Quantitative Ethnography of Policy Ecosystems: A Case Study on Climate Change Adaptation Planning

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Abstract. Analysis of policy ecosystems can be challenging due to the volume of documentary and ethnographic data and the complexity of the interactions that define the ecology of such a system. This paper uses climate change adaptation policy as a case study with which to explore the potential for QE methods to model policy ecosystems. Specifically, it analyzes policies and draft policies constructed by three different categories of governmental entity—nations, state and local governments, and tribal governments or Indigenous communities—as well as guidance for policy makers produced by the United Nations Intergovernmental Panel on Climate Change and other international agencies, as a first step toward mapping the ecology of climate change adaptation policy. This case study is then used to reflect on the strengths of QE methods for analyzing policy ecosystems and areas of opportunity for further theoretical and methodological development.

Keywords: Quantitative ethnography, policy ecosystems, policy analysis, climate change policy, health policy

1 Introduction

A key affordance of quantitative ethnography (QE) is the extent to which it can facilitate analyses of complex systems embedded across cultural contexts. For example, *policy ecosystems* [1] are characterized by interactions of actors (institutions, interest groups, bureaucrats, citizens), activities (campaigns, town hall meetings, research, governance), and artifacts (policy briefs, social surveys, budgets) around some agenda. Policies themselves are emergent properties of these interactions in at least four ways:

1. Policies are situated in *narratives*, including what Deborah Stone terms *causal stories* [2]: accounts that convert complex social situations into simpler problems amenable to structural intervention. In this sense, a policy exists as the answer to a question of social importance.
2. Policies are codified as *warrants*, official or semi-official documents that carry institutional or other authority to promote particular behaviors, allocate funds, set priorities, or otherwise guide decision-making and action.
3. Policies are eventuated through *enactments* justified by narratives and warrants. These enactments are often mediated by those Michael Lipsky labels *street-level bureaucrats* [3], functionaries who typically are not involved in the development

or codification of policies but are their primary interpreters, implementers, gatekeepers, and enforcers.

4. Policies are manifest in the *experiences* of people and communities (or interpretations of the experiences of non-humans, such as animals or ecosystems) affected by enacted warrants. Experiences often reveal fault lines in policies, which may arise from misalignments of narratives, warrants, and enactments or from mischaracterization of the social situation itself. Ideally, experiences inform the policy development and implementation process, leading to iterative refinement and improvement.

This suggests that multi-level ethnographic and hermeneutic analysis both *of* and *for* public policy is not only useful but likely necessary to improve the processes and outcomes of policy development, implementation, evaluation, and refinement and to broaden participation in policy making [4].

However, policy ecosystems generate massive amounts of data, such as policy drafts and briefs, research reports, training manuals, applications, plans for and records of implementations, and evaluations, in addition to stakeholder data such as records of participatory design sessions or town hall meetings, survey responses, position statements, and online discussions, and there is considerable opportunity to conduct interviews, make observations, and apply other ethnographic methods [5]. The volume of data available (or collectable) can provide a more dynamic and ultimately more accurate view of how policies are made, implemented, and evaluated, and also demystify the process of policy-making to facilitate broader participation, but the scale renders traditional ethnographic or hermeneutic methods less useful if not impossible to implement.

In this pilot study, I explore how techniques and methods from quantitative ethnography can provide expansive but grounded views of policy ecosystems. Specifically, I use *epistemic network analysis* (ENA) [6, 7] to model the policy ecosystem of *climate change adaptation plans*—sometimes called climate change action, preparedness, or resilience plans. Climate change adaptation plans are produced by nations, localities, government agencies, institutions, or other bodies to recommend adjustments that address current and expected effects of climate change. Unlike mitigation efforts, which address the causes of climate change, adaptation aims to reduce harms (to humans, other forms of life, and ecosystems) and exploit opportunities resulting from changes in regional or local climate. As such, adaptations may include action in any sector of human activity or influence, including the built and natural environments and social, institutional, economic, or legal interventions.

In this pilot study, I model four types of policy document: climate change adaptation plans developed by (1) national governments, (2) state and local governments, and (3) tribal nations or other Indigenous communities, as well as (4) climate change adaptation guidelines for policy makers produced by the United Nations' Intergovernmental Panel on Climate Change (IPCC) and other international organizations. In other words, I look at policies and draft policies constructed by three different categories of governmental entity and guidance for policy makers produced by international agencies as a first step toward mapping the ecology of climate change adaptation policy.

2 Data and Methods

2.1 Data

The dataset used in this analysis includes 107 documents: 39 national adaptation plans, 44 state and local adaptation plans, 19 tribal adaptation plans, and 5 reports by international agencies.

The adaptation plans (n = 102) were published between 2006 and 2022 and are written in English (n = 79), Spanish (n = 15), and French (n = 8). Nearly all parts of the globe are represented in the dataset, though North America accounts for nearly half of the documents (n = 47). The remaining plans come from Africa (n = 9), Europe (n = 10), Asia (n = 9), Oceania (n = 5), the Caribbean (n = 9), Central America (n = 2), and South America (n = 6). Plans were identified based on Internet searches and were included in the dataset if they were (a) prepared under the auspices of a national, state, local, or tribal government; (b) written or translated into English, Spanish, or French; and (c) published in a single-column text format. (The final criterion was included because it is very difficult to extract text from PDF files with multi-column formats in a way that preserves the correct order of lines.) Thus, the dataset contains a broad but haphazard sample of climate change adaptation plans.

The reports (n = 5) included are those published by an intergovernmental or non-governmental agency with global scope. These include the third (2001), fifth (2014), and sixth (2022) climate change assessment reports prepared by the IPCC, which cover the approximate range of the adaptation plans in the dataset; the fourth report (2007) was omitted because it was published in a double-column format. Two additional reports are included: the World Bank's *Action Plan on Climate Change Adaptation and Resilience* (2019) and the World Health Organization's *WHO Guidance to Protect Health from Climate Change through Health Adaptation Planning* (2014).

Text was automatically extracted from PDF documents, segmented based on punctuation and line breaks, and placed into a data table with metadata, including the source, year of publication, type of document, region, and language. This resulted in a dataset with more than 82,000 ordered entries, most of which are paragraphs or other discreet pieces of text (e.g., lists, captions, bibliographic entries, &c.).

2.2 Coding

Because there are hundreds of specific adaptations proposed, many of which interact or intersect in complex ways, this analysis focused on the broad domains in which such adaptations occur. In other words, this pilot analysis is an attempt to map the major features of the policy ecosystem's landscape rather than its microterrain. To do this, the study includes seven Codes: HAZARDS, the local and regional consequences of climate change that adaptations are intended to address; four domains that are key targets of adaptation activities (FOOD SECURITY, WATER SECURITY, HUMAN HEALTH, and ENVIRONMENTAL HEALTH); and two governing perspectives proposed to guide adapta-

tion design or implementation: the perspective from justice, equity, diversity, and inclusivity (JEDI) and the perspective from local knowledge and diverse epistemologies (LOCAL KNOWLEDGE). These Codes are described in Table 1.

Table 1. Codes and inter-rater reliability statistics.

Code	**Description**	**Examples**	**Human vs. Computer**	
			κ*	$\rho(0.90)$
Hazards	Hazards to human well-being (either direct or indirect) related to climate change, including heat waves, drought, and other forms of extreme weather; sea-level rise and flooding; wildfire; invasive species and algal blooms; and erosion.	"Many of the state's programs for home elevations or property buyouts prioritize owner-occupied homes, which leaves renters more exposed to flooding." "Asimismo, ha ocasionado la formación de grandes lagunas glaciares formadas por materiales erosionables que las convierte en una amenaza latente para la ocurrencia de desastres por aluviones."	0.96	0.01
Food Security	Food supply, availability, scarcity, price, or other issues related to maintaining an adequate amount of affordable food for a population, including issues that may affect food security such as plant and livestock disease or management of food supplies, as well as the results of food insecurity, such as malnutrition, hunger, or famine.	"Many of the 11 distinct cultures in rural Alaska prioritize their connection to place and subsistence way of life over the conventional Western amenities. This connection is deeply rooted in access to birds, fish, greens, berries and animals for food security." "La Pesca y la Acuicultura desempeñan funciones fundamentales en el suministro de alimentos, en la seguridad alimentaria y en la generación de ingresos."	0.96	0.01
Water Security	Water supply, availability, scarcity, storage, or other issues related to maintaining sufficient water for agriculture, human consumption, and other needs, including issues that may affect water security such as runoff or water quality, as well as approaches to improving water security such as desalinization.	"The critical issues emphasized included water resources which are mainly used for agriculture, energy generation in the form of hydroelectricity and human consumption." "Alta vulnerabilidad al desabastecimiento hídrico: la cantidad de agua usada es casi tanta como la oferta disponible promedio, mientras que el sistema hídrico tiene una baja capacidad intrínseca para regular esa oferta."	0.96	0.01

Human Health	Issues of human physical, mental, and emotional health, including climate-related disease and other health impacts of climate change.	"Research shows that carsharing can reduce overall household costs, and of course, walking and biking are important for overall physical health and well-being." "Fortalecimiento del sistema de vigilancia epidemiológica y sanitaria que incorpora los escenarios climáticos para la gestión del riesgo en un contexto de cambio climático en la salud pública."	0.96	0.01
Environmental Health	The health of the natural environment and the functioning, vulnerability, or resilience of ecosystems, including indicators of environmental health such as biodiversity, species extinction/extirpation, habitat destruction, or land degradation.	"This adaptation option will strive to enhance natural resilience to the adverse impacts of climate change by enhancing healthy and well-functioning ecosystems." "Los bosques proveen servicios ecosistémicos en favor de la diversidad biológica."	0.92	0.04
JEDI (Justice, Equity, Diversity, and Inclusion)	Issues related to vulnerable, marginalized, or minoritized populations, sovereignty or ownership, and social disparities or discrimination; promotion of planning or decision-making based on rights or what will be just and equitable for, and inclusive of, diverse stakeholders.	"The framework highlighted the following values as being important to the NAP process: 1) Participation and inclusivity of all stakeholders and interests. 2) Promotion of 'ecosystem-based' and 'gender and human rights-based' approaches to adaptation." "Los impactos del cambio climático afectan principalmente a los más pobres."	0.92	0.04
Local Knowledge	Local, traditional, or Indigenous knowledge or practices; cultural resources and knowledge transmitted via oral tradition, stories, or intergenerational education; diverse epistemologies or those distinct from Western science.	"Identify opportunities for citizen science and community observations to add value to research used by the state. For example, analyze ways for risk assessment to include qualitative methods and local knowledge." "Recupera, valoriza y utiliza los conocimientos tradicionales de los pueblos indígenas u originarios y su visión de desarrollo armónico con la naturaleza."	1.00	< 0.01

** All kappa values are statistically significant for $\rho(0.90) < 0.05$.*

Automated classifiers for binary coding (indicating only the presence or absence of Codes) were developed and validated using the ncodeR package (version 0.2.0.1) for

the R statistical computing platform [8]. Inter-rater agreement was assessed using Cohen's kappa and Shaffer's rho. Agreement between the author and the classifier for all Codes was high, with acceptable Type I error rates: $\kappa > 0.90$ and $\rho(0.90) < 0.05$ (see Table 1). The whole dataset was then coded for these seven constructs.

2.3 Analysis

The dataset was analyzed using the rENA package (version 0.2.3) for the R statistical computing platform [9]. The units of analysis are the individual documents ($N = 107$).

Connections were accumulated for each document using a moving window of 2 lines. The window length of 2 was chosen based on the structure of the data. In formal writing where the lines in the data table correspond roughly to paragraphs, a window of length 1 might be more appropriate, under the assumption that information within paragraphs is more closely related than information in adjacent paragraphs (which is in turn more closely related than information in distal paragraphs). However, the documents in this dataset also contain numerous figures (with captions), tables, lists, and other forms of text data, which are independent lines in the data, and these are typically associated with at least one adjacent paragraph. Moreover, because the data were scraped from PDF documents, single paragraphs often break across two lines in the dataset due to page breaks. Thus, a window length of 2 was chosen to account for these issues.

Dimensional reduction was performed via singular value decomposition (SVD), and networks were visualized in the space formed by the first two SVD dimensions.

3 Model 0 of the Climate Change Adaptation Policy Ecosystem

This pilot study produced a "model zero" [10] of the climate change adaptation policy ecosystem, a model designed less to be analyzed for insights on the topic itself than to guide exploration and further model development. The model was developed using ENA as described above, and the network graphs are shown in Fig. 1.

The first dimension (SVD1) explains 29% of the variance in the structure of connections among documents, and the second dimension (SVD2) explains 17%. The HAZARDS code appears near the origin in the ENA space, as adaptation plans are generally organized around responses to the current and anticipated consequences of climate change. The first dimension (x-axis) differentiates networks with strong connections to WATER SECURITY (high x values) from networks with strong connections to JEDI issues and perspectives, FOOD SECURITY, and ENVIRONMENTAL HEALTH (low x values). The second dimension differentiates networks with strong connections to HUMAN HEALTH (high y values) from networks with strong connections to ENVIRONMENTAL HEALTH and WATER SECURITY (low y values).

As Fig. 1 (top) shows, there are marked differences among the types of document, with only the state and local and tribal adaptation plans showing similar characteristics.

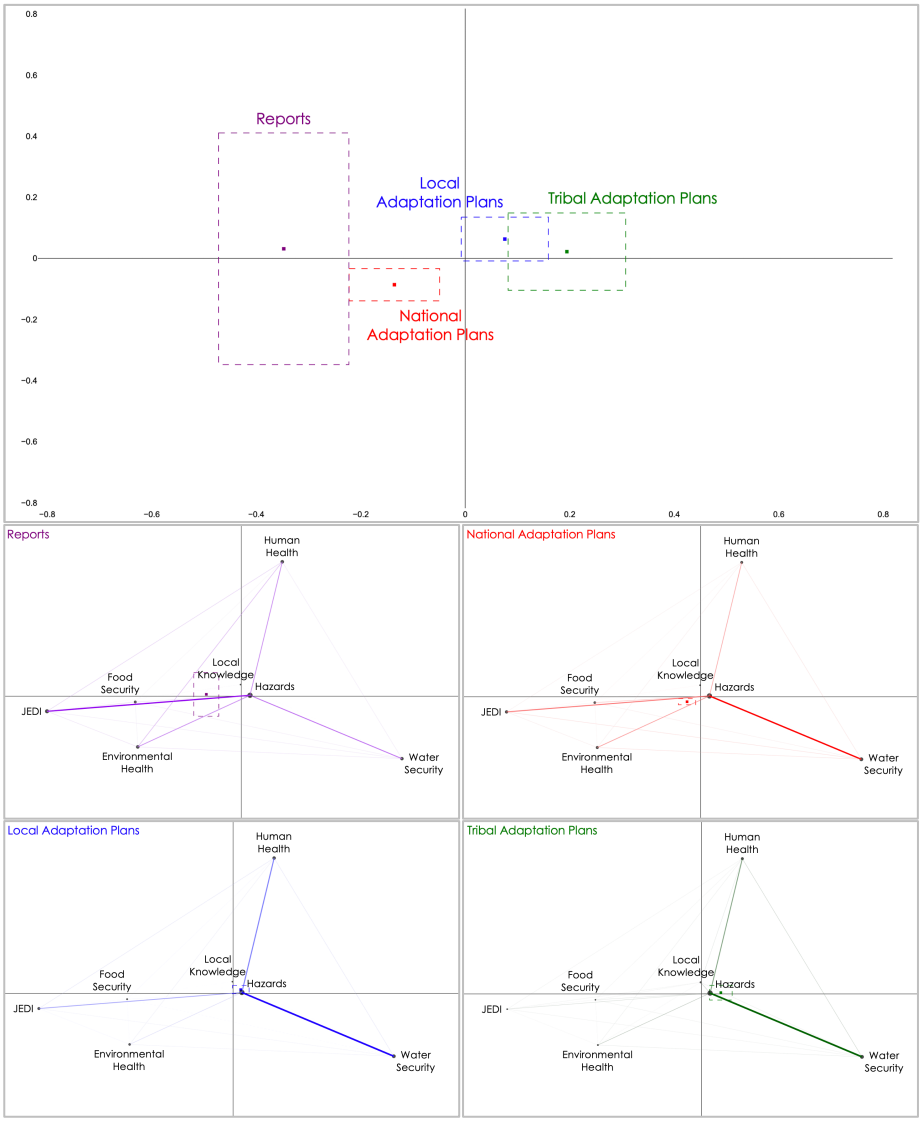

Fig. 1. ENA means and mean network graphs. **Top:** Mean ENA scores (squares) with 95% confidence intervals (dashed boxes) of the reports (purple) and the national (red), state and local (blue), and tribal (green) adaptation plans, and ENA scores (purple points) of the three IPCC summaries for policy makers. **Middle:** Mean ENA networks of the reports (purple; left) and of the national (red; right) adaptation plans. **Bottom:** Mean ENA networks of the state and local (blue; left) and tribal (green; right) adaptation plans.

The national adaptation plans differ from both the state and local and the tribal plans in the extent to which they emphasize JEDI issues and perspectives and

ENVIRONMENTAL HEALTH, and to a lesser extent, FOOD SECURITY. Both the state and local plans and the tribal plans have stronger connections to WATER SECURITY and HUMAN HEALTH. In comparison with all three types of climate change adaptation plans, the reports intended to inform policy decisions exhibit more and stronger connections to JEDI issues and perspectives, HUMAN HEALTH, and ENVIRONMENTAL HEALTH. Moreover, where the mean networks of the adaptation plans themselves have largely "hub and spoke" structures, dominated by connections between HAZARDS and the other codes, the mean network of the reports has a somewhat more distributed structure.

These differences are largely consistent with expectations. For example, food systems are highly globalized and food policy is typically a national issue, so it makes sense that national adaptation plans would have a stronger emphasis on FOOD SECURITY. Water, in contrast, is often locally managed and consumed. With the exception of bottled drinking water and the *virtual water trade*—the portion of a population's water needs that comes in the form of food or other water-containing commodities that may be globally sourced—water is not commonly distributed more than a few hundred miles from its source. Thus, it makes sense that connections to WATER SECURITY would be stronger in state and local adaptation plans and tribal plans. In addition, coastal tribes are overrepresented in the dataset, in part because the threats of climate change to coastal communities are more immanent, and thus the need for climate change adaptation plans may be greater. Similarly, environmental regulation is typically a national-level issue, while public health has a stronger local component, especially in the United States, which is also overrepresented in the dataset.

The stronger connections to LOCAL KNOWLEDGE in tribal adaptation plans are also not surprising given the emphasis in most tribal plans on traditional knowledge and practices not only as effective means of current and future mitigation and adaptation, but also as past targets of suppression by colonizers through genocide and epistemicide [11]. For example, the *Karuk Climate Adaptation Plan* (2019) discusses the ways in which USian wildfire management approaches have suppressed traditional Karuk food and fire stewardship and led to the "erasure of cultural landscape, of particular artifacts, and of the future ability to learn from the ancestors and the land" (p. 135). This "exclusion of indigenous management" (p. 135) led to ultimately harmful shifts in the ecological balance of the region (in this case, reduction of sugar pines and expansion of Douglas firs and brush such as ceanothus, poison oak, tanoak, and madrone), reduced germination rates, and increased plant disease, and thus the renewal of traditional practices is a restorative act, not only for addressing climate change but also for Karuk culture.

The weak connections to JEDI issues and perspectives in tribal plans is thus not reflective of a reduced focus on justice, equity, diversity, or inclusion but rather the extent to which those issues are implicit in many tribal approaches to climate change. The explicit reference to JEDI issues and perspectives in national and state and local plans reflects a belated attempt on the part of dominant cultures to reengage subjugated cultures, or perhaps more cynically, the need for dominant cultures to *appear* to address structural and historical inequities despite continuing to uphold systems of oppression.

What is most striking in this analysis, however, is the extent to which reports providing guidance for policy making emphasize JEDI issues and perspectives, HUMAN HEALTH, and ENVIRONMENTAL HEALTH more than the plans produced by national, state

and local, and tribal governments. This could suggest that climate change adaptation policies are falling somewhat short of policy goals, or it could reflect differences in the structure of the documents. But as Fig. 2 shows, even policy guidance produced by the same organization can shift markedly over time.

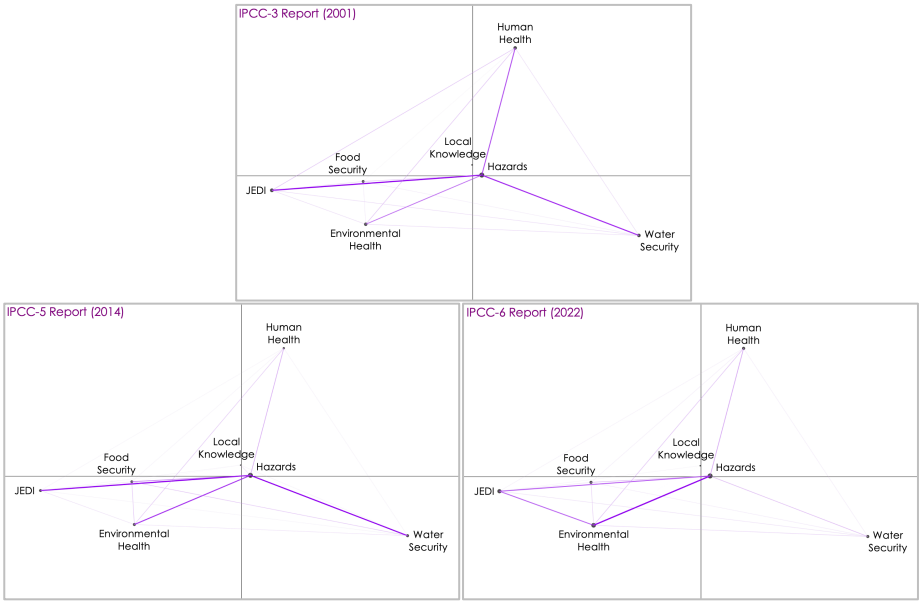

Fig. 2. Mean ENA networks of the three IPCC summaries for policy makers.

The networks of all three IPCC summaries for policy makers three load strongly to the left in the ENA space (see Fig. 2), but the three networks are quite different. Only IPCC-5 (2014) contains a significant connection to LOCAL KNOWLEDGE, while the most recent summary (IPCC-6, 2022) contains far weaker connections to WATER SECURITY yet stronger ones to ENVIRONMENTAL HEALTH. Moreover, the network of the most recent summary (IPCC-6, 2022), which was published in draft form after nearly all of the adaptation plans included in this study, is markedly different from the mean network of the national adaptation plans. Although all the summaries feature fairly rich networks of connections, this suggests that policy makers must navigate a volatile landscape of climate change information, and that frequent updates to adaptation planning may be required.

4 Reflections on Modeling Policy Ecosystems

This pilot study produced a model zero that captures salient features of the climate change adaptation policy ecosystem. The ENA space reflects meaningful characteristics of adaptation planning, the model shows visual and mathematical differences among adaptation plans produced by different types of governmental entity, and com-

parisons between policies and resources produced for policy makers can be made. Future models could be constructed to explore more fine-grained issues either within or across the Codes included here, different types of adaptation, and a number of other questions that could guide policy development or identify areas for civic engagement.

Yet this study also revealed opportunities and challenges for further development of QE methods as they may be applied to policy ecosystems, and I examine some of these in what follows. My goal is not to detail the limitations of the present study, though there are many, but to use this pilot analysis to explore in a more grounded way some of the theoretical and practical challenges of constructing ecologically sound models of policy ecosystems.

4.1 Time and Space

The development of QE techniques has largely taken as its modal case the modeling of conversations, in the broadest sense of that term: interactions among two or more people that are in person or online; synchronous or asynchronous; structured, semi-structured, or unstructured. This includes collaborative work, idle chit chat, formal debate, mentoring, interviewing, and other forms of human interaction. For example, the concept of a *moving window* [12, 13] in ENA is an operationalization of relational context based on the theory that people in conversations generally respond to prior contributions based on recency (with what counts as recent being, of course, context dependent). In other words, conversations are linear and progressive, much like our experience of time.

When the focus of analysis is documents rather than conversations, *temporality* is less meaningful than *spatiality*. Documents are often multimodal, containing graphs, maps, photographs, and other images in addition to text, but also different types of text: paragraphs, lists, tables, bibliographic entries, and so on. Some text information, such as that contained in tables, is explicitly multidimensional, which poses particular challenges for constructing linearly organized qualitative data tables of the kind needed for most analytic methods, including ENA. Yet it also raises questions about segmentation [14] and relational context [13]. For example, including bibliographic references in an anlysis of policy may be useful, as it reflects the kind of information policy makers draw on to warrant policy decisions, but there is no reason to think that one entry has any relation to those that proceed or follow it in a reference list, which may simply be organized alphabetically by author or in the order of appearance in the text. The relational context for each bibliographic entry is in some other part (or parts) of the document, separated by dozens or even hundreds of pages. Figure captions, in contrast, are almost always proximate to some related discussion in the text, and thus nearly always have a relational context that is the previous or following paragraph. The latter can thus be reasonably modeled with a standard moving window analysis where the former cannot.

This issue is further complicated if we consider not just the structure of documents but the ways in which they are used. For example, a text document is at least mostly linear (excepting things like tables and bibliographies) because words, sentences, and

paragraphs are meaningfully ordered. Yet people don't necessarily read documents linearly, particularly professionals who engage documents more like resources to be interrogated than like an authorial monologue [15]. But even setting aside any attempt to model the reading process, simply modeling the content structure of a document is more complex than modeling the content structure of a conversation simply because the former typically *has* a more complex structure—and one that is difficult to preserve when extracting text from machine unfriendly formats like PDFs, the standard file format of digitally disseminated documents.

4.2 Savoir Fair Coding

Another challenge QE researchers face in attempting to model policy ecosystems is linguistic. This small pilot study required developing automated classifiers in three different languages—which essentially meant developing three different codes for each Code. This presents challenges on both pragmatic and theoretical levels.

Pragmatically, it is more challenging to develop coding algorithms using regular expressions because a problem developing effective expressions in any one language reduces the accuracy of coding as a whole *and* introduces the potential for *subgroup unfairness* [16]: systematic inaccuracies in the coding applied to one or more subpopulations. This, in turn, undermines the validity of any model developed based on unfair coding. For example, I intended to develop an AGRICULTURE domain Code, but while this was fairly straightforward in English and Spanish, French posed significant challenges. The French word for "farm" is *ferme*, but *ferme* also means "firm", "solid", "hard", and "definite"; it is part of one term for "land", *terre ferme*; and it is also a conjugation of *fermer*, "to close." It is relatively easy to exclude *terre ferme* using a regular expression, but other disambiguations are far more challenging. Even worse, a common French term for "farming" is *de culture*, e.g., "méthodes de culture plus respectueuses de l'environnement."

For the purposes of this pilot study, I simply abandoned my attempt to construct a code for AGRICULTURE. But that is not a viable solution more generally, and with the addition of documents (or other data) in still other languages, this problem only grows more likely. In the current pilot study, there is likely still some bias in the coding. For example, the frequencies of HUMAN HEALTH in English, French, and Spanish are 5%, 3%, and 1%, respectively. It is certainly possible that those differences reflect real variation across contexts—or that they are artifacts of a haphazard sample—but it is also possible that the classifier for HUMAN HEALTH is more accurate for English than for French and Spanish, and is thus biased. The classifier for ENVIRONMENTAL HEALTH, in contrast, produced frequencies of 3%, 3%, and 4%, respectively, but it is equally unclear whether that indicates the *absence* of bias, as we have already seen that there are meaningful differences in how different cultures think about climate change adaptation.

Another challenge is the ability to involve a second human rater as part of the effort to warrant that the coding is fair and valid, which is predicated on the availability of someone with expertise in both the *content* and the *languages and cultures* involved. In this pilot study, I forewent validation of the coding process using a second human rater in part because my modeling goal was to create a tool for thought and not a tool

for action and in part because finding another person with sufficient knowledge of climate change adaptation planning and reading comprehension in English, Spanish, and French is non-trivial.

From a more theoretical perspective, multilingual and multicultural corpora raise questions about the extent to which Codes are similarly meaningful (or not) across different languages and cultures. For example, this analysis included a number of adaptation plans from North American tribes and Indigenous communities, whose epistemologies often differ significantly from those of Western science and governance. The *Confederated Salish and Kootenai Tribes Climate Change Strategic Plan* (2013) argues that

> Western science has allowed societies to segregate the roles and different functions of each part of nature. Native people to this land understand that these functions cannot be separated from each other. They understand that there is a direct relationship among everything in the natural environment. As such, Traditional Ecological Knowledge is not only incorporating Tribal traditions and culture, but it is applying Salish, Pend d'Oreille, and Kootenai world views into decision-making (p. 28).

The LOCAL KNOWLEDGE Code captured some aspects of this epistemological and ontological perspective, but as discussed above, the JEDI Code was perhaps less successful in this regard. In another sense, the JEDI Code functioned exactly how it was supposed to function, as the very concept is inextricable from systems of oppression, but the ENA model made me reconsider whether that is the best way to understand what is happening in these documents. And that is, after all, what QE is all about, and why the *unification* of methods is so much more important than simply using different tools to solve different problems [10].

This raises another, related theoretical question. Although this pilot study involves only documents, I regard the interpretive process as one that is both hermeneutic and ethnographic, and so the inclusion of documents from such a broad range of cultural and linguistic contexts raises questions about power, and in particular about power imbalance. In the 1970s, Laura Nader challenged ethnographers to "study up," noting that far more ethnographic effort had been expended studying the cultures of oppressed minorities than studying the cultures of the minorities who oppress them [17]. Building on Nader's challenge as well as the field of *critical policy ethnography* [4], this pilot study explicitly included documents from as broad a range of cultures and languages as possible, documents that form a coherent corpus only by virtue of their stated goal of producing plans for dealing with the effects of climate change.

Yet coding (and modeling more generally) is an explicit application of power [16], and the goal of modeling a policy ecosystem in the way I have conceptualized it requires some ability to represent that ecosystem with one, consistent set of Codes. I certainly cannot pretend to expertise on every culture represented in even this small dataset, nor, likely, could anyone else. While there are clear advantages to including as many policy perspectives as possible in a model that purports to represent a policy ecosystem, it is difficult to determine whether my attempt to code and model this dataset is truly fair to all the represented cultures, languages, and perspectives. And given my positionality as a White, male, academic in a position of considerable privilege, it is an important ques-

tion because the potential for epistemic violence cannot be ignored. Yet in some respects, this is a policy ecosystem in which epistemic violence may also be embedded, in the sense that presumably not all cultures would regard a written document, composed in English or another colonial language, as the most appropriate method of formalizing or communicating policy; yet those cultures that do not engage with the substance as well as the form of climate change adaptation planning may also be unable to obtain the funding and other resources necessary to survive the coming climate crises.

4.3 Seeing What Isn't There

In this pilot study, the only data included in my initial attempt to model a climate change adaptation policy ecosystem were adaptation plans and guidance for policy makers; that is, data on implementation or evaluation of plans were not incorporated. This makes, of course, for a limited theory of ecology, though one that is not without its uses. Yet even when we consider only one part of this ecosystem, the plans themselves, there are intriguing questions raised. For example, the most recent IPCC summary for policy makers (2022) notes that "most observed adaptation is fragmented, small in scale, incremental, sector-specific, designed to respond to current impacts or near-term risks, and focused more on planning rather than implementation" (p. SPM-21). All the more reason to include data on the implementations that *do* exist, an extension of "follow the policy" ethnography [18] in which policies are traced through the four stages I characterize above.

But this also suggests a challenge in modeling policy ecosystems, for what is *not* present in such systems is often as important as what *is*. Absence is not merely lack of presence, for it could come about due to deliberate *exclusion*—the intentional omission of something from the system based, for example, on the choice of narrative that frames the development of policy or decisions about who qualifies as a stakeholder; due to *extinction*—the disappearance of something once part of the system, whether intentional or not; or due to *occlusion*—the inability to see something that is or should be part of the system. For example, when the latest IPCC report (2022) notes that "less attention has been paid to low-regret [adaptation] options, especially at the national and local levels" (p. 4-130), how do we account for that?

Most if not all of the tools of quantitative ethnography are, in one sense, positivist ones: coding is a process of asserting whether *or not* something is present in data, but the "or not" is predicated on there being at least some instances where the Code is positively invoked. Similarly, network analyses are fantastic tools for modeling connections, but they are less useful for showing connections *not made*. And yet as the examples above indicate, scholars routinely attend to what is not present in addition to what is, and this is a particularly powerful approach when we take seriously the task of giving voice to those who may lack full participation in some process. In policy contexts, it is as important to ask who is not sitting at the table as who is, and what is not being discussed as what is.

5 Inconclusion

If it seems that this paper has raised more questions than it answered—or perhaps has answered questions only with more questions—then this pilot study has served its purpose. Modeling something as complex as a policy ecosystem is not something one achieves at first attempt, and it is almost certainly not something that *one* achieves at all. While this pilot study has, I hope, demonstrated the considerable potential of QE methods for modeling policy ecosystems—building on the work of Siebert-Evenstone and Shaffer [19] on the construction of measurement spaces for evaluating alignment of curricula with policy and the work of Schnaider and colleagues [20] on comparative national health policy—my primary goal is to advance the conversation around the theoretical and methodological challenges QE researchers face in attempting to model multinational, multilingual, and multicultural systems.

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References

1. Kirby, P., Shepherd, L.J.: Women, Peace, and Security: Mapping the (Re)Production of a Policy Ecosystem. Journal of Global Security Studies. 6, (2021).
2. Stone, D.A.: Causal Stories and the Formation of Policy Agendas. Political Science Quarterly. 104, 281–300 (1989).
3. Lipsky, M.: Street-Level Bureaucracy: Dilemmas of the Individual in Public Service. Russell Sage Foundation (1980).
4. Dubois, V.: Critical Policy Ethnography. In: Fischer, F., Torgerson, D., Durnová, A., and Orsini, M. (eds.) Handbook of Critical Policy Studies. pp. 462–480. Edward Elgar Publishing (2015).
5. Eagan, B.R., Siebert-Evenstone, A.L., Hamilton, E., Faul, M., Ashton, L., Wong, N.: Engaging Policy with a QE Lens. In: Wasson, B. and Zörgő, S. (eds.) Third International Conference on Quantitative Ethnography: Conference Proceedings Supplement. pp. 139–147. International Society for Quantitative Ethnography (2021).
6. Shaffer, D.W., Collier, W., Ruis, A.R.: A Tutorial on Epistemic Network Analysis: Analyzing the Structure of Connections in Cognitive, Social, and Interaction Data. Journal of Learning Analytics. 3, 9–45 (2016).
7. Bowman, D., Swiecki, Z., Cai, Z., Wang, Y., Eagan, B., Linderoth, J., Shaffer, D.W.: The Mathematical Foundations of Epistemic Network Analysis. In: Ruis,

A.R. and Lee, S.B. (eds.) Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1-3, 2021, Proceedings. pp. 91–105. Springer (2021).
8. Marquart, C.L., Swiecki, Z., Eagan, B.R., Shaffer, D.W.: ncodeR: Techniques for Automated Classifiers. (2018).
9. Marquart, C.L., Swiecki, Z., Collier, W., Eagan, B.R., Woodward, R., Shaffer, D.W.: rENA: Epistemic Network Analysis. (2019).
10. Shaffer, D.W.: Quantitative Ethnography. Cathcart Press (2017).
11. de Sousa Santos, B.: Epistemologies of the South: Justice against Epistemicide. Routledge (2015).
12. Siebert-Evenstone, A.L., Irgens, G.A., Collier, W., Swiecki, Z., Ruis, A.R., Shaffer, D.W.: In Search of Conversational Grain Size: Modelling Semantic Structure Using Moving Stanza Windows. Journal of Learning Analytics. 4, 123–139 (2017).
13. Ruis, A.R., Siebert-Evenstone, A.L., Pozen, R., Eagan, B.R., Shaffer, D.W.: Finding Common Ground: A Method for Measuring Recent Temporal Context in Analyses of Complex, Collaborative Thinking. In: Lund, K., Niccolai, G., Lavoué, E., Hmelo-Silver, C., Gweon, G., and Baker, M. (eds.) A Wide Lens: Combining Embodied, Enactive, Extended, and Embedded Learning in Collaborative Settings: 13th International Conference on Computer-Supported Collaborative Learning (CSCL) 2019. pp. 136–143. International Society for the Learning Sciences (2019).
14. Zörgő, S., Swiecki, Z., Ruis, A.R.: Exploring the Effects of Segmentation on Semi-structured Interview Data with Epistemic Network Analysis. In: Ruis, A.R. and Lee, S.B. (eds.) Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1-3, 2021, Proceedings. pp. 78–90. Springer (2021).
15. Wineburg, S.S.: Historical Problem Solving: A Study of the Cognitive Processes Used in the Evaluation of Documentary and Pictorial Evidence. Journal of Educational Psychology. 83, 73–87 (1991).
16. Shaffer, D.W., Ruis, A.R.: How We Code. In: Ruis, A.R. and Lee, S.B. (eds.) Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1–3, 2021, Proceedings. pp. 62–77. Springer (2021).
17. Nader, L.: Up the Anthropologist—Perspectives Gained From Studying Up. In: Hymes, D. (ed.) Reinventing Anthropology. pp. 284–311. Vintage Books (1974).
18. Peck, J., Theodore, N.: Follow the Policy: A Distended Case Approach. Environment and Planning A: Economy and Space. 44, 21–30 (2012).
19. Siebert-Evenstone, A., Shaffer, D.W.: Cause and Because: Using Epistemic Network Analysis to Model Causality in the Next Generation Science Standards. In: Eagan, B., Misfeldt, M., and Siebert-Evenstone, A. (eds.) Advances in Quantitative Ethnography: First International Conference, ICQE 2019, Madison, WI, USA, October 20–22, 2019, Proceedings. pp. 223–233. Springer (2019).
20. Schnaider, K., Schiavetto, S., Meier, F., Wasson, B., Allsopp, B., Spikol, D.: Governmental Response to the COVID-19 Pandemic - A Quantitative Ethnographic

Comparison of Public Health Authorities' Communication in Denmark, Norway, and Sweden. In: Ruis, A. and Lee, S. (eds.) Advances in Quantitative Ethnography: Second International Conference, ICQE 2020, Malibu, CA, USA, February 1-3, 2021, Proceedings. pp. 406–421. Springer (2021).