

MAP, TERRITORY, AND EVERYTHING IN BETWEEN: ENVIRONMENTAL DATA AND TERRITORIALISATION

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Over the last decade or so, there has been a marked increase in discourses that situate environmental data as a global resource for tackling environmental crisis (Nadim 2016). As several scholars have pointed out, data-driven environmental governance is gathering a-pace. Karen Bakker and Max Ritts (2018) call this governance through "Smart Earth", relying on increasingly networked multi-scalar environmental monitoring technologies; Eric Nost and Jenny Goldstein likewise draw attention to the sway environment data holds over policy makers, governments and corporations as "a neutral, objective resource for accountable and transparent decision-making around nature" (2021:2) and even beyond this, that the president of USA's Environmental Defense Fund "argues that we have reached "fourth wave environmentalism" where the vast quantities of big data produced everyday supersede the need for what are increasingly unaccountable and unresponsive governments" (:2-3). The current faith in the power of environmental data to tackle everything from floods to famine seems much less obviously problematic than previous "techno-fixes" such as those offered by geoengineering – who could disagree with the power of open data, data sharing and data democracy? It only seems natural that this should entail not only the collection of more and more environmental data, but also to collaborations and partnerships between state, local and corporate actors, and ambitious 'planetary' or global *open data* sharing platforms and organisations. Some examples of such large-scale initiatives are the Intergovernmental Group on Earth Observations, Microsoft's AI for Earth, and the European Space Agency's Copernicus programme.

This confidence in the power of environmental data has however been critically interrogated by political ecologists and critical geographers. Most of these have pointed out the ways in which the current moment – which sees tech companies developing so – called “planetary computers”, and the private development of remote sensing infrastructures - rehearses a familiar relationship of extractive practice and profit from crisis (Nost and Colven 2022). These scholars point to the ways in which environmental crisis is serving as a justification for the extraction of data, and the ways that this data is becoming valued on financial markets (Nost and Goldstein 2021). This also echoes critical interventions around big data in other areas, most notably the corporate extraction of personal data for profit by companies such as Meta, Google and Amazon (eg Thatcher et al 2016; Couldry and Mejias 2019). These processes of appropriation and extraction by private companies have garnered attention over the last decade, most recently under the label of “data colonialism” (Couldry and Mejias 2019), “platform capitalism” (Srnicek 2016) or “surveillance capitalism (Zuboff 2018), and raise broader concerns around the privatisation, monetisation and commodification of data generally – whether it be environmental data, personal data, or health data.

However, this focus on commodification has obscured critical attention being paid to environmental data infrastructures which do not, on the face of it, have profit as their main motivation. Such *open data* initiatives rather draw on contrasting narratives of openness, sharing, and informational democracy. If we want to get a grip on what it means to do environmental politics through data, it is crucial we also attend to these *open data* initiatives, in which the data practices and imaginaries underpinning them are presumed to be somehow de-spatialised, unbounded and un-situated. In this article, I argue that we need to pay renewed attention to the emergent and assumed spatialities of environmental data. This includes not just questions of access, but enquiring into what forms of spatiality – what social geographies, spatial imaginaries, and dynamics – environmental data governance relies on and inscribes, and therefore what forms of spatial politics it enacts. After initial interest in the new forms of data power in relation to space that animated geography a decade or so ago (Thatcher et al 2016), spatiality has dropped from view, beyond repeating spatial tropes around global north/global south digital divides; even fewer have investigated it when it comes to ‘open’ scientific data (although see Gabrys 2020 and Leonelli 2013, as notable exceptions).¹

Although there are different ways to approach the issue of the spatial politics of environmental data, in this article, I focus on one very specific form of spatial imaginary and set of practices: territory. This is in part because I seek to counter the de-territorialised claims that are being made about *open data*; one early promotional online demo for an *open data* initiative in the Earth Sciences for example exclaimed “Countries have Borders; Earth Observations do not”.² Thinking

through the territories of environmental data will allow me however to go well beyond this explicitly geopolitical lens. Drawing on geographer Stuart Elden's long-term investigation of the political technology of territory, and particularly his critique of the assumptions of de-territorialisation that characterised analytical approaches to globalisation in the early 2000s, I argue that we need a similarly relational approach that can address *open data* infrastructures, discourses and practices as a form of territorial spatial politics, where territory is understood as a political technology emerging from a certain enactment of space. Drawing on Gilles Deleuze and Félix Guattari's development of the term, Elden makes the case for renewed attention to be paid to the "re-territorialisation" of globalisation, asking "[h]ow is the globe being reconfigured, remade, re-divided?" (2006:57). I will not in this article cleave to the details of Deleuze and Guattari's philosophical conceptualisations, but inspired by Elden's question, I am equally interested in thinking through how to analyse the re-territorialisations and re-configurations of the world through *open data* initiatives in environmental science.

In order to start to address the territories of *open data* in this way, I turn first to ethnographic work I conducted with scientific researchers and data technicians in the Brazilian Amazon, focusing on the way in which environmental data is collected from the forest *in situ*, rather than remotely. Although remote sensing has captured the contemporary political imagination, this older form of *in situ* data collection shares with remote sensing many of the same practices that characterises territorialisation, according to Elden: cartography, gridding, surveying, and the geometricization of place. But when out in the forest on a field campaign, measuring transects, inputting coordinates into GPS, or hacking through undergrowth, it is very clear that there is an active, ongoing, materially-complicated (and often unsuccessful) domestication of place occurring. This experiential understanding of what it takes to collect data may be lost from the perspective of remote sensing. Data collection *in situ* is much more obviously about actively *making* a particular kind of space, than it is about mapping it. But it is not only that. The inscription of territorial space in the field in this way is not simply reductive, an abstraction of "territorialised space" from "local place" – but has affective, social implications and entails the production of social worlds, even if those worlds are ambivalently positioned. It is also not *ex nihilo*. Past spatialities layer underneath present ones in convoluted ways. Once space is produced as calculable in these ways, it becomes habitable for other worlds to latch on to and grow. That is, the production of space is always also about the production of difference (Hawthorne 2019; Mckittrick 2006). At the end of the paper, I use these ethnographic insights to then pose some questions about the territorial and spatial imaginaries of *open data* initiatives, using one such initiative as a case study.

Social Data Territories

As a political technology of domination and control (Elden 2010) that works across many spatial dimensions, territory has been a useful tool for critical geographers to grasp the spatio-social and spatio-political co-ordinates of power, the means through which they are implemented and their effects. Pushing back against a conception of territory as a bounded, abstract space of sovereignty, (credited often to the Westphalia treaties of 1648), several critical geographers have argued instead, with Foucauldian bent, for an idea of territory as a "political technology", a "process... continually made and re-made" (Elden 2013:36, 2010) through techniques of calculation, measurement, land surveying, cartography (Crampton 2010). Stuart Elden is one of the most prolific anglophone geographers to argue that territory needs to be understood "as a distinctive mode of social/spatial organization, one which is historically and geographically limited and dependent, rather than a biological drive or social need" (2010:810). In this, he was joining with other geographers who were pushing back against the idea that a territory be understood as a bounded area, a "container of modern society" (Elden 2005:11, cf Agnew 1995, 1999). Elden makes the argument that territory is best understood not as an area of land under sovereign control, but rather is a very specific way of understanding and enacting space: it is a way of making space calculable, which can trace its history back to Aristotle and Descartes (Elden 2005).³ Elden argues that as such, a concept of space emerged over the course of the Renaissance and early modern period in which space was bounded, exclusive, calculable and abstract, and therefore could be "superimposed over already-existing places, be they land, home or country" like a kind of grid (:15-16). This conceptualisation turned on the idea of the geometric point, developed by Descartes into a form of geometry which could encompass the world. By the early modern period, "[s]pace was conceived of as something extending into three dimensions, qualitatively measurable and thereby amenable to partitioning, regulation and order. The sense of "space," of *spatium*, that emerges in the late medieval period, which finds its most clearly worked through argument in Descartes, is not *necessarily* something that is circumscribed and divided politically into separate sovereign entities. But this sense of space is a necessary *condition* for such a political system: it makes it possible." (Elden 2006:55)

Territory is thus not in the first order about boundaries, but about the emergence of a conception of space that permits the idea of boundaries in the first place; it is also a conception that had and has political and philosophical correlates, and depends on "geo-metric" practices: "calculative strategies turned towards land, terrain and territory" (Elden 2013:49) such as cartography, statistics, surveying. Territory emerges as a practice and a logic, a form of spatialisation that then gives

rise to territorial politics of policing, conquest and containment as evidenced in the cartographic practices of European colonialism. The fact that these are concepts and practices is important; Elden makes the point that territory is in fact constituted through simultaneous processes of re- and de-territorialisation, and it is to these processes that we should attend (2006). These processes of de- and re-territorialisation are also always in negotiation with material forces and entities. Although the "geo-metric" practices that Elden points to for the most part seem to summon the horizontal – maps, surveys, plans – several scholars, including Elden himself, have also insisted that territory be understood beyond the two-dimensional and cartographic, and can be seen as both vertical and "volumetric" (Crampton 2010:96 in Elden 2013:35; Billé 2019; Bridge 2013; see Elden 2020 for a comprehensive review). The "volumetric" forces consideration of the atmospheric as well as subsoil and subterranean, and necessitates a consideration of material textures, flows and the terrain.

I want to use these insights to excavate the claims of *open data* initiatives to be de-territorialised, by focusing on exactly how re- and de-territorialisation plays out *in situ* in the process of collecting environmental data. Although the scientific data practices I present here - measuring of atmospheric composition, the preparation of experimental sites, maintaining scientific instruments - might not seem to be, or even be intended to be, directly aimed at territorialising the forest, the collection of such data relies on the ordering and disciplining of space which is closely related to the geo-metrics that Elden describes. These data collection efforts also speak to the long history of the relationship between science and empire through engagements with what we might call the environment. Scientific research has often been a crucial element of territorialisation, from the early expeditions to measure "the New World" in the 18th Century (Safier 2008), to geological surveys in the 19th Century being used to "geologise" Canada's territory and render it amenable to new forms of extractive economy (Braun 2000:14), to more recently climate models in India being used to negotiate international relationships (Mahoney 2014). Nevertheless, the link between environmental data and territory has often been reduced in contemporary critical imaginary to the cartographic – that is, satellite images and remote sensing. Whilst such remote data extraction technologies and infrastructures re-iterate and rely on the concept of geometric space that Elden describes to such an extent that it is often taken for granted, what is less obvious is that they often work in tandem with ground measurements that are taken "in the field". Venturing into the field, what then becomes obvious is that these spatialising technologies and practices, whilst territorialising, also generate alternative forms of space and place at the same time. That is, to use Elden's terms, just as they de-territorialise, they also re-territorialise, and sometimes in surprising ways. Turning now to ethnographic fieldwork with

scientists and researchers in the Brazilian Amazon, I show below not only the ongoing work of territorialisation, and the layering of histories and spatialities, colonial and otherwise, that are always present when data is being extracted from a terrain; I also show the social worlds that this collection of environmental data constitutes and is constituted by, the data collectors, technicians, scientists that labour to ensure its continued existence. These social worlds emerge as places of ambivalent differentiation.

In 2010-2011 I conducted ethnographic fieldwork with the Large Scale Biosphere Atmosphere Experiment in Amazonia, known as the LBA. This was at the time a long-term international project led by Brazil, based at the Instituto Nacional de Pesquisa da Amazônia (INPA) in Manaus, Brazil. It was made up of many different areas of scientific enquiry, but an overarching question it set out to tackle was whether the Amazon forest was taking in more carbon than it gave out or vice versa. It was particularly remarkable for the long term data collection systems it had set up over the last few decades. These were focused on the micrometeorological towers, which stretched up 20m above the forest canopy and were covered in instruments that were continuously measuring variables that might affect carbon flux - wind direction and speed, precipitation, radiation and so on - as well as carbon flux itself. Alongside this long-term monitoring with the towers, which was overseen by a team called "micro" (*micro*)⁴, there were also individual projects running that were looking at hydrology, soil composition, biomass, as well as frequent visits from non-Brazilian scientists from Europe or the USA, and PhD students from the LBA's graduate programme, with more specific data collection agendas. There were also therefore lots of different ways that data was being collected, transmitted, processed and stored. The tower data, for example, was sometimes collected in person, sometimes collected automatically (although this telemetric system was being set up whilst I was there and often failed); for towers in remote places, it was downloaded onto a hard drive and then sent on an aeroplane, to be picked up at the airport. PhD and master's students collected their own data, traveling into the forest with the micro team, to the main research site known as ZF2.

Such infrastructures of measurement recall Elden's focus on practices of calculation, survey, legal device, statistics and measurement as productive of territory. And certainly, as I accompanied various researchers as they went into the forest to collect data, this effort to create a certain kind of space was always a precursor to any data being collected – from the laying out of transects to the careful location of the towers or selection of sample sites. I remember one particularly confusing conversation I had with a micrometeorologist who was very patiently trying to explain to me how air was fractioned into "parcels" as it was measured. It didn't seem to matter that in one sense, air observes no neat

metrological partitioning. In another example, a student who was measuring the way decomposition in the soil affected carbon production spent most of their time trying to design a system using fibreglass boxes dug into the ground to separate out and maintain the precisely measured areas of soil but which also let sufficient light in – to 'grid' the soil. And to even access the fieldsites where data was being collected required that wooden trails wide enough to permit a quad bike down them be constructed through the forest, as well as bridges over rivers, and clearings. All of these transected the forest in linear ways. In one instance, I was enlisted to help build a small plastic wendy house in the middle of a national park in order to shelter a particularly delicate instrument that could measure atmospheric composition, but needed to be protected from the heat and the humidity. This entailed carefully clearing a space in the undergrowth, making sure it was flat, and ensuring there was a clear route for the input pipes – literally "making a space" for the instrument. In one sense, this clear, flat, space is being superimposed on the forest, and a sense of this "space" is being abstracted from "place"; but what this looks like in the forest is not exactly an abstraction, nor superimposition. It is in fact much messier and uncertain than that.

In fact, as Mark Usher has argued (2020), focusing only on the technological practices of spatialisation can marginalise the capricious role of the earth, or the 'non-human', in the production of territory. Usher draws out the various ways in which what he calls "the physical" is in fact a crucial element of territory, arguing that the widened purview of the "volumetric" – that takes us away from abstract 2D space and into flows, atmospheres, oceans, caves, earthquakes – also allows us to see the "nomadic" qualities of territorial space, "obscuring, impeding and evading sovereign rule" (Usher 2020:1035). In a different vein, Clark and Jones (2017) have also explored the unruliness of volcanoes and earthquakes in their study of the formation of the contemporary nation state of Iceland. And certainly, over the time I was at the LBA, data collection was often far from what it was expected to be. Animals played with the instruments, frogs fell in pluviometers, bees made their hives in the datalogger boxes, lightning struck the tower. The instruments got covered in mould if they were in the forest (or dust and ants if they were in the dry cerrado region, I was told) (Walford 2017). The micro team often went to download the data from one of the towers and ended up fixing a broken instrument or datalogger⁵ for hours instead - "soldering in the forest is not the same as soldering in the lab!" I was told as I watched one of them fixing the datalogger's connections, with their tools laid out precariously half-way up the tower. The terrain also often got in the way: one of the researchers at the LBA had discovered during his PhD that the unevenness of the ground was affecting how carbon moved around the forest; whilst the towers measured carbon exchange on the vertical, as carbon moved between the forest and the atmosphere, he

realised that some carbon was pooling and then rolling down the hills and so 'escaping' his measurements (Tota et al 2011). It could also be that you failed to collect any data at all over a period of days because of the rain, or the wind, or because your instrument – which was designed to work in temperate European climates - did not work in the heat or the humidity. The technicians who collected the data often all had to learn not only the idiosyncrasies of each instrument and the tower, but also about the forest and how the instruments interacted with it. Not only this - once achieved, it was also clear that the necessary organisation of space in the forest that permitted the extraction of data always entailed ongoing labour and often protracted negotiation with the forest. The micro team spent a lot of time on maintenance of the towers and equipment and instruments on them – soldering connections, fishing out frogs as I have mentioned; but the infrastructure, trails, bridges and clearings also needed constant attention. In fact fixing trails was one of the most specialised jobs for the logistics teams in so far as none of the scientists could do it themselves. It should also be noted here that in the context of chronically underfunded scientific projects, as the LBA was at times, the nature of this negotiation with the forest was always also a function of other material possibilities – funding, access to instruments and infrastructure. Speaking more recently to someone I spent time with at the LBA a decade ago who is now a postdoc at a well-funded European institution, they remarked that one of the major differences they noticed was that they did not have to set up and maintain their own experiment in the field, they had team of technicians who did this for them.

From this, we can see that 'making space calculable' in order to collect data is not a one-off event, cleanly and easily executed. There might well be an idea of a perfectly-gridded, extendable, homogenous space that underlies these efforts, but in practice, this imaginary has to be actively achieved. Data is the result of sustained relationships with the forest, constant and everyday acts of maintenance and care. So the first thing I want to stress is that the process of territorialisation here is an ongoing, sometimes fragile, set of relationships between the terrain of the forest and the technologies, infrastructures, technicians and researchers. Territorialisation in this case has to be constantly made and maintained. Abstraction, such as it is, is ongoing labour and can be unsuccessful.

Another characteristic of the spatiality of territorialisation encountered in my ethnographic material is the way it is layered, folded and piled up, as well as unevenly distributed. Because of the effort and cost of building infrastructures in the forest, many of the LBA's projects focused on relatively small patches of forest where there has been a significant investment to make them accessible, as already discussed - in the case of the team at Manaus, it was mostly one specific area, ZF2 (which stood for Zona Franca 2), around 34km along the motorway

and then another 10km or so along a dirt track that got increasingly smaller and bumpier as you went. At ZF2, where I spent most of my time during my research, alongside the trails, paths, and bridges there was a base camp where there was a cook who prepared meals, a dining room, a place to hang a hammock, and a very intermittent and unstable internet connection. The access this gave to the forest also meant that as you walked along the paths, you every so often came across the ghosts of experiments past – rusting tags on trees, trenches that had been dug and were filling in, the remnants of transect string. Past efforts to extract data were overlaid with present ones. But there were also other pasts which were not so quietly kept at bay. Previous acts of colonial appropriation surfaced and resurfaced over the time I was conducting research, with some people talking to me about how the flow of data out of Brazil and to Europe and the USA was an extractive economy, an exploitation of the global south by the global north; some likened it to biopiracy, specifically of the açaí berry. Some of the researchers who came from the USA were aware of this and one even told me they felt like a “scientific imperialist”. Others seemed oblivious to it, uncertain what to say when asked by Brazilian colleagues where the data was going and who would have access to it. Even within Brazil, there were tensions between those who came from the south of Brazil from better-resourced institutions to do research in the Amazonian area, and researchers from northern Brazilian states. In these cases, it was clear even in an ethnographic register that the spatialities of territorial control were not simply lying underneath more contemporary globalised formations, but were actively re-elicited and re-experienced by people.

Furthermore, the name of the research area, ZF2, was because it was along the ZF2 road, which refers to the Zona Franca of Manaus, a de-regulated free economic zone set up in the 50s and 60s in Manaus to stimulate economic development in the region and populate the area. However there were not the resources to support the subsequent influx of people into city and as such some have argued it translated into “precarious informality. Infrastructure and housing were ill-prepared to accommodate masses of low-skilled workers turned underpaid, underemployed assembly workers” (Kanai 2013:2392). As most of the technicians that collected the data and looked after the research sites at the LBA were local people from Manaus, neoliberal economic formations of territory are also an important part of this story. And of course, ongoing alongside this is indigenous people's endless fight in Brazil for their territory and demarcation and protection of their land, a lot of which is in the Amazon. Whilst I was at the LBA this was rarely discussed openly, or if it was discussed it was not in front of me. The only example I heard of when I was there was the LBA meteorological tower near São Gabriel de Cachoeira, in the National Park Pico de Neblina, which required negotiation with state officials as well as indigenous leaders in the area. But more

generally during the time I was conducting research, I overheard discussions in other contexts of scientific researchers who wanted to work in certain areas in Brazil who were increasingly confronted with indigenous territorial rights, as more indigenous communities required permits and permissions to be gained. At the same time, as recent political events in Brazil show, these rights were and are constantly under threat and undermined.

Although it is beyond the scope of this chapter to lay out a history of the centuries of colonisation of Brazil and the violent dispossession of indigenous people's land that goes with it, nor the correlated economic history of the region, ethnographic investigation shows that it is clear that these histories do not just lie dormant underneath more contemporary relationships, but are constantly reiterated in torqued versions. Theo Vurdubakis and Raoni Rajão chart for example how the militarisation of the Amazon, and the policing of its borders, transformed over the years into "development" models into which scientific research was enrolled. They describe the intense remote monitoring of the Amazon region was initiated by the Brazilian military in the 80s, who were concerned about whether settlers from neighbouring countries were "infiltrating remote parts of the region"; at the same time, farmers from the Northeast were being encouraged to settle the area themselves (Vurdubakis & Rajão 2022:83). Thus the National Institute of Space Research (Instituto Nacional de Pesquisas Espaciais, INPE) was formed with the express intention of "'providing information to improve the process of occupation of the Amazon' (Novaes et al. 1980:10)" (:84). Vurdubakis and Rajão track how this concern with sovereignty slowly morphed into a discourse of development, in which scientists at INPE were intimately involved as issues associated with the colonisation of the Amazon such as deforestation suddenly became problems requiring scientific measurement and monitoring: "[t]he Amazonian rainforest was no longer an impenetrable jungle waiting to be tamed by human enterprise, but a fragile ecosystem in need of protection" (:85). This then led to the creation of the environmental law enforcement agency (IBAMA) which was responsible for controlling deforestation in the region; and indeed in a number of sites I visited around the Amazon, LBA scientists were often in conversation with IBAMA officials. So the way in which these different forms of territorial expansion surfaced and resurfaced throughout my fieldwork was complex, multi-scalar, temporally differentiated.

Territorialisation then emerges here in a temporal register as an ongoing layering of spatial claims, and indeed forms of space. My observations here chime with Bob Jessop, Neil Brenner and Martin Jones' idea of spatial polymorphy, which they use to think through how different sorts of spatial formation – network, places, scales and territories specifically – can be intertwined and importantly can result in socio-spatial relational configurations that are contradictory, conflictual,

and volatile (2008:394). As Byrne et al point out, in their case in the context of Nepalese territorial claims, "[m]aking territory ... is the effect of the entanglement of different territorial politics and practices" (2016:1272). They explore the way that a Nepalese forest has been part of contested claims by the Forest Department, Maoist rebels, district officials and local notables, as well as Community Forest User Groups, since the 1960s, and now more recent efforts to re-inscribe borders as part of Nepalese federalization, they not only show how "territorialization is a multi-sited process and constitutes a multitude of political spaces" (:1273) that can often contradict each other. And Thomas Stigler's (2014) use of the idea of the "palimpsest" to describe the re-inscription of "layers" of territoriality of Panama's transit corridor likewise allows him to show that territories are "fabrics that have been reformulated multiple times over the course of history" (:887). Rather than use the palimpsestic to describe how the territorial overwrites socio-cultural structures and relations, Stigler draws out the layering that is inherent to territorialisation itself. This permits not only a thoroughly historicised approach, but also a temporal one that takes into account the ephemerality of territorial formations. All these notions allow us to see a layering effect as different sets of technologies, practices, claims are piled on top of each other over time and by different actors, and to enquire as to how these are related to each other, and continue to endure through time.⁶

Recognising this folding and plurality to territorial spaces is in fact crucial to understand the socially productive forces of territorialisation – how it can produce notions citizenship or statehood, for example – and also therefore the political possibilities for those who are living in these territorially entangled spaces. The last point then I would like to draw out from my ethnographic material is the way that these territorial technologies themselves have socialities that constitute them and that they are constituted by. On the one hand, the technicians, *mateiros* (forest technicians) and data collectors who I spoke to from the LBA who spent the most time out at the ZF2 basecamp in the forest were certainly in a precarious labour economy and spoke to me of their desire for more stability and money (Walford forthcoming). On the other, they told me that they loved going out into the forest, and talked of themselves as a "family". Some of them had to stay out there at the base camp, away from their families in Manaus, for weeks at a time, and were constantly moving in and out of the forest. There was a very clear sense of affective connection between them and the forest and between each other - several of them had known each other for years and years, as experienced data collectors and *mateiros* were extremely sought after. And there was also a stark contrast with the European or US researchers (*estrangeiros* – foreigners) who came out to do one-off data collection campaigns, staying only a few days or a week at a time at the base camp. These researchers could not speak Portuguese for the most part

and so were not included in the frequent banter and constant joking that went on amongst the long-time data collectors and technicians on whom these foreign researchers were often totally reliant to get their data collection done. On one occasion, a data-storing device belonging to one of the foreign researchers went missing, and this researcher accused someone amongst the technicians and LBA employees at the base camp of taking it. There was outrage amongst them, and an absolute refusal that anyone would have done that. The device turned up in a Landrover after a more extensive search. But the immediacy of the affective response, and the way that the technicians banded together, was palpable. Because these territorial infrastructures and configurations are established over long periods of time, they build up relational universes around them. This resonates closely with Cal Biruk's observations (2018) about the "survey research worlds" that coalesce around data collection health surveys in Malawi. Biruk deftly draws out the complex sets of relations that emerge through the collection of "good, clean" data, be it between data collector and those having their data collected, between demographers, between aid workers and local people, or between anthropologists and those they are trying to get to know; again, the act of data collection in Biruk's rendering is not a one-off event, a clean extraction of information, however much some researchers wish it could be – but rather brings into being and sustains certain kinds of richly textured worlds, and subject positions (:5).

One could read the emergence of such research worlds, that materially and affectively accrue around the collection of data, as a sort of rooting or grafting of social worlds onto the standardised, gridded and territorialised spaces of scientific knowledge production. This also puts me in mind of Anna Tsing, Jennifer Deger, Alder Keleman Saxena and Feifei Zhou's use of "feral ecologies" in their *Feral Atlas*, "that is, ecologies that have been encouraged by human-built infrastructures, but which have developed and spread beyond human control".⁷ The social worlds of data collection that I encountered similarly were budding off data collection infrastructures that were not intended to foster them. But at the same time, reading this through a spatial optic also points to the way that – far from standardising, identifying and abstracting – "making space" is also always about "making differences" (Hawthorne and Lewis 2023). Black geography has been pivotal in emphasising the way in which space-making is not an abstract, neutral process but in fact, historically and still, distributes and situates people as spatially differentiated: placeless, on the margins, outside (Hawthorne 2019; cf McKittrick 2006, 2011). As Camilla Hawthorne argues:

Such an emphasis counters long-standing trends in the discipline of geography, in which Black people were seen as lacking geography (due to the upheaval of the trans-Atlantic slave trade); or as victims

of geography (due to ongoing practices of displacement and spatial segregation). Taken together, these modes of analysis efface a Black sense of place (McKittrick, 2011) and perpetuate a dangerous understanding of space as transparent—of geographies as static, inert, and self-evident, and of current spatial arrangements as natural, innocent, and ahistorical (McKittrick, 2006, pp. 5–6 in Hawthorne 2019:5)

"Making space calculable" in Elden's terms must also be read through this lens; these practices of calculation, the 'geo-metric', are political technologies which are restricted to a few people only, whilst others become the objects of calculation and spatialisation. As Katherine McKittrick notes, in such regimes, "subaltern populations have no relationship to the production of space" (in Hawthorne and Lewis 2023:). The geo-metric also eclipses its own capacities for spatial politics beyond containment. This is apparent, in the example I gave above, in how the social worlds of data that unfurl along the grooves cut by territorialising practices permit relational proliferation and flourishing at the same time as locate those who live there as always-already potential criminals (cf Gibson and Walford forthcoming).

Returning to the context with which I started this paper, regarding the de-territorialised claims of emerging *open data* initiatives and corollary forms of environmental politics, it seems an obvious point (and one I have made before, see Walford 2021) that these social worlds of environmental data collection should be kept in mind when thinking about what "openness" means here. This is a familiar ethnographic move, to "ground" abstractions in the every day, and in this way to curtail their power. But further to this, rather than just counter narratives of infinite openness – de-territorialisation - with situated social realities – re-territorialisation - we can start to interrogate and unpack the spatial correlates of openness itself. That is to say, we can ask: what sort of space-making is openness, if we understand space to always be charged through with difference? What forms of territorialisation emerge here? I turn to this in the final section of the paper.

From Open Data to Earth Intelligence

Whilst in the first context above I am grounding environmental data in the places of its emergence and collection, places which are simultaneously territories and social worlds, here to finish I turn to the ways in which environmental data might be seen to be de-territorialised, as it becomes part of spatial imaginaries of openness, flow, and planetary informational democracy. I focus here particularly on

the Intergovernmental Group on Earth Observations (GEO). When encountering the GEO website, the social worlds of data collection that I have just presented seem to be left behind, as data enters into an apparently virtual space of databases, data portals, data infrastructures, data formats. Returning to Elden's work, he pushes back against an analogous framing of globalisation in the early 2000s which suggested that it was the end of territory and the state, a time of total de-territorialization. Globalisation does not, he argues, "escape the logic of territory" (2005:16) – it rather extends it to cover the whole world:

Globalization – ontologically – rests upon exactly the same idea of homogeneous, calculable space. It is, effectively, a continuation of Cartesian thought by other means. What may have happened is that the abstract space we have imposed over the world is taken more and more as real in itself, rather than as a reflection of something below it, something that it seeks to represent. (Elden 2005:16)

Heeding Elden's call, what sort of re-territorialisations are occurring in the move to more and more ambitious, global or planetary, *open data* initiatives in environmental data?

To begin to answer this question, I want to briefly present the Intergovernmental Group on Earth Observations. This is an intergovernmental organisation aimed at providing Earth data "for all"; that is, developing data infrastructures to share data across the world, as well as develop partnerships and collaborations to this end. It is made up of government agencies, third sector and civil organisations, universities, research institutes. I have not conducted ethnography with this organisation so am relying on their website and the documents which can be found on there. But it is enough to start to draw out the spatial logics or imaginaries that underpin such initiatives.

Turning to the way the GEO presents itself online, certainly we can see the hallmarks of many *open data* projects. Its website informs us:

Our planet faces challenges that don't stop at borders. From the pressing issues of climate change, the alarming loss of biodiversity, to the widespread pollution affecting our lands, skies, and seas, there's much at stake. While the challenges are integrated, the global response often remains fragmented. Among the ever-growing flood of information and data sources, there's a noticeable gap in cohesive global partnerships. This is where GEO steps in, striving to unify these fragmented efforts and championing inclusivity in seeking holistic solutions for global challenges.⁸

There is clearly here an appeal to a particular idea of the problem the GEO – as proxy for humanity – faces, which is that the planet is one integrated whole, but our 'responses' are fragmented. So how to integrate earth governance in order to ensure 'holistic solutions' to global problems? Over the time I have been accompanying this initiative from afar (around 4 years), the GEO has itself shifted from what appeared to be quite a fragmented and virtual organisation, and slowly concretised into an array of different projects and research programmes, tackling everything from biodiversity loss to water security. But there has been also a deliberate consolidation around another mobilising term: *Earth Intelligence*. As we can see above, the problem is not just piecemeal responses to global environmental catastrophes, the problem is also in fact the "ever-growing flood of information and data sources". Whereas the rallying cry used to be "open data for all", this has now morphed into "Earth Intelligence for all", so that now the GEO's mission is:

co-producing user-driven Earth Intelligence solutions. By collecting and sharing vital information, ranging from satellite images of forests to oceanic temperature readings and beyond, GEO provides a comprehensive view of our planet's well-being, allowing us to monitor and safeguard its health. These are not just datasets; they're the tools that inform decisions, shaping policies and initiatives worldwide that guides society towards a sustainable future.⁹

It narrativizes this shift itself in the Strategic Plan documents available on their website: from 2005-2015, the focus was on "data for all"; then 2016-2025 "services for all"; then 2025 onwards, the aim is "Earth Intelligence for All". (GEO 2024: p3)¹⁰ In the same document, the GEO goes on to explain exactly what "earth intelligence" is:

Earth Intelligence comprises integrated Earth and social science derived knowledge and insights that inform strategic decisions, build capacities and empower society to address environmental, societal, and economic challenges. Its design is based on user needs at all scales and across sectors and integrates Earth observation data, socio-economic data, research and science, citizen observations, indigenous knowledge and other sources of information and combines this with modelling, prediction and scenario analysis (GEO 2024:15).¹¹

A further shift can be seen with a direct and deliberate emphasis on equity; that is, what does “for all” mean?: GEO will pursue global equity in Earth observation, making resources and opportunities available that lead to best outcomes in communities with varying needs and capacities (GEO 2024:15).

What is interesting here is the tension between an appeal to an integrated world that needs more than a fragmented response, and an acknowledgement of how different groups of people might be around that world. Of course, this is a very generic style of writing and presentation, intended for the public, so there is only so much that should be read into it. There is no doubt much more going on at the GEO than these soundbites let on. However, it is the case that they are signalling a very specific, and familiar, spatial imaginary here.

I take the idea of spatial “imaginaries” from Gonin et al (2024) who develop Elden’s critiques of globalisation, by observing that behind Elden’s calculative technologies lies what they call a “spatial imaginary” of the “globe”. Characterising this as a product of the Renaissance, a “new concept of the Earth” (:7) but “conceived as a homogenous, uniform, and continuous extension” (:7), their argument dovetails with that of Elden up to a point; however, they go on to posit that the Anthropocene marks a shift in this spatial imaginary from “globe” to “Gaia”:

Gaia is ... an Earth that presents itself as much more heterogeneous, dynamic, and patchy than previously thought, no longer divisible into discrete, identical, juxtaposed units that can be claimed or occupied by a group or an institution (:3)

Gaia, they argue (through a close reading of the little Latour ever wrote on the idea of ‘territory’) is not tied to sovereign rule, but is a planetary entity; it is a territorial actor itself, not a framing for others to act within. But it is also not a “harmonious whole”, nor the sum of its parts; rather, Gaia is a “profoundly manifold, plural, and inherently differentiated entity” (:11), intrinsically divided, or “a constantly evolving web of coupled physical, chemical, and biological processes, where rock, soil, water, air, and living organisms shape the planet through their combined activities and interactions” (:10). In this telling, the refusal to summarise Gaia, means it can become “a bridge between different narratives and a rallying point for diverse voices in the pursuit of counter-hegemonic alliances (Luisetti 2017). It not only possesses the potential to reshape our collective understanding of the Earth but also to create a more inclusive platform for knowledge production” (:9). Gaia, they argue, demands a new understanding therefore of territorialisation which can take this radical heterogeneity into account.

If there is a shift in spatial imaginary from globe to Gaia, then it could well be that *open data* is its territorial correlate. As Gonin et al point out, Gaia emerges

from “modern rationality, supported as it is by scientific modes of inquiry, technical instruments, mathematical models, sets of data, and so forth” (:9). Gaia then could be one spatial imaginary which emerges from, and underpins, the sorts of *open data* initiatives I am interested in interrogating. But it does not seem like it. In the way the GEO presents it, there is a clear appeal to the world as unified and integrated. The world may be in crisis, that is, in a disordered state, but the issue is really with humanity's disintegrated responses, a result of bad (fragmented) data practices. Any difference is re-framed as diversity — as a sort of multi-culturalism which still adds up to a unified world fighting environmental disasters together. The arithmetic here is still unitary, and global, which seems a far cry from the Gaia that Gonin et al present.

But something has shifted. I want to dwell on the shift from *open data* to earth intelligence that characterises the GEO in their vision for the future. This resonates closely with what Halpern et al (2021) have called the shift from “big data” into “surplus data”. Surplus here indicates the transformation of “quantity” into “quality”, or as they also put it, surplus is the quality itself of quantity:

The paradigm big is a quantitative designation of data itself; surplus is the quality of the social after the quantitative surge. This transformation from quantity to quality demands a new conception of the relationship between what is being measured and represented by data and its efficacy and impact on the world (:199)

In another context, that of the data deluge in genomics, Jenny Reardon (2018) has talked about this shift as the emergence of the “post-genomic condition”, which is characterised by a search for what she calls “meaning” — now we have collected all this genomic data, what does it *mean*, and for whom?

This shift into a search for “intelligence”, “quality” or “meaning” is a characteristic of the current data moment, in which, again to cite Halpern et al,

the transformation of a finite, if extremely large, resource into a seemingly endless source of value through the recombination and discovery of new relations and patterns in the same data set... This form of derivation and optimization is based on the extension of data's life beyond the use envisioned in its initial gathering (2021:200-201).

To bring us back round to the spatial politics of this, it is the term “extension” which I want to end on. De- and re-territorialisation seem to rely on series of abstractions and superimpositions, however difficult or fragile they may be; this

harks back to the old tension between map and that which is mapped, implying a representational dynamic, even if a performative one where the map creates that which it maps. What we are confronted with by initiatives like the GEO are infrastructures and imaginaries of extension and recombination – ‘flat’ spatialities.¹² Whilst it may espouse an integrated holistic spatial geometry in which everything adds up, the GEO functions as an endless extension which forever complicates this: earth intelligence (which is *everything*) for all (*everyone*). The GEO does not frame itself as a map; it is the means to make a map, the means to make a million maps in fact. Openness then, as I put it earlier, is from this perspective not a spatial form that the world is assumed to take, but the connective tissue between worlds, the apparatus of surplus. It is the social and political machinery of de- and re-territorialisation, not that which is being territorialised - but writ so large it becomes its own entity. As such, it forces us to confront a third element in the old adage: it is neither map nor territory but what lies in between – the material realisation of the relationship between the two. The infrastructures, portals, websites, databases and communities of people who build them and work with them instantiate this relationship, and they also constantly renew it and maintain it. By materialising this relationship in this way, however, they also present the possibility that it could be done differently.

Notas

- 1 See also here the Environmental Data Governance Initiative (EDGI) and Critical GIS studies.
- 2 This was subsequently taken down but originally was at: <http://geoss.maps.arcgis.com/apps/MapJournal/index.html?appid=085cf926a2464132846286829864de1f>, last accessed 29 June 2016.
- 3 "Essentially the argument here is that the emergence of a notion of space rests upon a shift in mathematical and philosophical understanding, related particularly to geometry. This development is partnered by a change in conceptions of the state and its territory. The modern notion of measure, which finds its most explicit exponent in Descartes, sees beings as calculable, as quantitatively measurable, as extended; for Descartes calculation is the fundamental determination of the world" (Elden 2005:15).
- 4 Short for "micrometeorology" because the towers were for the most part collecting micrometeorological data on physical processes which would affect vertical carbon flux.
- 5 The small computer which stored the data from the instruments until it could be downloaded.
- 6 Beyond the scope of this paper, but also crucial here, is the work of critical race studies scholars, who emphasise how the (socio- spatial) past is not just submerged or written-over, but can be constantly re-inscribed – for example, Saidiya Hartman's notion of "the afterlife of slavery", which draws out not only the effect slavery had on enslaved people of violently severing their connection to their kin and their histories, but also demands that we countenance how "[b]lack lives are still imperiled and devalued by a racial calculus and a political arithmetic that were entrenched centuries ago" (2007:6).
- 7 <https://feralatlas.org/#:~:text=The%20More%2DThan%2DHuman%20Anthropocene&text=Seventy%2Dnine%20field%20reports%20from,and%20spread%20beyond%20human%20control>.
- 8 <https://earthobservations.org/mission/geo-at-a-glance>, accessed 1st July 2024.
- 9 <https://earthobservations.org/mission/geo-at-a-glance>
- 10 <https://earthobservations.org/resources#key> – GEO Post-2025 Strategy Full Document.
- 11 <https://earthobservations.org/resources#key> – GEO Post-2025 Strategy Full Document.
- 12 Interestingly this is also how Gonin et al (2024:10) characterise Gaia: "Such lack of wholeness means that Gaia is nothing else than 'what those intertwined agents have been producing through their entanglements' (Latour & Lenton 2019:664). In other words, Gaia is something that is 'added' – an 'extension', as put by Sébastien Dutreuil – next to its parts: 'the whole is nothing above the parts but is in continuity with the parts – the word part being a way to name rather clumsily how elements are overlapping with one another' (Latour & Lenton 2019:677)." I am therefore less optimistic than they are about the radical potential of Gaia as spatial imaginary.

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MAP, TERRITORY, AND EVERYTHING IN BETWEEN: ENVIRONMENTAL DATA AND TERRITORIALISATION

Abstract

This article argues that in order to get grips with emergent forms of environmental governance and politics, the de-spatialised and un-situated claims of *open data* initiatives need to be interrogated. Drawing on ethnographic work with an international scientific project in the Brazilian Amazon, the article explores the everyday collection of environmental data in the field as a way of making space, through simultaneous processes of re-territorialisation and de-territorialisation. It brings to light the ongoing labour and complex layering and folding of these territorial formations, as well as their capacity to foster ambivalently differentiated social and affective worlds. These worlds emerge from technologies of territorialisation but are not subsumed by them. The article then turns to a contrasting case, that of the apparently virtual data infrastructures and portals of *open data* initiatives, asking what forms of territorialisation they might constitute. The paper ends with the tentative suggestion that 'openness' is not a spatial form that the world is assumed to take, but is the apparatus itself of extension, the social and political machinery of de- and re-territorialisation.

Keywords: Environmental Data, Smart Earth, Territory, Space.

MAPA, TERRITÓRIO E TUDO QUE HÁ NO MEIO: DADOS AMBIENTAIS E TERRITORIALIZAÇÃO

Resumo

Este artigo argumenta que, a fim de lidar com formas emergentes de governança e de política ambiental, as alegações desespacializadas e não situadas das iniciativas de *dados abertos* (*open data*) precisam ser interrogadas. Com base em uma etnografia com um projeto científico internacional na Amazônia brasileira, o artigo explora a coleta cotidiana de dados ambientais em campo como uma forma de criação do espaço, por meio de processos simultâneos de reterritorialização e desterritorialização. O artigo traz à luz o trabalho contínuo e as complexas estratificações e dobragens destas formações territoriais, bem como suas capacidades de fomentar mundos sociais e afetivos ambivalentemente diferenciados. Embora estes mundos emergjam de tecnologias de territorialização, eles não são totalmente definidos por elas. A seguir, o artigo aborda um caso contrastante de infraestruturas de dados e portais aparentemente virtuais em iniciativas de *dados abertos*, questionando que formas de territorialização eles poderão constituir. Ao final, apresenta a sugestão provisória de que a 'abertura' não é uma forma espacial que o mundo supostamente assume, mas o próprio aparato de extensão, a maquinaria social e política de desterritorialização e reterritorialização.

Palavras-chave: Dados ambientais, Smart Earth, Território, Espaço.

MAPA, TERRITORIO Y TODO LO DEMÁS: DATOS AMBIENTALES Y TERRITORIALIZACIÓN

Resumen

Este artículo sostiene que, para abordar las formas emergentes de gobernanza y política ambiental, es necesario interrogar las afirmaciones desespaciales y no situadas de las iniciativas de *datos abiertos* (*open data*). A partir de una etnografía con un proyecto científico internacional en la Amazonía brasileña, el artículo explora la recolección cotidiana de datos ambientales en el campo como una forma de producción de espacio, a través de procesos simultáneos de reterritorialización y desterritorialización. El artículo saca a la luz el trabajo continuo y las complejas estratificaciones y pliegues de estas formaciones territoriales, así como sus capacidades para fomentar mundos sociales y afectivos ambivalentemente diferenciados. Aunque estos mundos surgen de tecnologías de territorialización, no están completamente definidos por ellas. A continuación, el artículo aborda un caso contrastante de infraestructuras y portales de datos aparentemente virtuales en iniciativas de *datos abiertos*, cuestionando qué formas de territorialización podrían constituir. Al final, sugiere de forma provisional que la "apertura" no es una forma espacial que supuestamente asume el mundo, sino el aparato de extensión en sí, la maquinaria social y política de desterritorialización y reterritorialización.

Palabras clave: Datos ambientales, Smart Earth, Territorio, Espacio.

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