs and partnerships convey authority and power that others enthusiastically align with. In doing so, few question the potential social impacts of such interventions and the extractive drivers of biodiversity loss outside these technologies' focus.

More recently, researchers have pointed to how conservation and development interventions are commonly framed as successful in ways that obscure or obfuscate the actual messiness of their operationalization (Mosse, 2005; Büscher, 2014; Svarstad and Benjaminsen, 2017). Building on this, our analysis demonstrates how the networked actors behind smart technologies similarly sell the success of and legitimize such technologies in anti-political ways, with little reflexivity on potential harms and limitations. Big tech and dominant conservation actors valorise and promote the use of such technologies in partnerships with rural residents and governments, often leading to a perception of 'the suspension of politics from even the most sensitive political operation' (Ferguson, 2006, 273). Going beyond existing research, we argue that discourses of success generate something of a herd mentality, wherein big tech, BINGOs and bilaterals are drawn to politically palatable tech solutions that, seemingly simple and intuitive, generate new enthusiasm and partnerships for technological, market-oriented solutions that are framed as holding potential *only* to improve conservation outcomes and promote poverty reduction. In time, this leads to what Borup et al. (2006) have called an "economy of expectations", whereby actors, their knowledge, and their interventions stoke new "imaginings, expectations and visions" concerning the future potential of conservation outcomes (285–86) (see also Fletcher et al., 2016).

Such anti-politics, we argue, has the potential to *automate* violence on two interrelated fronts. First, violence can be automated directly, given that smart technology can rapidly aim, shoot, capture and monitor, and these processes are automated by algorithmic designs and hardware. Second, violence can be automated structurally, in that the anti-politics of technological fixes neglects attention to the extractive political economies that ultimately drive biodiversity loss and underpin the financing and legitimacy of the very states sanctioning smart technologies.

Based on a comprehensive analysis of policy documentation and insights from the second author's two decades of fieldwork on Palawan Island, the Philippines, we examine how the global-local partnerships described manifest with state agencies, provincial politicians, and NGOs adopting smart technologies and the narratives of success underlying them. After the introduction, Part 2 outlines the emerging global smart tech conservation architecture generally to set the stage for our ground-level analysis. Part 3 then turns to the regional and country level of the Philippines to explore how these global partnerships manifest in concrete initiatives within the political economy of Palawan Island specifically. We focus on the global-local partnership between the United States Agency for International Development (USAID) and Conservation International (CI) funded 'Wildlife Insights' (Google) platform and its implications for Indigenous peoples' rights and livelihood security in southern Palawan, as well as a Huawei-Rainforest Connection-local government initiative in the island's north. Rather than demonstrating clear causality, the cases illuminate how the market-orientation and valorisation of these smart technologies as the 'go to' solution for successful biodiversity conservation has the very real potential to intensify surveillance of Indigenous and local peoples' activities while simultaneously neglecting to engage the political economy of oil palm plantations and nickel mining encroaching upon Indigenous territories and the protected areas encompassing them.

2. Evolving corporate-NGO smart technology partnerships

The use of smart technology is now integral to the architecture of global biodiversity conservation (Dauvergne, 2021; Pimm et al., 2015). While the United Nations, World Bank and other international partners

[2] While *direct* violence entails "the rending of flesh with the intention to harm" (Nordstrom, 2004, 60–61), *structural* violence is more subtle, referring to the way that violence is embodied is societal structures such that many people contribute indirectly to its exercise without any particular person being directly responsible for it (ibid).

have helped legitimize the use of smart technology globally,[3] is it big tech corporations that have become central to the design, financing and enabling of smart technologies for global biodiversity conservation efforts specifically (Dauvergne, 2021; Sarkar and Chapman, 2021). With big tech comes the drive for big data and the latter's legitimacy and authority in international conservation arenas, including implementing powerful data management, storage and use mechanisms (Runting et al., 2020) (see Fig. 1). While conservation scientists have long used technology to track, monitor and manage species and environments, global tech giants such as Microsoft, Google, Huawei, Intel and Apple have recently accelerated and scaled up these efforts through various partnerships with BINGOs (e.g., Conservation International).

Independent of and increasingly through these corporate alliances, BINGOs have emerged as key brokers of the emerging global 'smart conservation' agenda (Runting et al., 2020). This agenda hinges upon global-scale narratives of success of technology-based conservation solutions, including the pursuit of corporate and global carbon neutrality, enabling market-based ecosystem valuations and saving endangered species via audio and visual surveillance. For example, tag lines from TNC celebrate AI's potential in generating global planetary solutions: '*As technology changes our world faster than ever, our scientists are partnering with innovators in the private sector to develop and scale technology that ensures people and nature thrive*' (TNC 2022). As the Program Manager for Global Oceans at TNC noted, '*Technology accelerates everything it is applied to. It therefore holds the promise to accelerate conservation solutions so that they scale to global environmental challenges*' (TNC 2021).

Among the big tech corporations, the promotion and distribution of smart technologies have involved global campaigns to conserve ecosystem services across biodiverse regions by sponsoring and providing the technological infrastructure to support large-scale carbon sequestration and offsetting projects. In partnership with BINGOs, major international initiatives have been rolled out through satellite branches, local conservation organisations and local community groups worldwide. For example, Apple and CI are developing a new blue carbon accreditation system to be executed by Verra (a verified carbon accounting standard), and they are working alongside the finance giant Goldman Sachs to launch what they dub the $200 million 'Restore Fund' for investments in market-based 'natural climate solutions' (Apple, 2021) (e.g., removing carbon dioxide from the atmosphere by investing in the conservation and restoration of ecosystem services). According to Apple, this will account for 25 % of the emissions they cannot eliminate from their own supply chains—apparently allowing them to achieve carbon neutrality by 2030 while only directly cutting 75 % of their own emissions. With financial support from Apple, CI has initiated carbon sequestration projects in Colombia's mangrove forests, the savannas of Kenya's Chyulu hills and northern Peru's Río Nieva Reserve Zone as the basis of this global carbon removal scheme (Apple, 2021; CI 2022). As the CEO of CI noted on the Apple webpage (2021):

> '*We are excited to build on our long-standing partnership with Apple and believe the ground breaking approach with the Restore Fund will make a huge difference and benefit communities around the world with new jobs and revenue that support everything from education to healthcare* (Apple, 2021).'

Alongside pledges, donations and commitments to carbon neutrality, tech giants competing to 'greenwash' their companies have been providing their automated processing software and technology as innovative conservation tools—most notably in the tracking of endangered wildlife (Duffy, 2022). In addition to striving for complete reliance on carbon-free energy by 2030, Google, for example, have partnered with CI and six other conservation partners[4] to create the 'Wildlife Insights' platform (www.wildlifeinsights.org; see also WWF, 2021). Established in 2019, and implemented in parts of Southeast Asia, including Palawan, the Philippines (see Section 3), the platform utilises the "unrivalled processing power" of Google Cloud and AI models, allowing users to upload, automatically sort and analyse 'camera-trap' images (Vander Velde, 2019). Algorithms initially trained using around 8 million camera trap images supplied by the conservation partners can process thousands of images and quickly identify species under threat, expediting interventions in forest and ocean settings. Openly accessible, this platform seeks to make conservation science more widely available and efficient across scale (Google, 2021). Critically, the more users of the platform, the more effective the algorithm can become, as each photo added can further 'train' the AI to improve its accuracy and capacity to sort through large datasets at a pace and scale that individual researchers could not match (Ahumada et al., 2020).

Like Conservation International, TNC has, since 2017, been a key recipient of Microsoft's AI for Earth cloud computing grants to support its work on ecosystem accounting (see also Smith, 2017; Microsoft, 2021). Working with BINGOs such as TNC, Microsoft has established a series of open-source tools, models, infrastructure, data, and application programming interfaces (APIs) integrated with the aforementioned 'Planetary Computer', which allows for the storage and analysis of global environmental data. According to Microsoft, TNC's access to the cloud technology *'not only provides a powerful and flexible platform to store and crunch data; it also enables tools like machine learning and data scraping that the non-profit staff can use to better understand the state of the world's natural resources—and how they can better protect the planet'* (Spelhaug, 2018; Toadvine, 2020). TNC has used this technology to pursue a global natural capital valuation in market terms, ascertaining the economic, social, and cultural value of the world's coastal and marine resources under their 'Mapping Ocean Wealth' initiative (see https://maps.oceanwealth.org). This algorithmically generated economic valuation of coastal resources is seen as a powerful conservation initiator, with Mark Spalding, Senior Marine Scientist at TNC, stating that *'if we can show [local economies] where nature provides significant economic returns, then we can do a much better job of persuading them to look after nature'* (Spelhaug, 2018).

[3] As part of this new governance shift, the UN, World Bank and the International Union for Conservation of Nature (IUCN) recently launched a global AI-based 'System of Environmental Economic Accounting' that quantifies data on global environmental 'stocks and flows'. These data feed into the Post-2020 Global Biodiversity Framework to inform the Sustainable Development Goals (SDGs) (UNEP, 2021) and nudge countries toward cataloguing their 'natural capital' and 'ecosystem services' in terms of nature's imputed financial value (UNEP, 2021). Drawing on parallel technologies, the UN Development Programme, UNEP, Convention on Biological Diversity (CBD), and the Global Environment Facility (GEF) established a global partnership across 200 countries involving 400 global datasets to create the "UN Biodiversity Lab" (see https://unbiodiversitylab.org/).Run on Microsoft's 'Planetary Computer', the Lab functions as an "interactive mapping platform design to solve biodiversity conservation and development challenges" (UN Biodiversity Lab, 2021). NASA, National Geographic, Global North universities, the World Bank, the IUCN, and the BINGO, The Nature Conservancy (TNC), now all work together to manage and feed digital data into the Planetary Computer. These new UN legitimated AI and smart technologies have helped further cement the evolution of new corporate-NGO smart technology partnerships at a global scale (Vinuesa et al., 2020).

[4] These include WWF, Wildlife Conservation Society, 2SL Let's work for wildlife, Map of Life, Smithsonian Conservation Biology Institute and the North Carolina Museum of Natural Sciences.

2.1. Decentralizng AI 'success' to the local level?

Most of these global programs have "community-based" components that are implemented through and ultimately implicate NGO counterparts as well as local and Indigenous peoples in ancestral territories. Indeed, big tech's machine learning capabilities have been weaponised to 'protect' natural capital from degradation, with drones, bioacoustic monitoring devices and camera traps becoming the 'eyes and ears' of the world's forests and oceans (Browning et al., 2017). Since 2019, Chinese telecommunications tech giant Huawei has framed its technologies as 'guardians of nature'. After a controversial Greenpeace report in 2017 condemned the company as lagging behind the major tech players in their environmental records (Cook and Jardim, 2017), Huawei partnered with various BINGOs to greenwash its corporate image, donating their technology to the cause of forest and biodiversity conservation. Initially, a partnership was formed with the IUCN through a project titled 'tech4nature'—a 'global partnership to scale up success in nature conservation via digital innovation' (IUCN, 2022). Building on this, Huawei partnered with Rainforest Connection (RFCx)—a non-profit Silicon Valley tech company—to use refurbished Huawei smartphones as forest and ocean 'Guardians' in Indonesia and the Philippines (see case, Section 3). Placed in strategic locations such as high in the forest canopy, the refurbished (solar powered) smartphones are meant to detect and transmit sound in real time using bioacoustics and cloud AI systems. Foresters and park rangers can then use these systems to monitor and respond immediately to threats to forest environments (Huawei, 2021b). These 'forest guardians' have been linked to narratives of conservation success on a planetary scale, fighting climate change via their purported power to halt illegal logging (Huawei, 2021c). Similar smart governance partnerships and initiatives exist for marine environments (Huawei, 2021a)

Intel, a US-based multinational technology company, has also been active in this automated surveillance space in conservation. In 2018, Intel and the WWF signed an agreement to use AI to monitor and protect the endangered wild Amur tigers found in China's north-eastern Jilin province (Wang, 2018). Intel's Movidius infrared motion-detecting cameras were set up by WWF in the region to "enhance the challenging and tedious process of gathering information on tigers" (Wang, 2018). Intel's AI algorithm and data analysis software then analyses the images and traces the paths of the tigers. If successful, officials from the Northeast Tiger and Leopard National Park have suggested that the same technology could be used to "track suspicious people who enter the park", assisting ranger patrols deter poachers (Wang, 2018). Intel has been involved in similar AI-driven anti-poaching initiatives such as 'TrailGuardAI'—a camouflaged device that can be installed in treetops to capture images of species and potential intruders to alert rangers in real time. This project was developed alongside Washington-based environmental NGO, Resolve, and the National Geographic Society (Intel, 2019). In 2019, the technology was used in 100 reserves in Africa, focusing mainly on halting Elephant poaching. Resolve aims to expand similar projects across parks and protected areas in Southeast Asia (Geib, 2020; Intel, 2019; Resolve, 2021).

As Fig. 1 shows, the political and economic architecture of these global-local smart technology partnerships in biodiversity conservation is scaled, multi-level and complex. Big tech corporations work as the meta-architects, designing and valorising big data storage, platforms, machine learning, and financing. They scale elements of this architecture down and across to those who facilitate and broker at the national and local level: BINGOs, bilaterals, and national governments, and local and Indigenous peoples. Together, more powerful upper-level facilitators and brokers may define biodiversity conservation priorities and programs independent of and through the promotion of smart technology to entice and enrol local implementers. These implementors, in conjunction with local NGOs and government actors, then roll out new programs through community-based initiatives among Indigenous and local peoples, often in existing protected areas. As the arrows in Fig. 1 indicate, the potential exists for the architects and facilitators to centralise finance, knowledge, power, and control at the expense of local implementers, and particularly Indigenous and local peoples' right to ancestral territories and resources.

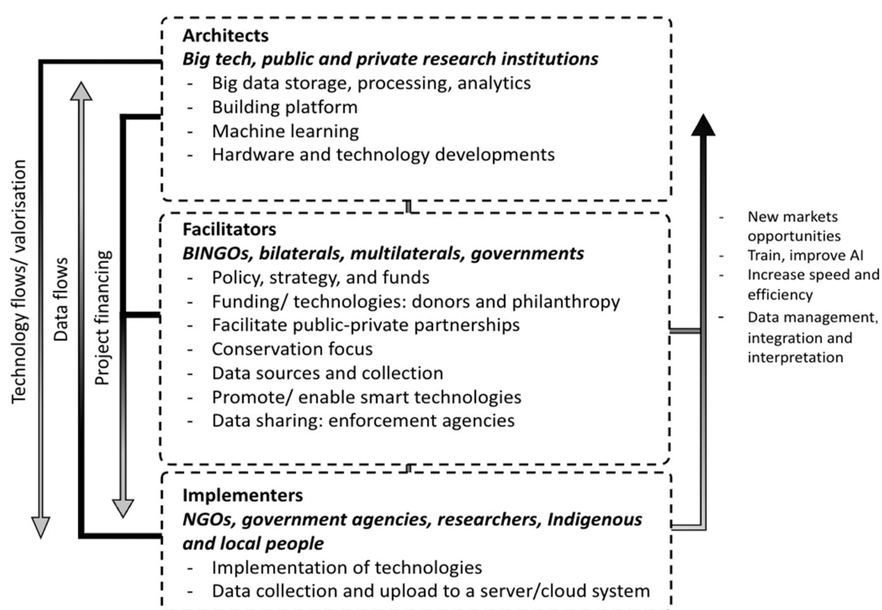

Fig. 1. The architecture of smart technology biodiversity conservation partnerships.

Social and ecological justice considerations are largely absent from these global-local partnerships. The application of smart technologies in forest and ocean settings can thus be achieved with little regard for the potential violation this poses to Indigenous and local peoples' rights to access and use resources in ancestral territories. Potential threats to livelihoods and well-being are significant. With limited engagement in free, prior, and informed consent regarding the rollout of smart technology in Indigenous territories, there is little scope for negotiating protections for Indigenous knowledge, cultural rights, and other intellectual property concerning data acquisition and management. As we show in the case of Palawan Island, even more conspicuous is the lack of attention to how such technological 'successes' relate to the political economic drivers of biodiversity loss from extractive developments, including plantation and mining expansion.

3. AI as 'development' and the Palawan frontier

We now substantiate these concerns raised by emerging global smart-tech-for-conservation partnerships by exploring the architecture of the 'Protect Wildlife' programme and its bio-surveillance network initiative on Palawan Island, the Philippines. We highlight the programme's *potential* impacts on Indigenous land rights and livelihoods, how the programme has done little to mitigate extractivism, and how government officials who endorsed the programme have also facilitated extractivism in the same Indigenous forest territories that smart technologies are meant to protect.

3.1. Palawan, the smart frontier?

Once connected to Borneo via the Sundaic land bridge, Palawan island's high levels of endemic biodiversity, contiguous forest cover, and abundant, diverse seas have positioned it squarely in the global imaginary of conservation and development (Eder and Fernandez, 1996; Dressler, 2009; Smith, 2021, 2022). As a result of this attention, local NGOs, state agencies and bilaterals worked together to progress different conservation and Indigenous lands rights initiatives on the island and across the Philippines. In the 1990s, they succeeded in having Palawan declared a Biosphere Reserve and years later they assisted in spearheading the enactment of the Indigenous Peoples' Rights Act (IPRA 1997) and the National Integrated Protected Areas (NIPAS Act, 1992) (Dressler, 2009). IPRA (1997) legislated the demarcation and implementation of ancestral domain title areas and the NIPAS system open the door to the implementation of terrestrial and marine protected areas. More recently, the expansive protected area system has hosted comprehensive smart technology governance interventions that encompass the ancestral uplands of the Pala'wan, Tagbanua and Batak (Figs. 2 and 3).

Our case focuses on the social and ecological justice implications of smart technology implementation among the Pala'wan in southern Palawan and, to a lesser extent, among the Tagbanua in the north of the island (see Fig. 2).[5] Most upland Pala'wan and Tagbanua families continue to draw on a socio-ecologically complex suite of livelihood practices in upland areas—including, but not limited to swidden agriculture, diverse tree and root crop cultivation, and the harvesting of non-timber forest products (NTFPs), as well as riverine species. These activities are supplemented by the cash from wage labor or trading/ selling upland goods in the lowlands, such as cassava for fish and salt (Macdonald, 2007; Dressler, 2009; Smith, 2015, 2021; Theriault, 2017). With greater elevation and distance from town centers, both Indigenous peoples become more reliant on, and self-sufficient through, the diversity of flora and fauna in lush ancestral forests that support social relations, livelihoods, and nonhuman worlds. As we show, however, Indigenous peoples who live in ancestral territories and rely on forest resources for income and subsistence also overlap with and are affected by the protected areas and the associated smart technologies that regulate—and criminalise—resource access and use. Moreover, the same smart technology partnerships and the politicians who endorse their implementation in ancestral territories simultaneously neglect to engage, or simply endorse, the expansion of mining and plantations into the forested uplands. As Figs. 3 and 4 show, indigenous territories, in the space of two decades, have thus become enclaved by protected areas, smart technology interventions, and expanding extractive industries.

CI, USAID and the Department of Environmental and Natural Resources (DENR) were the first major proponents of using smart technology for biodiversity conservation on the island. Established in 1995, CI's main office in Manila formed a satellite unit in Puerto Princesa City, Palawan Island. Guided by CI headquarters' vision from Arlington County, Virginia, the USA, the Philippine offices have made conserving the biodiversity hotspot, the Mt. Mantalingahan Range, a main priority. With financial support from international donors, in 2009, CI Philippines worked with the national government to establish the legal and management framework for the 120,000 ha Mount Mantalingahan Protected Landscape (MMPL), making it the largest terrestrial protected area in Palawan (CI Philippines, 2022). As part of CI's market turn, the BINGO monetised the net value of the MMPL's forest in terms of 'natural capital', with an imputed market value of 'US$5.5 billion worth of ecosystem services' (CI Philippines, 2022). The income drawn from the protected area's imputed ecological value was meant to incentivise the transition from swidden ('slash and burn') agriculture to fixed plot 'conservation agriculture' (DAI, 2021, 110). Such conservation agendas were soon accelerated through the adoption of smart technology aimed at curbing illegal resource uses more efficiently and effectively.

From 2016 to 2021, the CI, DENR, Palawan Council for Sustainable Development (PCSDs) and USAID implemented the 'Protect Wildlife project' across Palawan Island. Apparently financed by payment for ecosystem services (PES) (through minor tax levies from extractive industry and tourism), the USAID and the government, the project established 'Forest Land Use Plans' (FLUPs) involving upland management plans and graduated zoning systems to align with and harmonise conflicting state zoning and laws. Building on CI's initial work on natural capital valuation for the MMPL, the USD $22 million Protect Wildlife project would use the FLUP and PES architecture to further ascertain the economic value of key ecosystem services. The generated finances were meant to subsidise community-based initiatives and further incentivise Pala'wan pursuit of entrepreneurial 'conservation-oriented cultivation' and 'agroforestry', which would replace swidden, spare forests, and generate income to offset the need to hunt wildlife in the protected area (DAI, 2021, 9). These so-called project 'co-benefits' were meant to encourage the Pala'wan to become forest stewards and wildlife guardians to ensure a sustained flow of ecosystem goods and services' (DAI, 2021, 8).

3.2. Digital enforcement networks and human practices

A central motive of Protect Wildlife was to incorporate Pala'wan uplanders and other local peoples as 'proud and environmentally aware' wildlife enforcement officers (WEOs) within an island-wide Palawan Environmental Enforcement Network (PALAWEEN) (DAI, 2021). The entire enforcement network is meant to connect via an online monitoring and reporting BRAIN, or 'Biodiversity Resources Access Information Network' system, developed alongside the PCSD to 'innovate enforcement coordination and management and to promote efficiency in the agency's regulatory processes' (DAI, 2021, 173). The BRAIN

[5] Both the Pala'wan and Tagbanua are of Malay descent and both number at around 50,000 plus individuals. Both groups predominantly reside on state lands (public domain or timberlands) in the forested mountains, valleys, and, increasingly, the lowlands of southern, central and northern Palawan (Macdonald, 2007; Dressler, 2009; Smith, 2015, 2021; Theriault, 2017). They speak an Austronesian language that is generally unintelligible to other indigenous uplanders (though Batak and Tagbanua to understand one another).

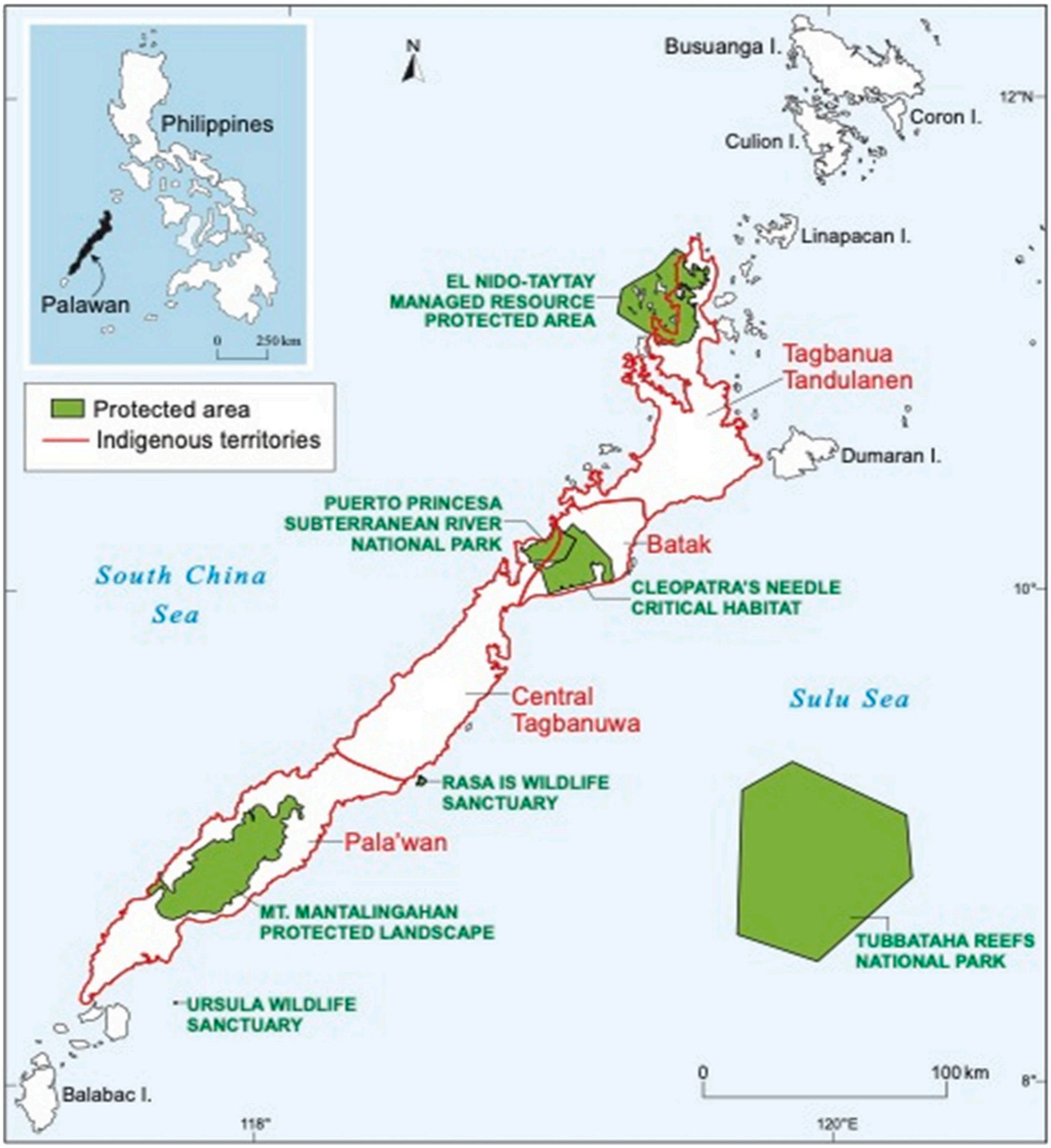

Fig. 2. Broader overlay of indigenous ancestral territories and protected areas on Palawan Island, The Philippines (Chandra Jayasuriya 2022).

virtually connects rapid enforcement units comprising WEOs, wildlife tracking monitoring units and members of the PALAWEEN network. It consists of three modules focused on wildlife crime, online permitting and public reporting, respectively. The online Rapid Enforcement Support, Planning, Operation and Network System Enhancement (RESPONSE) hub centralises the planning of enforcement activities. A geographic information system (GIS) mapping tool then allows government and NGO staff to 'share real-time information with partners, and plotting enforcement routes, target locations, and entry and exit points of illegally harvested flora and fauna' (DAI, 2021, 173). The public reporting module allows citizens to anonymously report illegal activities online.

Alongside the BRAIN system, DENR forest rangers and PCSDs law enforcement officials were provided with a mobile application known as 'WildALERT', or the Wildlife Agency and Citizen Law Enforcement Reporting Tool. The application contains a species library with photos and a reporting platform that allows DENR rangers and law enforcement partners to use their mobile phones to capture images, identify endangered species, and rapidly transmit real-time reports to DENR field units and the Biodiversity Management Bureau (BMB) on any wildlife poaching, illegal trade and trafficking they encounter (Cudis, 2020). Nearby authorities receive these reports electronically, can act on them immediately, and pursue rapid arrests (DAI, 2021). Launched in 2020 and available to the DENR and partners, the WildALERT application is meant to become publicly available across the Philippines relatively soon, with BMB director urging '*the public to act as eyes and ears in their communities and help report wildlife violations*' (Leader News Philippines, 2021).

3.3. *Protect[ing] wildlife with 'wildlife insight'*

In addition to arming rangers and law enforcement officers with mobile applications to track and trace wildlife crimes on their personal mobile devices, the Protect Wildlife project is also installing camera-traps in Palawan's flagship protected areas, including the MMPL (see Fig. 3). As noted in Section 2, the project uses Google's Wildlife Insights monitoring system involving numerous camera traps powered by AI and machine learning to assess species populations and inform conservation

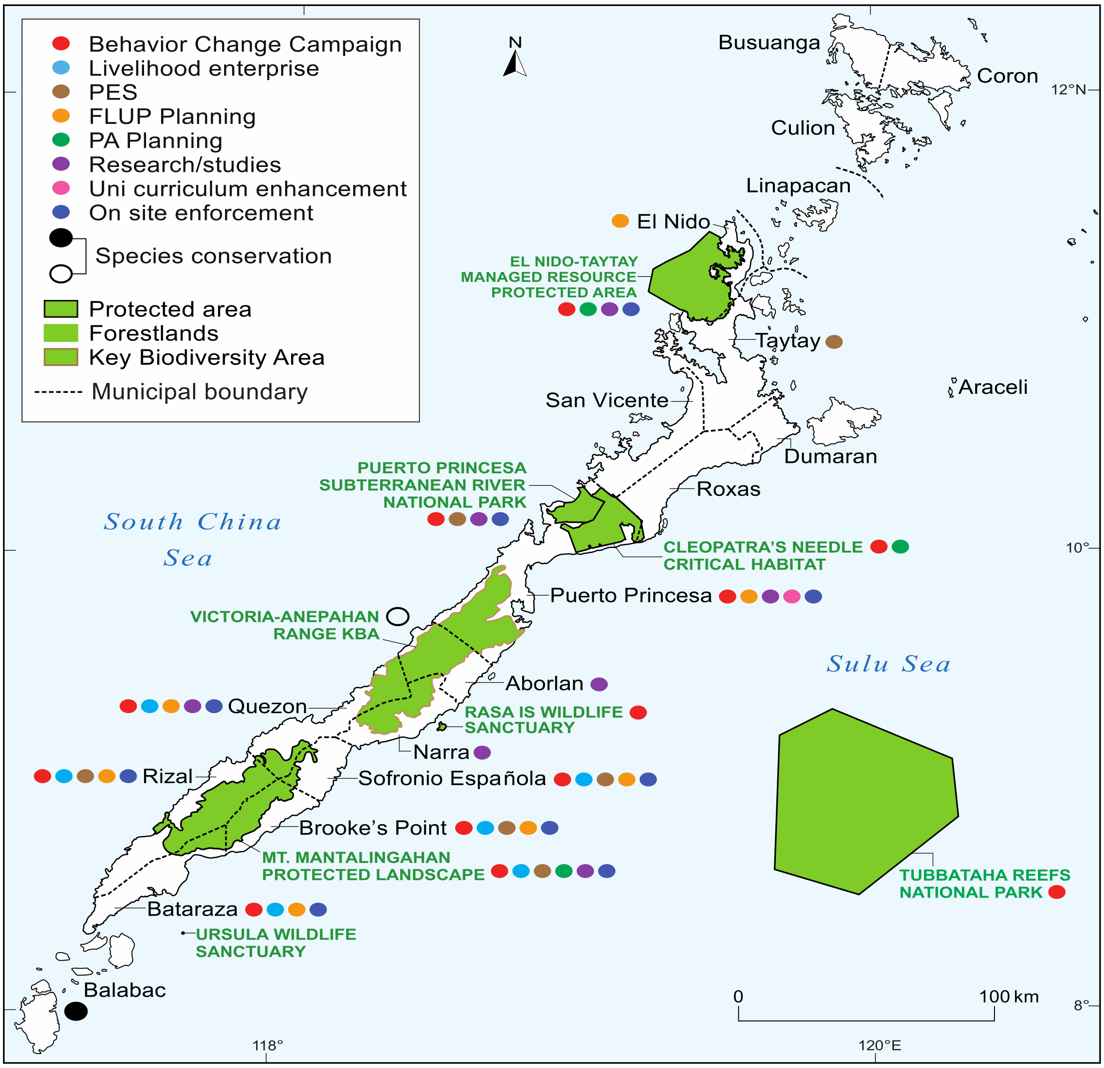

Fig. 3. Major protected areas on Palawan and Protect Wildlife initiatives (Chandra Jayasuriya 2022).

actions in the protected areas.

According to the global development company, Development Alternatives Incorporated, "Wildlife Insights helps conservationists share wildlife data and better manage wildlife populations through standardized and repeated camera trap deployments and advanced analytics" (DAI et al. 2021, 171). Between 2019 and 2020, 80 camera-traps were set up in the protected areas, with the digitally collected images being analysed using machine learning to identify species automatically. Annual assessments of these data will supposedly allow protected area officials to "pinpoint areas that may be experiencing degradation, poaching or other threats that could trigger changes in wildlife populations" (DAI et al., 2021, 172). If successful in Palawan, CI aims to up scale the Wildlife Insights program across the nation (DAI et al., 2021). The rollout of camera traps, enforcement networks, and government's broader call to 'arm' the public via their cell phones against 'wildlife criminals' may have profound implications for Indigenous and local peoples' access and use rights, while also contradicting the DENR and PCSDs' approval of expanding oil palm plantations and nickel mines in the same forests they aim to conserve—ancestral forests that the Pala'wan have long occupied and managed sustainably.

3.4. *Floating forest guardians in northern Palawan*

As USAID and CI rolled out visual surveillance tools across the island's protected areas, in 2020 the tech giant, Huawei, and the NGO, Rainforest Connection, initiated a bioacoustic surveillance program in partnership with the DENR intended to halt illegal activity and aid enforcement efforts by listening for forest disturbances in northern Palawan. The initiative aimed to implement acoustic monitoring devices, called 'Rainforest Guardians', to record, trace and predict noises associated with illegal logging and illegal poaching so as to stop such activities before they occur (see https://rfcx.org/our_work). By installing solar-powered acoustic monitoring devices (retrofitted mobile phones donated by Huawei) high in the forest canopy, strategically positioned along the perimeter of forests or at major access points (via roads or trails etc), these listening devices continuously transmit forest soundscapes via a cellular network (operated by PLDT) to a computer algorithm to detect the sounds of threats (Tan, 2021 - Strait Times). Foresters, rangers, scientists, and community members engage the system through mobile phone applications that enable monitoring through signal alerts and other forms of communication (other free applications from Rainforest Connection allow the public to donate funds to support the system's implementation).

In the El Nido Tatay Managed Resource Protected Area, the ancestral home of the Indigenous Tagbanua people, the devices listen for, transmit, and instantly alert government rangers and community members to any sounds from logging, poaching, and hunting (e.g., sounds of the use of chainsaws, axes and heavy machinery for timber felling) that may

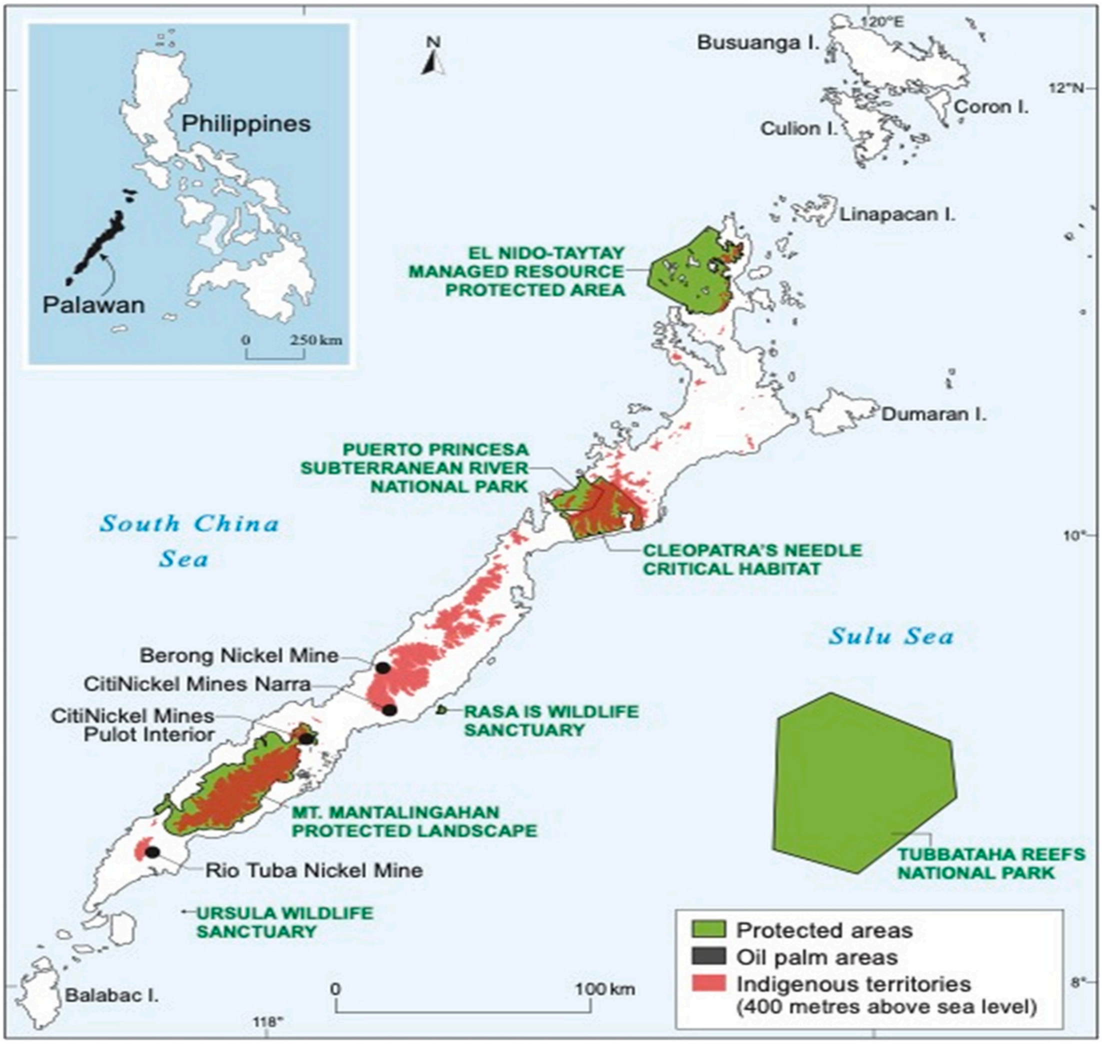

Fig. 4. Overlay of nickel mining, protected areas, and indigenous highland territories (Chandra Jayasuriya, 2022).

significantly disrupt ambient forest soundscapes. The sound pattern data are processed by AI to sense where and when any significant anomalies in sound patterns occur, identifying location, day and time, activity, and species at risk (see Hitachi, 2021). The broader aim is to "make the world's biggest shareable Audio Ark of rainforest sound" (Rainforest Connection, 2022).

Just as in southern Palawan, the rollout of the Rainforest Guardian initiative in the canopy of Tagbanua ancestral forests has various implications for their access and use rights in the El Nido Tatay area and ancestral territories. We explore the anti-political implications of these initiatives below, with greater emphasis on the southern Palawan case study.

3.5. The antipolitics of smart technology

The introduction and valorisation of smart technologies in forest governance in Palawan has the potential for 'automated violence' by restricting Indigenous and local rights to forest resources and land while further neglecting the need to curb expanding resource extractivism that most threatens biodiversity. By introducing the technology, government foresters' history of criminalizing Indigenous peoples' livelihoods on the island, particularly charcoal production and swidden in protected areas (see Dressler, 2009; Theriault, 2017; Smith, 2021), will likely only worsen. Using WildALERT on their smartphones, rangers can 'snap and share' photos of alleged perpetrators clearings and burning forests for swidden and any game captured for subsistence purposes or the wildlife trade. Any photos taken can be quickly relayed back to headquarters and stored in databases about illegal resource uses. Similarly, any sound of an axe felling a tree in the understory can be immediately transmitted by Rainforest Guardians perched in the canopy to authorities who are often quick to judge. Indeed, major problems arise when notionally legal and illegal resource uses are ambiguous and difficult to distinguish apart. Any one resource may be used in ways that are legal in some instances and illegal in others. This may be the case for swidden agriculture, timber felling, and wildlife harvesting on ancestral lands.

Despite the Indigenous Peoples Rights Act (IPRA) (1997) allowing Indigenous peoples to clear secondary forests for swidden plots on ancestral lands covered by "Certificates of ancestral domain titles" (native title), most government conservation officers continue to criminalise, monitor, and penalize the clearing of forests for swidden plots and the cutting of timber as planks (usually by borrowing a chainsaw) from cleared fields for sale for much needed income (Dressler, 2009, 2021). Forest rangers usually deem both activities legal only when they understand the implementing rules and regulations of the IPRA Act or when Indigenous farmers secure a Resource Use Permit from the DENR— a bureaucratic task most find difficult to fulfil (Pulhin and Dressler, 2009). However, once the act of cutting hardwood for swiddens and timber planks is captured by mobile phone cameras, Forest Guardians and other technologies, and transmitted to the head office before questions are asked, the act itself may be immediately criminalised and penalised, despite being on ancestral lands. Regular patrols involving verbal engagements are less likely to misinterpret the legality of clearing forests for a living (Dressler, 2014).

The same risk of law enforcers criminalizing and harassing Indigenous peoples applies to their harvesting of threatened wildlife in ancestral domains for commercial and subsistence purposes. Differentiating between species harvested for direct sale in the wildlife trade versus those killed for family consumption and income is made more difficult due to the automation of prosecution through smart technology. For example, most Indigenous peoples hunt the threatened Palawan bearded pig (Tag, *baboy damo*, wild boar; *Sus ahoenobarbus*) (Linkie et al., 2017; Smith, 2020) for subsistence meat, but they also sell its meat, teeth, jaws and fur for income. The pig's bristly beard and back hair are also used as powerful talismans, *mutya*, to increase a hunter's courage, ward off evil spirits, and depending on the circumstances, inflict serious illness upon others (Dressler, 2009; Macdonald, 2007). The potential for state (and nonstate) actors to capture images of Indigenous peoples' hunting practices and brand the entire act illegal without due process remains problematic and neglects the cultural, ecological and regulatory complexity of hunting wildlife in the forests of the Philippines.

Camera traps placed across forest landscapes have the same potential for automated violence. Camera traps can incidentally capture images of groups and individuals walking along trails or using resources near illegal activities, and by default, cause them to be considered suspects without the ability to defend themselves. For instance, Sandbrook et al. (2018) found that conservation actors ($n = 235$) using camera traps in 65 countries reported various negative social impacts, such as technology infringing upon privacy and instilling fear among forest users. The inappropriate use of such technology can thereby exacerbate tensions between Indigenous customary practices and state enforcers.

Both camera traps and bioacoustic monitoring devices may also be placed within and infringe upon forests of socio-cultural significance. In the highlands of Palawan, the potential exists for enforcement officers to inadvertently patrol, set up camera traps and take photos in areas of cultural significance without free, prior, and informed consent. In the southern mountains, for example, using camera traps in or near forested areas known to the Pala'wan as *'Lihien'* (forbidden spaces) can lead to frictions between conservation actors and Pala'wan. Most Pala'wan avoid the *Lihien* forests because they host invisible humanlike entities, or "people of the forest" (*tawa't gebaq* or *taw't talun*), who, when disturbed without ritual appeasement, are prone to anger, jealousy, and revenge that can inflict serious illness and death upon violators (Macdonald, 2007; Theriault, 2017; Dressler et al., 2018). Dangerous subgroups of invisible forest peoples or entities exist. There are *Meliwanen*, people of great beauty who seduce and kill outsiders who trespass in or clear *lihien* forest groves without permission (Macdonald, 2007). Another is the *Mengeringen* who inhabit large rock outcrops or boulders covered in pandan (*Pandus* spp.), which are almost always off-limits (causing leprosy among those who breach their sanctum [ibid, 103]).

In northern Palawan, the same holds true for placing retrofitted bioacoustic listening systems into the canopy of spiritually significant *Li'yen* forests of the Tagbanua and violating the sanctum of the malicious *panya'e*n who reside in dense old growth forests or dangerous *balete* (*Ficus*) groves (Dressler, 2009). These two cases thus illustrate the significant potential for smart technology to automate violence upon such cultural spaces and curb rights to access and use resources on ancestral lands.

3.6. *Neglecting extractivism*

As big tech corporations, bilaterals and BINGOs valorise and implement smart technology with state actors, they largely neglect attention to how governments and corporate partners continue to invest in and promote major extractive development. Unsurprisingly, the same senior Filipino politicians who have enthusiastically enabled and legitimised the DENR and PCSD's involvement in the Protect Wildlife project have also supported and invested in the expansion of extractive industries, such as mining and oil palm plantations, on so-called 'idle and unproductive' lands—Indigenous swidden fallows on ancestral lands (Montefrio and Dressler, 2016) (see Plate 1). Our review of relevant policy documentation (for the Protect Wildlife project) moreover failed to reveal any serious considerations of how to curb or stop extractivism from encroaching upon the forests and biodiversity of ancestral lands and protected areas implicated in smart conservation programming.

To illustrate, just as a former high-ranking provincial politician consolidated USAID-PCSDs-DENR partnerships for community-based coastal governance (One Ocean, 1998), the same politician emerged as a key architect in promoting the expansion of the palm oil industry in southern Palawan (Harbinson, 2016). In particular, while promoting 'sustainable partnerships' with USAID, the provincial politician played a leading role in persuading the Agusan Plantations Group, the Palawan Palm and Vegetable Oil Mills Inc., and the Agumil Philippines to begin palm oil plantation operations near Brookes Point, claiming that "*the palm oil industry in southern Palawan did not involve destroying our forests because the areas chosen and planted were areas long eroded and all of these*

Plate 1. Expanding oil palm plantations in southern Palawan (Source: Anonymous, 2018).

areas have been idle for many years" (ALDAW Geotagged Report, 2013, 22). The first oil palm seedlings were planted in 2007 and harvested in 2011, with the initial 3591 ha planted and set to expand beyond 15, 469 ha (Dressler, 2021). Not only did neglecting the expansion of mono-cropped oil palm plantations automate violence, it also further entrenched social and ecological violence through incrementally encroaching upon and severing contiguous tracks of ancestral forests in the island's southern uplands (Montefrio and Dressler, 2016).

Just a few years later, the same anti-politics of extractivism that enabled the plantations became viciously violent. The darker side of government crony-capitalism and extractivism emerged with the same high-ranking politician being charged for alleged links to the murder of anti-mining and anti-plantation activist Doc Gerry Ortega (Dressler, 2021). Just months before the 2022 national elections, the social violence of the jailed politician "emerged in public for the first time in years on Sunday to campaign for his bid to return to the seat of power in the Provincial Government…" after apparently obtaining paperwork allowing for his temporary release (see https://newsinfo.inquirer.net/1577752/joel-reyes-back-to-reclaim-top-palawan-seat).

The simultaneous embrace of smart technology and pivot to accelerate extractivism continued under Palawan's previous provincial administration in 2021. In the capacity of PCSDs Chairman, and thus signatory of the USAID-PCSDs-DENR Protect Wildlife project, the previous administration pushed for the amendment of strict conservation "core zones" in southern Palawan under the so-called Environmental Critical Area (ECAN) network —zones demarcated at 500–1000 above sea level (asl) and comprised of old growth forest, diverse flora and fauna, watershed systems and steep slopes—to meet the surging demand for nickel production, a key ingredient needed for the expansion of smart technologies (Dressler, 2021).

In 2021, both the PCSD and the DENR responded to then-President Duterte's push to lift a nine-year moratorium on granting new mining permits in the Philippines as part of the country's COVID-19 recovery strategy. Signed into force on April 14, 2021, Executive Order 130 was meant to revive the country's ailing economy by reinvigorating nickel mining nationally, particularly in Palawan's mineral rich southern mountains (Chavez, 2021). With new mineral agreements on the table, the PCSD announced plans to review the criteria by which the ECAN's core and restricted zones are designated, noting that 'the probable amendments of the implementing guidelines of ECAN are projected to somehow reduce the restraints on many industries from operating in Palawan' (PCSD 2021). Ultimately, the aim was to modify the designation of "no-touch" core zones (meant strictly for forest conservation and watershed protection) into controlled or multiple-use zones that would allow for timber clearing and the expansion of nickel mining further upland.

The case of Rio Tuba Nickel Mining Corporation is illustrative. Running out of ore reserves, Rio Tuba recently petitioned the PCSDs to expand its 990 ha site to annex 3548 ha along the slopes of the sacred Pala'wan mountain, Mt. Bulanjao, located just south of the MMPL. The area to be mined covers "2,500 hectares or roughly the size of 57,524 basketball courts" (Ilagan et al., 2021), and overlaps with the ECAN's biodiverse core zone.

Gaining PCSDs environmental clearance (under a so-called Strategic Environmental Plan) for the mining in 2014, Rio Tuba finally secured a Mineral Processing Sharing Agreement (MPSA) from the Mines and Geosciences Bureau (MGB) in 2019, giving the company the green light to expand its mining operations into the mountain above 1000 m asl (Ilagan et al., 2021). Supposedly due to sustained Pala'wan and non-governmental protests, the area to be mined was reduced to approximately 2500 ha, and thus supposedly largely outside of the core zone (Ilagan et al., 2021). While a small victory for Pala' wan and progressive civil society, there interest in expanding the mine into sacred ancestral lands and forests hosting critical biodiversity—the same territories that host diverse projects and smart technologies that have supposedly aimed to curb swidden and conserve threatened species (see Fig. 4).

3.6.1. Bloody El Nido and failing forest guardians?

Several years before Huawei-Rainforest Connect program was implemented high in the canopy of the El Nido–Taytay Managed Resource Protected Area, local activists and park rangers were killed attempting to arrest illegal timber harvesters supplying the surging tourism market in El Nido (Global Witness, 2019). Ostensibly designed to curb such activities, the program faces obstacles as illegal logging near El Nido town shows few signs of abating since major pandemic travel restrictions have been lifted. More crucially, the investment by political elites in tourism infrastructure, allegedly facilitating timber poaching for their own tourism resorts, and relatively little state level attention to curb deforestation, suggests these trends will continue and possibly accelerate (Dressler, 2021).

In the same breath, provincial politicians have thus greenlighted extractivist projects —from mining to tourism development—that threaten "natural capital" while endorsing the expansive roll out of smart technology projects such as the Protect Wildlife project, that aim to conserve this same natural capital in Indigenous territories.

4. Discussion and conclusion

Valorising the adoption of smart technologies and selling their success obscure the messiness of their operationalisation and increases the potential to automate violence against Indigenous and local peoples' rights to livelihood, lands, and waters. The anti-politics of legitimising such technology with little reflexivity detracts attention from politically contentious extractive industries and their roles in biodiversity loss. As Ferguson phrases it, big tech, BINGOs, and the state play a 'good trick' by fetishizing smart technology partnerships and neglecting the deeper political engagements needed to curb extractive regimes from encroaching upon Indigenous and local peoples' biodiverse territories. State politicians and their smart technology partners have side-stepped the hard-truth that extractive expansion (and not local forest users) mostly drives deforestation, habitat loss and declines in biodiversity. Instead of showing the political will to curb extractivism, they have instead invested their political capital and finances in expanding industrial extractive development, irrespective of the socio-ecological consequences. The anti-politics of smart technology thus automates control over and violence upon Indigenous territories and resources, while enabling the extractive expansion into the same spaces meant to be 'conserved and catalogued' using drones, camera traps and listening devices.

In this way, government officials champion technological solutions and programs involving significant donor aid that avoids and detracts attention from the more politically contentious realm of extractive development and biodiversity loss. Such diversions create spaces for politicians to invest in accumulating more capital through expanding resource sectors, as BINGOs and bilaterals fail to critically reflect on the contentious nature of rolling out smart technology on Indigenous lands. The same state actors who approved project Protect Wildlife have also approved nickel mining and plantations that overlap with the ancestral spaces they are trying to conserve with smart technology schemes. All the while smart technologies are valorised and implemented, the political economy of extractivism is generally neglected and even encouraged on the ground. Such pervasive anti-politics thus *automates violence* through, on the one hand, smart technology that can capture and criminalise Indigenous and local peoples' resource uses and, on the other, through neglecting and accelerating the impacts of extractive political economies upon ancestral landscapes.

As bilaterals, BINGOs and government actors increasingly network globally to enthusiastically promote seemingly uncontentious smart technology solutions to conserve biodiversity in ancestral forests and marine spaces, they therefore not only often neglect the destructive nature of extractive industries that underpin their technologies (ie., copper, nickel etc), but politically and economically may legitimatise the expansion of extractivism into biodiverse Indigenous territories. In the Philippines, as Indigenous and local peoples lose lands and coasts to extractive development, they are relegated to the upland forests from which they draw their livelihoods and maintain biodiversity now governed through smart technologies (see Maps 2 and 3). Considering the historical context and uneven power relations that shape the politics of place in biodiverse territories, implementing programs involving smart technology monitoring and surveillance can threaten the sustainability of customary practices central to the production and maintenance of biodiversity.

As smart technology governance unfolds across Southeast Asia, critical analysis must consider how 'technological fixes' —drones, satellite images, bioacoustic data etc—capture, model, and integrate data that separates its use and control from Indigenous and local peoples' territories and social realities. Questions concerning what data are extracted and why, who extracts and owns the data, and how they are used now and, in the future, must be foregrounded. As part of conservation's market-based "innovate and grow" model, accelerated data flows, monitoring and surveillance threaten Indigenous and local peoples' access to and use of natural resources while potentially further criminalizing and automating violence on them and their livelihoods. Big tech, BINGOs and bilaterals must therefore make explicit commitments to ensuring that the smart technology partnerships and tools they enthusiastically promote are not used in ways that infringe upon Indigenous and local peoples' rights, and further politically confront and curb the associated resource extractions often unfolding nearby. Indeed, ensuring that Indigenous and local peoples can use smart technologies in ways that progress their social and ecological justice agendas remains crucial to guarantee rather than diminish social and ecological safeguards in biodiversity conservation efforts. Rather than becoming victims of smart technology, Indigenous and local communities can thereby better use these tools to defend their customary rights to their lands and seas, and by extension, conserve biodiversity over time (see Radjawali et al., 2017; Milner, 2020). Doing so on Indigenous and local peoples' own terms and conditons in self-governed and managed territories remains critical (ICCA Consortium, 2021).

Declaration of competing interest

The authors of this paper have no conflicts of interest in the preparation and publication of this paper.

Data availability

The data that has been used is confidential.

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