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Strategic environmental ignorance: Antipolitical knowledge gaps from drought measurement to adaptation in Cambodia

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ABSTRACT

In shaping environmental policy, knowledge is power. Yet the opposite is also true. Control over the absence of knowledge facilitates certain policy outcomes being deflected, obscured, or magnified in a way that furthers political, personal, or institutional ends. Applying previous work on ignorance studies and agnotology to the development of Cambodian drought policy, the paper demonstrates how data gaps, restrictions on data sharing, and obstacles to data dissemination serve institutional interests and shape policy development. It proceeds in three parts, each reflecting one aspect of drought sensing in Cambodia and more broadly: hydrological, meteorological, and agricultural. First, how data on the Mekong River is shaped by regional geopolitics. Second, how national rainfall and flood data reflect the political geography of sub-national government administration. Third, how this multi-scalar landscape of political and institutional interests links data generation, data dissemination and adaptation policy, closing certain adaptation pathways, whilst opening others.

1. Introduction

The 'vast machine' (Edwards, 2010) of climate science facilitates an unprecedented depth and accuracy of environmental knowledge. Yet mirroring this ever-expanding body of information is an equally important, but far less well understood body of non-knowledge: the questions that are not asked, the resolutions that are not deemed necessary, the data that cannot be readily accessed. This disparate array of environmental unknowns and ignorance emerges from the same landscape of interests and power as does knowledge (McGoey, 2012). Moreover, it is in many cases strategically articulated to suit political and institutional ends (Frickel et al., 2010). When it comes to the environment, non-knowledge is power.

Thus, whilst both environmental science and policy are commonly presented as technical endeavours, they are in reality deeply embedded in the same landscape of interests that governs resource use. This is true of both environmental data collection and of the policy that shapes and reflects these data. Far from being neutral, climate change policy decisions are 'highly normative' (Symons, 2014: 267) and play out in a 'political arena' (Lindegaard, 2018) in which some voices are far louder than others. The voices of marginalised people, communities, and institutions, on the other hand, are compromised not only in policy formulation, but also in decisions relating to data creation sharing, and dissemination.

This 'anti-political' inequality of representation (Paprocki, 2018) is increasingly recognised as a feature of policy formulation, but far less so in relation to the data that underpins it. Yet, whilst receiving far less attention, the antipolitical qualities of the latter may be equally important. In some cases, this means environmental sensing not being undertaken. In others, it means environmental sensing being undertaken in places that ignore or do not benefit communities. In others still, it means that necessary environmental data exists but is not shared or disseminated due to unequal power relations between adaptation parties. In each case though, this paper argues that environmental knowledge shapes an antipolitical geography of strategic environmental ignorance that reflects and underscores an existing landscape of power.

In evidencing this perspective, this paper uses data from Cambodia to demonstrate how environmental data gaps and adaptation policies are linked to political priorities. It does so specifically through the lens of drought, a phenomenon that is 'less well understood than flooding' in Cambodia and on which research remains limited, despite it accounting for a substantial proportion of annual agricultural losses (Chhinh, 2015). Using a multi-scalar analysis to elucidate the landscape of knowledge on this topic, the paper will analyse data on river levels, rainfall, and drought across three sections, each reflecting one aspect of drought sensing in Cambodia and more broadly: hydrological, meteorological, and agricultural (UNDP, 2019).

First, it will demonstrate how data sharing practices in the Mekong

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basin are intertwined with the politics of environmental management and exploitation, thereby limiting knowledge on Mekong River water levels. Second, it will outline how political and administrative geographies shape the collection (and non-collection) of data, creating an environmental record which is specific to the existing conditions of governance, whilst eliding the details of local rainfall patterns. Third, it will highlight how national and sub-national political-economic priorities discourage third sector investment in drought sensing and local adaptation strategies, thereby linking the data gaps outlined in section 5 to the assemblage of institutional and geopolitical interests described in sections 4 and 6.

2. Framing the strategic unknowns of environmental science and policy

The idea of development as 'anti-politics', first outlined by James Ferguson in 1994, speaks to the capacity of technocratic frameworks to supersede and undermine existing processes of political negotiation and contestation. As Ferguson (1994: 255) himself puts it, 'the "development" apparatus in Lesotho is not a machine for eliminating poverty that is incidentally involved with the state bureaucracy; it is a machine for reinforcing and expanding the exercise of bureaucratic state power, which incidentally takes "poverty" as its point of entry'. Building upon this framing, scholars of adaption have in recent years addressed the 'antipolitical' role of climate policy in a similar manner, (Hope, 2021; Paprocki, 2018; Swyngedouw, 2013; Bracking, 2015; Symons, 2014; Büscher, 2010; Blühdorn, 2007), pointing to the 'socially and historically specific configuration of power that governs the landscape of possible intervention in the face of climate change' (Paprocki, 2018: 955).

Rooted as they are in the poststructuralist framings of Foucault (e.g. 1980) and Deleuze (e.g. 1988), such accounts tend to conceptualise the regimes governing climate change as a 'mushy mixture' of the discursive and the non-discursive (Deleuze, 1988: 38), or as Ferguson (1994: 274) puts it, 'a knotting or a coagulation of power'. Generally absent, therefore, is a focus on the scale at which such power coagulates. Yet, as this paper argues, this constitutes a substantial shortcoming. By failing to engage fully with 'inherently political' (Ahlborg and Nightingale, 2019: 16) role of scale in geographic analysis, accounts of the anti-politics of adaptation themselves play an anti-political role, eliding much of the negotiation and contestation inherent across multiple scales of governance.

This is a crucial issue in the development of climate policy because of the 'significant issues faced by vulnerable countries in downscaling global frameworks to subnational levels' (Ohja et al., 2016: 415). As O'Neill and King (1998:6) put it, for example, 'if you move far enough across scale, the dominant processes change. It is not just that things get bigger or smaller, but the phenomena themselves change. Unstable systems now seem stable. Bottom-up control turns into top-down control'. Yet scalar conventions have a momentum that tends to override such concerns. As an issue with the potential to impact everything on earth, the 'globalising instincts' of climate science have drawn it consistently towards the planetary scale (Hulme, 2010: 559). More recently, the same trend has been evident also in the analysis of climate politics, 'as the global climate system dominates scientific and political discourses', causing the field below the scale of the nation state to 'disappear from view' (Mahony and Hulme, 2018: 399).

There is, therefore, a pressing need to elucidate the inter-scalar politics of climate policy, in order to achieve fair and effective adaptation to climate change (Ohja et al., 2016). Nevertheless, analysis thus far has focused predominantly on two separate scales of analysis, with limited consideration of how these scales relate to one another. First, numerous authors have examined climate politics at the scale of international diplomacy (Falkner, 2016; Giddens, 2009; Paterson and Grubb, 1992), whilst a growing literature has adopted a regional lens. Harris, for example, has explored climate politics in Europe (2007) and East Asia (2004), whilst Edwards and Roberts (2015) have examined climate change in the Americas and Sowers et al. (2011) have done so in the Middle East and North Africa. Secondly, a spate of studies have in recent years sought to provide overviews of the national politics of climate change, for example Carter (2014) in the UK, Beeson and McDonald (2013) in Australia, Dubash (2013) in India, Qi and Wu (2013) in China.

Part of the reason for this disjuncture is that topics and scale are related in the study of climate change. 'Differences in policy objectives across multiple scales have been frequently noted as a reason for the dichotomy between adaptation and mitigation' (Landauer et al., 2019: 742). Mitigation agreements tend to be contested at the global and national scale, whilst adaptation has been seen generally as an issue best examined through a local lens. The areas in between: sub-national governance, inter-ministerial power struggles and contestation between third sector and state tend to be less explored because they comfortably encompass neither topic, leaving sub-national politics a 'relatively underexplored area' (Bailey, 2017: 1129).

This missing middle is of particular relevance to the politics of environmental policy because it is here that the uncomfortable junction between global and local models plays out. At this scale, 'climate models that work at global scales are not easily merged with models that generate scenarios at smaller scales, nor with social science understandings of socionatural change' (Nightingale et al., 2020: 5). Climate data is assessed as possessing technical shortcomings, gaps and inconsistencies, yet the power relations, politics and policies that underpin these gaps are rarely examined in depth, despite growing recognition both of the uneven geography of data quality (Piguet, 2013; Gubler et al., 2017) and the 'diverse and contested spatialities of climate change knowledges' within which they are situated (Mahony and Hulme, 2018: 410).

Responding to this, this paper adopts an opposite focus to previous work on the politics of climate policy, examining not the policies themselves, but the gaps within and between those policies, the data that is not generated and the questions that are not asked. Defined here as the purposive facilitation of knowledge gaps, constraints, or inaccuracies, this agnotological approach to environmental science and policy emphasises the importance not only of what people know, but what they don't know (Mirowski, 2013). As outlined by Slater (2019), this approach foregrounds what falls outside of the knowledge-policy framing outlined by powerful institutions, in order to illuminate the environmental actions that were not made and the data that was not generated.

In situating this case, this paper draws on three areas of literature. First, it links recent literature on the anti-politics of climate policy (Hope, 2021; Vij et al., 2019; Paprocki, 2018; Ohja et al., 2016; Swyngedouw, 2013; Bracking, 2015; Symons, 2014; Büscher, 2010; Blühdorn, 2007) to a second, wider body of work exploring the epistemology of climate science (Parsons and Nielsen, 2021; Mahony and Hulme, 2018; Ahlborg and Nightingale, 2012; Hulme, 2010, 2009; Golinski, 2008; Demeritt, 2006, 2001). The third strand of literature at the core of this paper is the linked fields of ignorance studies (McGoey, 2016, 2012; Frickel et al., 2010; Gross, 2007) and agnotology (Slater, 2019; Mirowski, 2013; Proctor and Schiebinger 2008), both of which evidence the cultivation of unknowns and non-knowledge as a key strategic resource.

Drawing on these three areas of scholarship, this paper introduces questions of data generation and sharing into wider debates surrounding the politics of climate policy. As it shows, different actors interpret the problems posed by climate change differently. Where the power to frame and evidence these problems is unequal, 'actors interact to pursue their individual or collective interests' (Ojha et al., 2016: 418) resulting in a linked set of data and policies that support these interests. The result is first that data generation and dissemination are rooted in the same geography of interests and power as environmental policy, and second, that data generation thus speaks back to and reinforces that geography of power. This paper will evidence these points in three sections, each

evidencing the political intersections between two scales linking climate policy: regional/ national, national/ subnational, and sub-national/ local. At each stage, it will highlight how environmental data and policy are reshaped by political influences and contestations, often distancing the resulting outcomes from the intention laid out at larger scales.

3. Context and methods

As a Southeast Asian nation highly dependent on rain-fed rice production (NIS, MoP and MAFF, 2015), Cambodia is consistently ranked amongst the world's most vulnerable countries to climate change. The Mekong River Commission has calculated that 'the average temperature in Cambodia increased by 0.8°C from 1960 to 2005', with further rises forecast of 0.3° to 0.6°C by 2025 and another 1.4°C to 4.3°C by 2090' (MRC in CDRI, 2012: 62). Reaching a peak of #2 in the 2015 Global Climate Risk Index (Kreft et al., 2014) following a heavily disrupted monsoon season the previous year, climate change is now routinely described as 'a major threat' to the economy and society of Cambodia (Khut Chandara, Under Secretary of State for the Ministry of Environment, 2017).

This ongoing environmental crisis manifests primarily through the lens of water. Rainfall patterns have shifted significantly since the 1920s (Doch, Diepart and Heng, 2015), badly affecting farmers' livelihoods (Lawreniuk and Parsons, 2020; Doch, Diepart and Heng, 2015). The drought of 2016 was declared by Prime Minister Hun Sen to be the 'worst natural disaster to hit Cambodia in 100 years' (Save the Children, 2016: 3), but similar patterns have since become routine, compounded by El Niño Southern Oscillation [ENSO] anomalies[1] in four of the last five years (Climate Prediction Centre, 2020). At the same time, Cambodia's struggles with water are further magnified by the impacts of upstream dam construction on the Mekong River, which are now playing a significant role in worsening regional drought (Eyler and Weatherby, 2020).

Reflecting the fact that 'the adaptation mechanism of the local government and community remains very limited' (Nop, 2022: 43), adaptive responses to this heightened vulnerability 'usually involve a complex network of actors: international donors, national ministries and authorities, implementing companies, non-governmental (conservation) organizations (NGOs), and several levels of local stakeholders (local authorities, local land users, etc.)' (Work et al., 2019: 548). Historically, Cambodia's administration has been strongly influenced by aid dependencies and conditionalities, in the service of an outward facing neoliberal development model set in place in the early 1990s (Ear, 2012). This agglomeration of state and non-state actors operates within an environment of increasingly top-down control characteristic of Cambodia's recent 'authoritarian turn' (Lawreniuk, 2020). Yet as this paper aims to show, this has not precluded negotiation and contestation amongst non-state actors over the manner in which adaptation resources and policies play out.

Exploring these issues, this paper brings together extended qualitative interviews with authority figures and technical experts across multiple spheres and scales. At the national and sub-national scale, this involved informants from the Cambodian government, including district and provincial level Department of Environment officials, and national scale Ministry of Environment and Ministry of Water Resources and Meteorology [MoWRaM] officials. At a regional scale, technical experts from the Mekong River Commission [MRC] were interviewed, as were officials and experts from the Tonle Sap Authority, which oversees Cambodia's largest lake and its associated tributaries. At the international scale, interviews were undertaken with IOs and NGOs focused on climate adaptation, including the UNDP, the Swedish International Development Agency [SIDA], People in Need, and Dan Church Aid.

In addition to interviews with key informants, this paper draws also on qualitative interviews with people locally affected by climate change, including interviews with villagers, migrants, and local officials. In total, 25 interviews lasting between 15 and 90 min were undertaken between January and April 2019 by the author. Interviews were ether undertaken in English by the author, or by a two-person team comprising a native speaker and the author, a proficient Khmer speaker. In total, these interviews comprised 12 villagers, of which 6 were male and 6 female, 4 village, commune and direct level officials, 4 ministry level officials, and 5 NGO technical experts or directors. Khmer language interviews were subsequently independently transcribed, whilst English language interviews were transcribed by the author. Both sets of interviews were analysed together using the qualitative data analysis software nVivo.

Interview schedules covered topics related to the informants' occupational experience of environmental science and policy. Informants were asked about methods of data collection and the problems they generate, relevant policy actors and their influence of data collection and/or policy generation, and institutional constraints on the voices of relevant actors. All interviews were recorded and fully transcribed in the original languages, either English or Khmer. Direct quotes used for the publication were translated into English by independent transcribers where necessary. In broad terms, the data analysis followed an interpretive methodology (Yanow, 2017), with more than 300 pages of text being coded. During the coding process, relevant text passages were identified and categorised to inductively inform the analysis. An initial set of 46 environmental codes including floods, droughts, debt and climate measurement were inductively developed into five categories of institutional constraints: data collection, disaster response, data dissemination, and adaptation policy, while going through the text repeatedly (Creswell, 2003). The quotations presented in this paper are those selected for illustrative purposes.

4. Hydrological dimensions of drought from the regional to the national scale: Mekong river data sharing and dissemination

The hydrology of the Mekong River is increasingly recognised as a key factor in the manifestation of drought in Cambodia. Upstream infrastructural developments are key determinants of hydrological flows across the Mekong basin, contributing significantly to shocks and environmental pressures in Cambodia in recent years (Eyler and Weatherby, 2020). As Cambodia's Senior MoWRaM official explained, this places a highly influential dimension of Cambodia's water resources in the unpredictable hands of human actors:

'They have many disaster management committees to train people how to read the land, but the flood risk of a river you cannot predict perfectly…because the natural law is now changed. Upstream there are many developments, especially hydropower, so predicting the water levels is not so accurate. Sometimes, when a hydropower dam such as in Laos, for example, is connected, the water levels change and change quickly, dramatically. Before I used to record one hydropower station and they opened it not according to a regular process. [Rather], when they see the clouds getting dark, they open the [water] gates quickly, so the water [level] changes quickly, making forecasting water levels a little bit difficult for us [and making it difficult for us] to run modelling to calculate the level of the river' (Senior MoWRaM official, 28/02/2019).

As outlined here, the growing influence of hydropower dams on water levels in Cambodia renders hydrological modelling and flood forecasting highly problematic. Dams release water as suits their operational necessities, yet no centralised database exists to provide information on how water levels may be affected. As a Technical Expert at the Mekong River Commission [MRC] explained, 'we don't have that kind of

[1] The El Niño-Southern Oscillation (ENSO) is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean. These changes have affect weather patterns in the tropics and have been shown to impact rainfall patterns in Cambodia (Chhinh and Millington, 2015)

the information [on dam behaviour]. We have asked member countries many times to share this information but it sounds like we don't have any information yet…[Consequently], because we don't have actual data provided from countries so we don't know what is the effect by using water at downstream. We just estimate it…from agriculture projects' (MRC Technical Expert, 30/01/2019).

The imbalance of geopolitical power between Cambodia and China therefore leaves little leverage with which to negotiate access to information on upstream dam activity, forcing forecasters to rely on proxy measures. Yet this is only one dimension of the wider challenge faced by analysts in obtaining accurate environmental data. The Mekong basin is a closely interlinked region defined by 'coupled natural-human systems' (Pokhrel et al., 2018: 1). Consequently, international cooperation is essential to generate useful datasets and craft coherent policy.

Recognising this need, the Mekong River Commission was founded in 1995 as a way for the four states of the lower Mekong – Laos, Thailand, Cambodia, and Vietnam – to share data on hydrological management. However, despite the establishment of a formal data sharing protocol, the Procedures for Data and Information Exchange and Sharing (PDIES), commitment to data sharing in the Lower Mekong River Basin is considered to be amongst the weakest of such schemes in the world (Gerlak and Schmeier, 2014). Indeed, this is borne out in the discourse on the issue more broadly. As the senior MoWRaM official continued, this complicated information exchange between countries:

'So now, Cambodia, Vietnam and Laos are the members of the MRC, but sometimes it is a little bit depressing…Even though we are members of the MRC and it is supposed to facilitate exchanging information, sometimes we compete in what we use according to the requirements of economic growth of each country, so it can be difficult to facilitate [sharing data]. So, for the MRC, the council level is the ministry level, but now the ministry level has no power, so we established the Mekong summit for approving [decisions] at a higher level: presidents and prime ministers. So, every two years they have a Mekong summit, so that they can discuss political facilitation and political arrangements together' (Senior MoWRaM official, 28/02/2019).

Arrangements for data sharing are therefore intertwined not only in national political structures and international political arrangements, but also wider political discussions over resource use, situating data sharing in the same political negotiations as other issues related to the management of the Mekong, including hydropower, shared economic development strategies and water management. Crucially, this interlinkage renders environmental data and the environment itself mutually interdependent. The negotiation of hydropower development may include provisions for data dissemination, whilst refusals or impediments to data dissemination may be used as an instrument to impede or influence those developments.

Furthermore, in addition to natural resource governance, the management of human resources plays a subtle gatekeeping role also in this process of dissemination. By instrumentalising the selection of senior staff, domestic institutional actors are able to influence over international data flows. As in politics more generally, certain officials are viewed as open-minded and cooperative with external partners, whilst others are more concerned with institutional interests and retaining control over data flows. Still others represent effectively a non-presence in cooperative endeavours, as a UN technical expert explained:

'In ministries, people aren't always appointed due to their expertise, but their links. So, in any institution, only a few people are genuinely representative of the institution. You have to check the name. Often an institution is technically present at a meeting, but they aren't really present….

Consequently, '[whilst] Cambodia has an obligation to share the data with the different actors and vice versa…in practice it depends on the different actors…They may be doing things eye to eye and there may be some mechanisms and obligations of those member countries, but I haven't seen in practice the data from those organisations fed into one platform and that is what we need, because if we want to do climate modelling then we need all of this data put into one platform' (UN technical expert, 30/01/2019).

As the case of the MRC shows, therefore, the geography of environmental data sharing reflects an unequal regional geography of economic and political power. This in itself is not surprising. Yet of greater interest than the data that is shared is the data that is not. Due to the conflation of data sharing with political negotiations, the countries with the least political economic power within the region know the least about their riverine environments, undermining their capacity to adapt to changes in these systems and to identify with certainty the human causes of the environmental pressures they face. At the very least, this may be regarded as the passive articulation of strategic environmental ignorance, i.e. as a lack of power behind dissemination. Yet as what follows shows, there is also an active dimension to this process, as actors contest control over the resource of data.

5. Political meteorology from the national to the sub-national scale: domestic rainfall monitoring

The measurement of meteorological drought is highly dependent on rainfall sensing. Yet in Cambodia 'rainfall data are not calibrated to reflect the ground' (UNDP, 2019: 32), meaning a shortfall in the data necessary to assess and predict drought outcomes. This is a common problem in much of the global South, where station coverage is substantially lower than what is considered necessary to capture geographical variation, leaving blind spots between data collection points (Gubler et al., 2017). In Cambodia, stakeholders involved in responding to environmental impacts report this issue of data density being especially problematic. As the director of an NGO involved in climate sensing explained, 'we have a microclimate phenomenon in Cambodia, where even in the past few weeks now we've been getting rain, but it's very localised and in other areas we have drought, so we really need this micro level, district level information in order to inform decision making by farmers' (NGO Director, 11/04/2019).

Despite its importance, though, attempting to capture this variation is almost impossible, as stations are '50 kilometres apart, so it might be raining really heavily in between the two stations and you wouldn't know it' (NGO Technical Expert, 28/02/2019). As a UN technical officer bemoaned, 'we've figured out that to cover Cambodia completely, we need to get at least 200 stations and I think so far, we have only a combined 100 stations…and another problem is that the number given by MoWRaM doesn't necessarily mean that they're functioning' (UNDP Technical Expert, 30/01/, 2019).

That such gaps are rooted in political geography is widely noted on a global scale, where the density of sensing equipment is, as shown in Fig. 1, observably influenced by North-South inequalities (Piguet, 2018; Gubler et al., 2017). Yet the same issues are less appreciated sub-nationally, despite longstanding domestic inequalities rendering the technical capacity to reliably collect environmental data geographically inconsistent. As elsewhere in the global South (Hector et al., 2018), technical expertise tends to be centred in major towns and cities, leaving areas which are economically and geographically isolated with limited and low-quality data, despite often being of considerable importance to modelling. Outside of these areas, technical expertise tends to be so limited that 'even the government technical officers, sub-nationally, sometimes don't believe in climate change' (Climate Change Technical Expert, Ministry of Environment, 05/04/2019). As an MRC Technical Expert explained:

'In Cambodia we have many problems for rainfall data collection, especially for mountainous areas and low-lying areas. In the urbanised areas, much more data has been collected, so further from these areas, towards the forested or mountainous areas, the station distance is very far and they are difficult to maintain. Now I think that MoWRaM has been supported from outside by the UNDP and JICA to try to install some stations in remote areas. But the problem is operational maintenance, which is far behind what is needed…They're not difficult to maintain

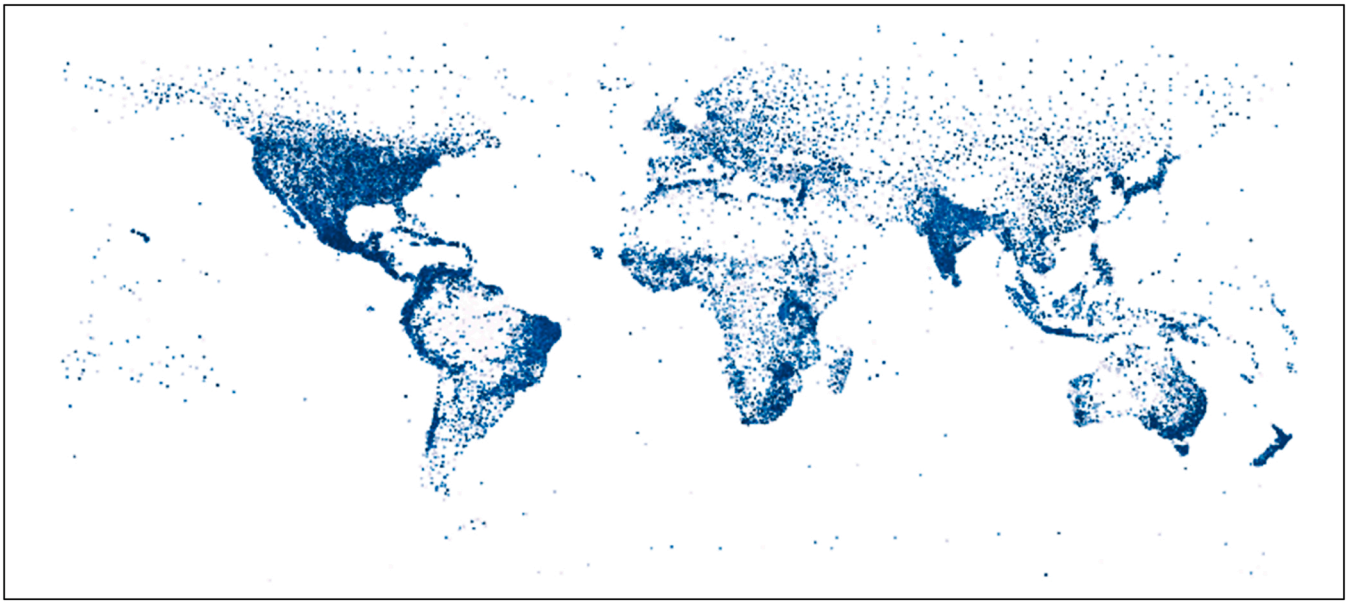

Fig. 1. Global Density of Weather Stations.
Source: WorldClim (2010).

but the telemetry requires some expert or technical people who can, I mean, go daily or weekly to check the stations and adjust the data logger at the station. But now, in Cambodia especially, we don't have enough capacity to do that effectively.' (MRC Technical Expert, 30/01/2019).

Such shortcomings lead inexorably to a higher proportion of missing data from stations located outside of urban centres, as local staff lack the technical knowledge to maintain the machinery. Yet the uneven geography of technical knowledge is not the only factor. Rather, the administrative geography of governmental budgeting plays a key role here also, as the practical concerns of allocating technical duties and maintenance funding inflects data collection with the realities of a sub-national administration whose priority is to ensure that such financial burdens are distributed equitably.

Consequently, as shown in Fig. 2, weather stations in Cambodia have – until a recent round of expansion headed by UNDP (see UNDP, 2018) – adopted a pattern firmly rooted in administrative logistics. Rather than representing local hydrology, this has generally resulted in a distribution of one weather station per province, often located either close to the provincial capital, or its geographic centre. This is a source of considerable frustration to those tasked with collating the data, who complain that:

'A working group was set up to discuss precipitation measurement, which depends on agro-meteorological zones. We need at least two to three per province, depending on historical disasters. However, population density was not taken into account and different funders fund different parts of the network. So, it was organised by province, but not in the correct way. I kept questioning this decision. Distance and hydrology should figure and hydromorphology is also important' (UN Technical Expert, 14/12/2018).

Despite these issues, the role played by political administrators in shaping decision making over environmental data collection is viewed as largely unavoidable. Simply put, 'it goes with the politics, the policies of the ministry' (UN Technical Expert, 30/01/2019). As long as money is allocated by central government, then so too is decision making power, an issue which often takes technical and scientific decisions out of the hands of the experts, undermining the usefulness of the data collected. As an NGO technical expert explained in relation to a recent flood modelling program, for example:

'One of the problems that we have here is that I haven't seen anyone at a ministry level that can actually properly understand these data and can actually guide us to properly say where these things could be. Even some of our rain gauges for example, I think may be in the wrong place, because we get directed by the provincial disaster management committees when we go out, so it's the people who are in charge of disaster management, especially floods, who tell us "this bridge or this river bank location is good", but often we end up placing our sensors in urban areas, so…it's basically measuring at the population centre that we want to evacuate' (NGO Technical Expert, 28/02/2019).

As a result, analysts and forecasters find themselves 'really struggling…to actually pinpoint where is really at risk. It's so erratic what happens' (NGO Technical Expert, 28/02/2019). Nevertheless, many of those involved in generating environmental data have little ability to influence these factors:

'As an NGO we're not at a level and it's not our mandate to lobby the government one way or the other. We provide tools for the government and then we work with the UN to work out strategies around what the UN wants to do and what the government wants to do. Most of the time all of those strategies kind of align into a bigger picture' (NGO Technical Expert, 28/02/2019).

Indeed, it is this bigger picture that is key. Rather than a series of disconnected issues in data collection, the capacity of the agglomeration of bodies involved in climate modelling to accurately monitor rainfall and water levels is itself shaped by political administrative, as well as scientific priorities. The data gaps that result reflect, in a direct sense, low capacity and/or socio-spatial distancing from centres of economic wealth and technical expertise. Yet in a wider sense, the uneven resolution of environmental data reflects the unequal geography of political administration. Unlike the passive facilitation of environmental ignorance evidenced in relation to Mekong River data sensing, this is an active agnotology, in which the geography of political administration is purposively selected over scientific priorities as the dominant frame of environmental data collection. As the next section will show, this uneven geography of knowledge provides a scalar bridge to adaptation policy, foregrounding certain pathways whilst constraining others.

6. From the sub-national to the local: drought data and adaptation policy

The impact of drought monitoring and policy is felt most acutely in the realm of smallholder agriculture (UNDP, 2019). However, as in

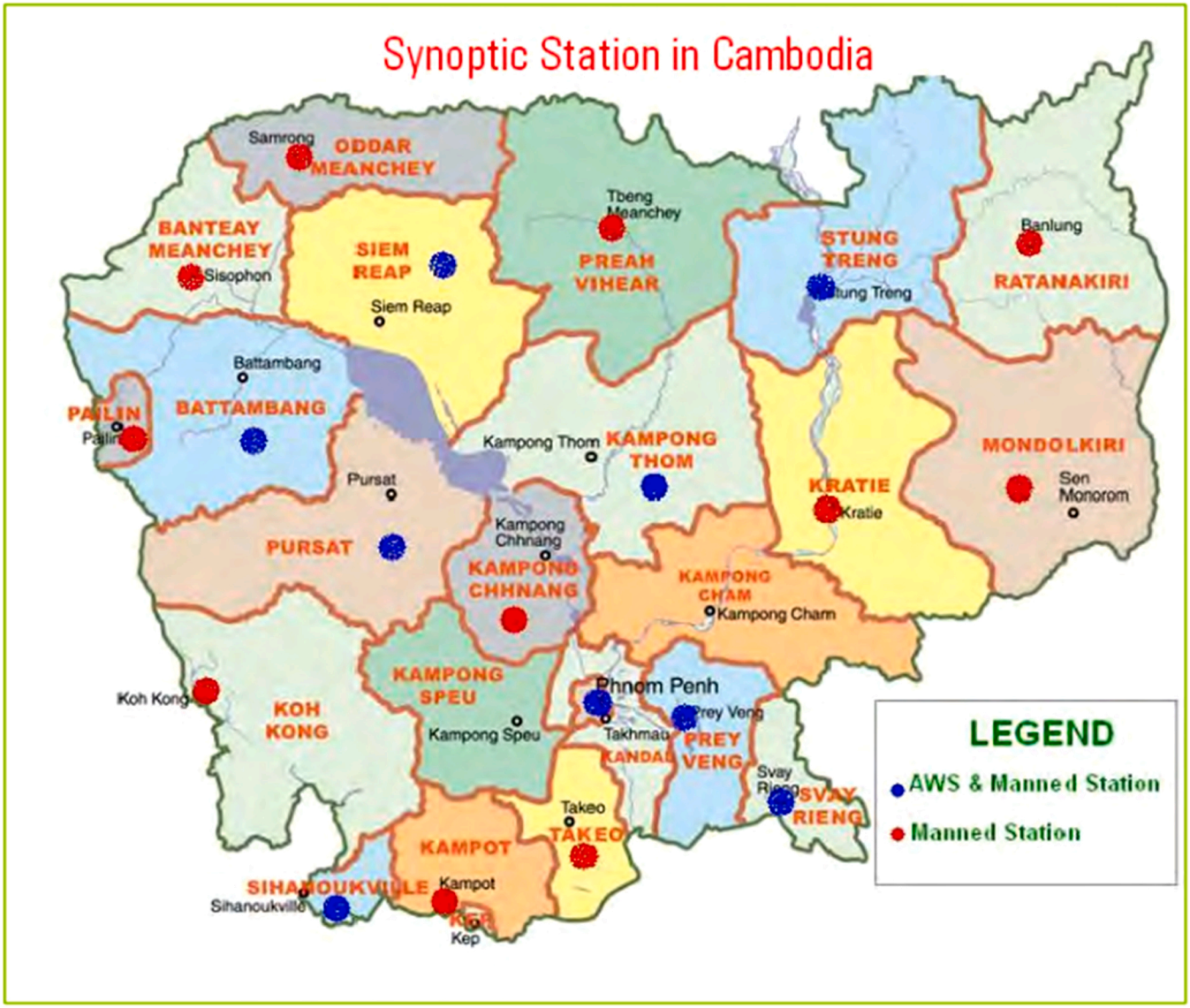

Fig. 2. Weather Station Locations in Cambodia, 2010, showing provincial boundaries and capitals.
Source: UNDP, 2010.

other areas of environmental sensing, national and international interests play a significant role in how relevant data on the topic are collected and shared. For a country increasingly dependent on foreign direct investment, reputational considerations matter and environmental factors play into this reputation. Consequently, when it comes to disaster reporting:

'Obviously there's always going to be politics included. Even in somewhere like Singapore, the air quality monitoring that Singapore has, has similar issues with politics playing in terms of "how bad should the situation look and how bad does it make us look if we're just sitting on the data and not doing anything about it?" and all these kind of things. So, in a country like Cambodia, where the government is a lot less mature, it's always going to be an issue' (NGO Technical Expert, 28/02/2019).

This is not to suggest that the Cambodian government is opposed to publicity surrounding the Kingdom's environmental vulnerability. Indeed, Prime Minister Hun Sen has himself referred to the threat faced by climate change on a number of occasions, calling it 'one of the grave challenges that must be addressed in the 21st century' in 2013 (Hun Sen, cited in Phnom Penh Post, 2013) and raising the issue again at various points since. Nevertheless, despite openness over the generalities of climate change, the specifics of its impact are politically charged. As the director of a Western NGO outlined:

'Flood, because it has a long history in Cambodia that predates climate change's effects, it's not as sensitive, but drought is a relatively new – it's not really new, but there is a perception that it is a new hazard resulting from climate change – and it's much more difficult to address, which I think is also why it's more sensitive.

We initially wanted [our flood program] to be a drought monitoring and drought forecasting service, but we deemed it too sensitive, especially as we were having these discussions before the national election, around the time of the commune elections and you're aware of the political events that have occurred. You know, today in 2017 the opposition party was dissolved, one of the opposition leaders was put into detention etc. and because of our risk position, we had to take it very seriously and so we pivoted away from any mention of this tool as a drought monitoring, or a drought forecasting tool' (NGO Director, 11/04/2019).

The sense in the third sector climate modelling community is therefore of an increasingly authoritarian government unwilling to engage on the issue of drought, a position which, viewed on a purely technical level, makes little practical sense. Viewed through a political

lens, however, the government's reluctance to engage more fully in drought measurement is rooted not in absolution of responsibility, but in a desire to downplay the public emergence of an intractable problem which might be construed as a loss of control over the affairs of state. As a UN technical expert continued:

'Measuring drought…is not an easy exercise because it could also be political. Because as a disaster it's not an easy thing to really specify the destruction, because you can't see the economic losses as much as you can the percentage of houses washed away by the floods, or those that have been affected, but drought is slow onset, something that's creeping. It's created only by the data' (UN Technical Expert, 30/01/2019).

As such, that drought is more difficult both to demonstrate and resolve than flooding provides both the means and incentive to downplay its impact. Governments can be more circumspect in addressing droughts than floods, adopting policies more favourable to long term economic and political planning and potentially more in line with the interests of individual and institutional actors. In Cambodia, this is reflected in the retention of control over drought warnings, which exist only in the form of ad hoc circulars referring to droughts expected at the national level. As one stakeholder put it, 'It's like they're happy to send out a piece of paper and send it around to the province and say: "we've done our job"' (NGO Director, 11/04/2019). Yet not only do NGOs 'have assurances that this information is not actually going to get the farmers' level' (NGO Director, 11/04/2019), but villagers themselves report that dissemination is uneven and often not undertaken at all:

'Like this year, there was a drought and we had no water, so we had to pump water to the farm. We spent so much money on rice production that [our livelihoods] became difficult. We were always pumping water. We joined the village meetings, but they did not tell us [anything about a drought]. The village chief did not care about the villagers. I went to the meetings, but they did not say anything about the climate at that time' (Villager, Prey Veng Province, 01/02/2019).

Rather than being viewed purely as technical shortcomings, data and adaptation shortcomings should therefore be read in the political-economic context within which they occur. Data dissemination is in practice subject to the same 'politics of the possible' (Mickelson, 2009: 1) as mitigation, constrained by the hierarchical politics of institutions and administrations. Viewed thus, there is a broader logic of control to the technical inefficiencies observed in the Cambodian case:

'Why is it so political? Why is there freaking out over sharing the data?. Well, they say it isn't easy basically. They say that they are improving the data, or they say that we don't want people to use this data.It's not a direct quote, but from what I understand from analysing their statements it is that if people use wrong information in a warning, then people could go against the ability of the government to prepare its responses' (UN Technical Expert, 30/01/2019).

Dissemination of data is therefore best interpreted through the lens of national-scale political and environmental goals. Fearing that specific local drought warnings may instigate pre-emptive action on the part of smallholders – notably the building of personal wells which has become common in recent years – the unwillingness of government departments to cooperate over drought warnings is rooted in part in an environmental strategy based on retaining control over farmers' activities. As the Senior MoWRaM official outlined:

'[Wells are] not under my control. It is for the Ministry of Rural Development [to deal with]. But I know that as a result of deforestation, water levels underground have changed and sometimes the water table also changes because they have many kinds of wells. Deep wells, shallow wells, surface wells or drill wells…But in the year 2015, some shallow wells or ponds dried up because the ground water had changed. And anarchy, without control, will create a lot of problems by [people] drilling wells without properly respecting sanitation, meaning they can cause ground water pollution. This is also now an issue' (Senior MoWRaM official, 28/02/2019).

On the one hand therefore, restrictions on drought data reflect a reluctance to cede direct control of adaptation initiatives and facilitate the "anarchy" of autonomous adaptation through well digging. Yet the reference to the Ministry of Rural Development [MRD] alludes also to the wider political context within which such preferences arise. Rather than occurring on a political blank slate, the broad context of adaptation crosscuts distinct zones of government responsibility, generating areas of ambiguity and arenas of political contestation that shape outcomes. In relation to irrigation policy, for example, clear lines of responsibility are not set out in official ministerial documentation, but fall within the overall purview of three ministries: MoWRaM, the MRD, and the Ministry of Agriculture, Forestry and Fisheries [MAFF]. Which ministry takes control over a given area of irrigation policy is therefore viewed as something of a political power struggle, as outlined by the director of the Rural Water Supply Authority within the MRD:

'[On the question of] responsibility between MRD and MoWRaM there is no official letter. the ministers say "OK, now the small canals at the small scale, the MRD can do [those], while MOWRAM can do the main canals"…This is a big challenge for us. If we had clear responsibilities like this, we could get the support of the Ministry of Economy and Finance as well. But because there is no clear responsibility for the MRD, then they don't have support. That is our challenge from year to year…there is an overlap of tasks. That is why our ministry, which is powerful, can take the work. If your minister doesn't have power, you don't qualify. [The work] goes to another ministry' (Deputy Director, Rural Water Supply Authority, 05/03/2020).

These struggles over the management of irrigation showcase the contestation inherent in the practical politics of adaptation. As investment in irrigation has grown in Cambodia in recent years, certain actors, such as 'MoWRAM, [have] not really subscribed to the political agenda of sharing irrigation management responsibilities beyond well demarcated projects' (Venot and Fontenelle, 2016: 17). Rather, it has made use of such initiatives to 'strengthen and position itself as the key player in the irrigation sector' (Venot and Fontenelle, 2016: 18). As one of the authors of that report continued in personal communication:

'Like every sector in Cambodia, [irrigation] is highly politicised and given that it is infrastructure there is a lot of money involved, so it's even more politicised…The ministry is shaping quite significantly the face of irrigation in the country (Jean Philippe Venot, 19/02/2019).

Specifically, 'irrigation comes as a package of intensifying agriculture' (Jean Philippe Venot, 19/02/2019), wherein large-scale irrigation projects are prioritised over smaller scale and privately owned initiatives. Rather than an adaptation agenda, this scalar emphasis reflects growing interest in agriculture as a larger scale, export-oriented business (Cramb et al., 2020a, 2020b) which has accelerated in the wake of crackdowns on Cambodia's mass deforestation since the late 1990s (Global Forest Watch, 2019). Since the turn of the millennium, logging has proved a hugely lucrative industry dominated by elite interests (Global Witness, 2007), yet as resources dwindle, regulations tighten and international scrutiny grows, its profitability is diminishing. Attention is turning increasingly to the potential of high value rice varieties – referred to as 'white gold' as part of a marketing push beginning in 2010 (Cramb et al., 2020a, 2020b: 439) – as a potential investment alternative for the coming decade, especially given Chinese interest in significantly expanding rice imports from Southeast Asia (Zhang, 2019).

'Logging…has been a huge source of revenue generation for the elite for the past 20 years and now the time is up for that. So, basically, they have to turn their sights to another industry, another sector and I think that's going to be agriculture. Cambodia has huge potential for agriculture. I know people who have worked in the private sector in agriculture, Westerners working with some of these elite families and he's saying that they have thus far no interest at all in developing their plantations or whatever it is, but now that you know their bills are still coming in, they need to send grandkids to expensive international schools, they need to find money, you know?' (NGO Director, 11/04/2019).

Viewed as part of this wider economic strategy, the Ministry's simultaneous control over data management, information dissemination

and irrigation generates an alignment of interests which influences activities in relation to all three. Placed within the wider context both of export-oriented agricultural intensification and regional contestation over the usage and control of the Mekong River set out in Section 4, the institutional bridge linking data collection and adaptation disincentivises the liberalisation of data to facilitate smallholder irrigation activity, whilst incentivising greater centralised control of both irrigation and data. Environmental data management is therefore viewed, even from within the government itself, as inextricably intertwined in the wider politics of climate policy, and Cambodia's political economy more generally:

'The problem is that the politicians and economists, they use our data to elaborate for the benefit for their own group, party or country. how much has the environment been degraded right now so they can come up with a new policy to make you feel more comfortable and happy but which will continue absorb or consume more out of the world? They don't stop. They just [want] more and more' (Director, Ministry of Rural Development, 18/02/2020).

As this final set of examples shows, environmental data is collected and disseminated in response to political priorities at multiple scales. This strategic delimitation of environmental data collection and dissemination shapes the landscape of possible environmental policy before it is conceived. Rather than manipulating or emphasising aspects of existing data to suit policy ends, the same goal is achieved by absenting data conducive to alternative ends. Environmental ignorance is thus strategically deployed in a purposive, institutionally interested manner intended to shape, inform and develop adaptation policy.

Not only are environmental unknowns tolerated and managed, but also cultivated within large-scale environmental projects in pursuit of strategic unknowns. Ignorance is in this way harnessed as a resource, enabling knowledge to be 'deflected, obscured, concealed, or magnified in a way that increases the scope of what remains unintelligible' (McGoey, 2016: 1). This occurs because the absence of environmental data at multiple scales reflects and underscores the multi-scalar geography of interests that govern resources. Geopolitical and regional contestations create the conditions within which sub-national institutions themselves compete for influence, curating data and its absence via the structural logic of sub-national administration and infrastructure. Thus situated, these institutions serve a bridging role between data generation, adaptation, and political contestation at multiple scales, drawing all three under a coherently interested rubric.

7. Conclusion

'Data inequalities matter' (Cinnamon, 2020: 222) not only because of their ability to disempower, misrepresent and elide, but because of what they are able to reveal about the 'diverse and contested spatialities of climate change knowledges' (Mahony and Hulme, 2018: 410). Data generation, data dissemination, and adaptation are often viewed as belonging to separate spheres within the realm of climate change scholarship, characterised by different literatures, experts and approaches. Yet distinct though they may be in theory, each realm of climate response exists within overlapping spheres of control, engendering a mutual influence and common character through which consistent interests may be read. By permitting, facilitating or actively shaping the non-availability of environmental data, institutions act as a scalar bridge between geopolitical interests and local data collection. In the midst of this, adaptation plays out in a landscape not only of unequal power to make decisions, but also unequal power to shape environmental knowledge.

Nevertheless, even as interest in the anti-politics of adaption grows, far less has been said about the situation of data generation within this same landscape. This represents a key oversight. As adaptation policy grows in its political currency, so too must the data underlying it grow also in political power. As described by Ferguson (1994: 274), this need not 'imply any kind of efficient, centralised, social engineering. It simply means that power relations must increasingly be referred through bureaucratic circuits'. As evidenced throughout this paper, the power of these bureaucratic circuits to overlook or elide certain types of environmental knowledge creation, be it generation, sharing or dissemination, plays a major role in controlling environmental narratives and thus shaping the policies that result.

By highlighting how this process plays out at multiple scales, this paper has aimed to draw attention to the politics of absent data. By considering three of the linked scales at which such agnotologies are generated, it has shown that data inequalities need not necessarily result from a coherent political agenda, nor necessarily be to the benefit of a single, large-scale planner (although in many cases they do). Instead, constraints on data may result from unequal geographies of power in multiple places and scales simultaneously.

Though its origins may be complex, understanding how the geography of environmental ignorance influences environmental policy is a powerful means of incorporating marginal voices into adaptation planning. This is especially pressing due to the limited evidence in the literature as to how climate policies incorporate the concerns of such groups (Ohja et al., 2016: 418). Simply put, environmental policy may (or may not) be chosen freely, but it is inevitably constructed under conditions of constrained environmental data. By helping to elucidate this geography of articulated non-knowledge, agnotology can help to analyse data gaps not merely as 'the absence of knowledge but an outcome of cultural and political struggle' (Schiebinger, 2004:233) and thus draw attention to policy pathways that may be proscribed before they are conceived.

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