



Colonialism, justice, and Indigenous knowledge: A critical analysis of climate change adaptation scholarship on U.S. territories

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ABSTRACT

Adapting to climate change is crucial for islands, as they are disproportionately vulnerable to climate threats that are often exacerbated by processes of colonialism. Non-self-governing territories face additional barriers due to their liminal political statuses being neither independent nations nor fully incorporated states. This causes territories and the peoples who live there to have minimal self-determination in decision-making processes. Indigenous communities in territories are further marginalized by power structures that favor Western scientific-technical climate solutions over Indigenous ontological approaches. To foster just adaptation, scholars studying non-self-governing territories must consider these forms of marginalization. This review focuses on the five U.S.-controlled unincorporated territories. Through a systematic review, I examine whether and how climate adaptation research on U.S. territories discusses the following three themes: (1) colonialism and political status, (2) justice, and (3) Indigenous knowledge. The analysis reveals that while justice is discussed in most studies, colonialism and political status are less commonly grappled with, and Indigenous knowledge is highly understudied. Further, different concepts of justice are incorporated to varying degrees with emphasis being placed on recognition, procedural, and distributive justice, while restorative and transformative justice are rarely considered. By analyzing the current state of climate change adaptation research on U.S. territories, I produce insights into the omissions and inclusions of key themes in existing research. I argue that adaptation scholars must pay greater attention to non-self-governing territories where colonialism and climate change are reproducing injustices. Finally, I propose new directions for adaptation research on colonized islands and territories more broadly.

1. Introduction

Adapting to climate change is imperative for small islands, as they are disproportionately vulnerable to climate impacts and often face compounding stressors from historical and ongoing processes of colonialism (Pelling and Utto, 2001; Thomas et al., 2020). The Intergovernmental Panel on Climate Change's Sixth Assessment Report found that small islands are already being impacted by climate change in many ways and that they will continue to face disproportionately high risks to human health, biodiversity, and critical infrastructure (Intergovernmental Panel on Climate Change, 2022). Islands, from low-lying atolls to mountainous volcanic archipelagos, are at risk from a myriad of threats, such as sea level rise, extreme storms, drought, heat, and more (Intergovernmental Panel

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on Climate Change, 2022).

Non-self-governing territories are met with additional barriers due to their liminal political statuses being neither independent nations nor fully incorporated states. This position leaves these places and the peoples that inhabit them with reduced autonomy and minimal self-determination over political decision-making, environmental planning, legal advocacy, and other processes (Aguon, 2010). The United Nations lists 17 such non-self-governing territories, 15 of which are islands (United Nations, 2020). Notably, this number has been disputed by other states, who have expressed that they are also under colonial rule (Amberg, 1985). The Charter of the United Nations defines non-self-governing territories as "territories whose people have not yet attained a full measure of self-government" (United Nations, 1973). This may be reflected by a lack of full protections under the constitutions of ruling governments, poor representation in national legislatures, and other forms of inequitable treatment (Corbin et al., 2021).

The United States controls five territories across the Pacific and the Caribbean that, in total, are home to over 3.62 million people (U.S. Census Bureau, 2020). These territories include American Samoa, Guam (hereafter referred to by the Indigenous Chamorro spelling as Guåhan), the Northern Mariana Islands (NMI), Puerto Rico, and the U.S. Virgin Islands (USVI). Notably, the U.S. territories of Puerto Rico and the Northern Mariana Islands were removed from the United Nations list of non-self-governing territories in 1953 and 1990, respectively, when they gained "commonwealth" status, but this decision has been critiqued and challenged as their political statuses still do not afford them independence and full autonomy from the United States (Developments in the Law: The U.S. Territories, 2017).

1.1. Climate change and adaptation in territories

The historical and ongoing structures of colonialism and the political status of each U.S. territory are inextricable from one another. These structures play important roles in the exacerbation and reproduction of climate change vulnerability and shape the production of adaptation. For example, colonialism has increased vulnerability to climate change through processes like military bases degrading resilient ecosystems and exposing people to hazardous chemicals (Frain, 2018; Na'puti, 2022). Along with these harms, the U.S. has imposed policies like The Jones Act of 1920 that have forced the territories to be more dependent on the federal government and the U.S. states for resources like food and emergency aid (Powell et al., 2020). The political and legal structures that reduce the autonomy of territories and the people who live there also weaken their ability to adapt to climate change in an equitable way that meets local goals and needs (Bordner et al., 2020).

Justice should also be a central concern when seeking to understand climate change adaptation anywhere, but particularly in territories. A significant body of work on climate change adaptation has addressed issues of distributive justice and procedural justice, with a growing emphasis on transformative justice (Newell et al., 2021; Rudge, 2021a). Here, distributive justice is defined as the equitable allocation of both environmental resources and negative impacts across different communities and within communities. In the climate change context, this relates both to how climate impacts are distributed and to where successful adaptation is taking place. Procedural justice is defined as the implementation of decision-making processes that are fair and inclusive to all impacted participants, which directly applies to how adaptation and climate change research is done. The concept of transformative climate justice is fraught with a lack of consensus among scholars and activists (Deubelli and Mechler, 2021; Bentz et al., 2022). Here, I define transformative justice as a process of dismantling the systems (be they social, political, economic, or otherwise) that continue to reproduce marginalization and create solutions using methods beyond those systems. In the context of adaptation, a transformative justice approach would address not only climate impacts like sea level rise and ocean acidification but also the systems that continue to produce harm, such as colonialism and capitalism (Frain, 2018).

Additionally, it is important to consider recognition justice and restorative justice in the context of territories. Recognition justice is particularly relevant when questions of sovereignty, political status, and self-determination are being considered. This form of justice requires an understanding that different cultures and peoples exist, are valued equally to others, and that systems of marginalization are impacting people (Whyte, 2011). This approach to adaptation emphasizes that it is necessary to recognize the rights and experiences of communities in order to develop solutions to how they are impacted by climate change. Restorative justice deviates from dominant Western colonial forms of retributive justice and instead often draws on traditional practices to center the values of healing, repair, and restoration to a previous state (Maxwell and Hayes, 2006). These traditional practices and less extractive ways of relating to environments are deeply intertwined with how communities have adapted to their environments for thousands of years prior to global human-induced climate change, and therefore restorative approaches are highly relevant to climate adaptation.

In addition to colonialism and political status and justice, Indigenous knowledge systems and the marginalization of these ontologies represent a third fundamentally important theme when studying climate change adaptation in U.S. territories. Indigenous ontologies are deeply important for how many island communities interact with their environments and deal with climate-related impacts. For example, Fa'a Samoa, or the Samoan Way of Life, emphasizes the value of place-based identity, reciprocal human-ecosystem relationships, and communal subsistence practices. Many of these values and practices can contribute to greater climate resilience (Peau et al., 2022). Similarly, the Chamorro values of chenchule' (collective action and a system of social reciprocity) and inafa' maolek (striving for harmony) that have historically been important for social-environmental relations are driving climate change activism in Guåhan and the NMI because they are important for fostering resilient communities (Na'puti, 2022; Quintanilla, 2020).

While many Indigenous communities work to maintain these relationships, processes of colonization in the territories have resulted in the marginalization of Indigenous knowledge systems, which are vital to fostering healthy ecosystems and adapting to climate change (Cox and Elmquist, 1993; Serrano and Tapu, 2022). This can be seen through conservation measures, land management, climate change research, and adaptation practices that rely solely on Western scientific-technical solutions.

As the U.S. territories face a significant need to adapt to climate change and address underlying power structures, scholars should produce research on adaptation that addresses the issues that have been outlined here. Without explicitly analyzing the role that underlying power structures play in furthering inequities, climate change adaptation research and practice fails to challenge dominant systems and can reinforce the power of status quo structures (Rudge, 2023).

To understand gaps in scientific knowledge concerning climate change adaptation in U.S. territories and reveal insights into the intersections between adaptation and colonial power structures more broadly, this review provides a crucial analysis of whether and how existing literature has grappled with the main themes described in this section: (1) colonialism and political status, (2) justice, and (3) Indigenous knowledge.

American Samoa		<ul style="list-style-type: none"> ▶ Status: Unincorporated, unorganized territory ▶ Indigenous peoples: Samoans ▶ Population: 49,710 ▶ Land area: 76 sq. mi. ▶ Colonized by the United States: 1900 ▶ Previous colonizers: Germany; Great Britain
Guåhan		<ul style="list-style-type: none"> ▶ Status: Unincorporated, organized territory ▶ Indigenous peoples: Chamorros ▶ Population: 153,836 ▶ Land area: 210 sq. mi. ▶ Colonized by the United States: 1899 ▶ Previous colonizers: Spain; Japan
Northern Mariana Islands		<ul style="list-style-type: none"> ▶ Status: Unincorporated, organized commonwealth ▶ Indigenous peoples: Chamorros ▶ Population: 47,329 ▶ Land area: 179 sq. mi. ▶ Colonized by the United States: 1947 ▶ Previous colonizers: Spain; Germany; Japan
Puerto Rico		<ul style="list-style-type: none"> ▶ Status: Unincorporated, organized commonwealth ▶ Indigenous peoples: Taíno ▶ Population: 3,285,874 ▶ Land area: 3,515 sq. mi. ▶ Colonized by the United States: 1899 ▶ Previous colonizers: Spain
U.S. Virgin Islands		<ul style="list-style-type: none"> ▶ Status: Unincorporated, organized territory ▶ Indigenous peoples: Taíno; Kalinago (Caribs) ▶ Population: 87,146 ▶ Land area: 134 sq. mi. ▶ Colonized by the United States: 1917 ▶ Previous colonizers: Spain; France; Great Britain; the Netherlands; Denmark

Fig. 1. Shapes and descriptions of the U.S. territories.

1.2. Indigenous and colonial histories of the U.S. Territories

Different peoples are Indigenous to each of the U.S. territories and the demographics of each place have been greatly altered through centuries of colonialism. Fig. 1 depicts the geography of each territory and lists key attributes of each one.

The Chamorros (also spelled CHamorus) are the Indigenous peoples of both Guåhan and the NMI (Bevacqua et al., 2016). These territories are part of the same volcanic archipelago, and the peoples of these now politically separated places have a shared heritage. Chamorros have lived across these islands for more than 5000 years and over the past 400 have faced colonization and warfare at the hands of Spain, the United States, Japan, and Germany (Rogers, 2011). Guåhan became a U.S. possession first in 1899 following the conclusion of the Spanish-American War, then was briefly captured and controlled by Japan during World War II, after which the United States took back control (Rogers, 2011).

In the NMI there is also a significant Indigenous Refaluwasch (Carolinian) population that migrated from what is now the Federated States of Micronesia (FSM). This group maintained contact with the Chamorros for thousands of years and a substantial relocation occurred under Spanish colonialism in the late 1800s (Rogers, 2011). This process came as Spaniards forced Chamorros to move from the Northern islands to Guåhan, and allowed Refaluwasch migrants to settle in the NMI following the destruction of villages caused by typhoons (Alkire, 1984).

American Samoa, the only U.S. territory located in Polynesia, is home to the Samoan people. In a similar fashion to how Guåhan and the NMI were partitioned due to competing colonial claims, American Samoa was politically separated from the now-independent nation of Samoa in 1899 through a treaty between the United States and Germany (Ellison, 1939). The majority of residents in American Samoa are still Indigenous Samoans (U.S. Census Bureau, 2020). American Samoans arguably have the weakest constitutional protections of any U.S. territorial residents, as they are by default "U.S. nationals" rather than U.S. citizens (Developments in the Law. The U.S. Territories, 2017).

In the Caribbean, the USVI has 2 main Indigenous groups: the Taíno and Kalinago (Caribs) (Dookhan and Sheridan, 2002). Indigenous peoples from South America settled in islands throughout the Caribbean sometime between 5000 B.C.E. - 4000 B.C.E. in the "pre-Arawak" era, with evidence of the Taíno culture existing in the USVI and Puerto Rico around 500 B.C.E. – 1000 B.C.E. and the Kalinago settling in the USVI around the same time (Dookhan and Sheridan, 2002; Fortwangler and Stern, 2004; Fitzpatrick and Keegan, 2007). Throughout the late 1400s to the 1700s the islands of St. John, St. Thomas, and St. Croix were subject to colonization from multiple European nations that made disputed claims, decimated the Indigenous populations, and built ecologically detrimental plantation economies driven by slave labor from captured African people (Dookhan and Sheridan, 2002; Fortwangler and Stern, 2004). In the 1900s the United States gained control from Denmark and established these three main islands and nearby smaller ones as the USVI (Fortwangler and Stern, 2004).

The Taíno people are also the Indigenous peoples of Puerto Rico, which has a similar history to the USVI (Pierce Flores, 2010). However, Puerto Rico was colonized and controlled by Spain alone before its colonization by the United States following the conclusion of the Spanish-American War in 1899. This history of Spanish and then American colonization has created parallels and connections in the histories of Puerto Rico and Guåhan even as they are separated by a vast distance. Puerto Rico is by far the largest U.

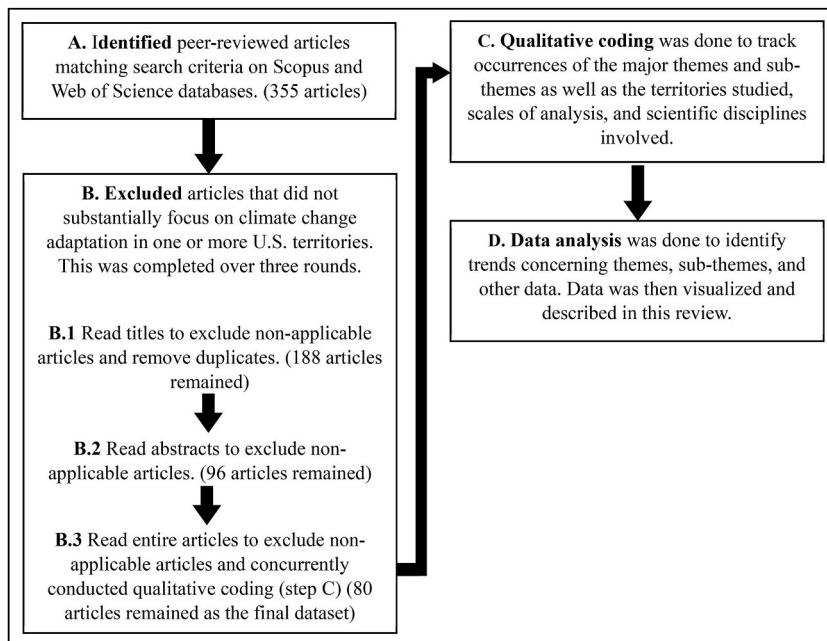


Fig. 2. Methods process.

S. territory both by population and land mass ([U.S. Census Bureau, 2020](#); [U.S. Central Intelligence Agency, 2021](#)).

1.3. Objectives

These histories demonstrate how Indigenous peoples and island environments have been continually impacted by colonialism and injustices. This context in which climate change and adaptation must take place informs the objectives and focus of this review. The three themes of (1) colonialism and political status, (2) justice, and (3) Indigenous knowledge were chosen because colonial power structures, which are intertwined with the reproduction of injustice and marginalization of Indigenous knowledge, are a dominant force impacting non-self-governing territories and islands. Therefore, this review aims to do the following: examine whether and how climate adaptation research on U.S. territories discusses these key themes, demonstrate the implications of omissions and inclusions of different topics, highlight key insights from existing scholarship that emphasizes key themes, and demonstrate why adaptation researchers must pay attention to non-self-governing territories to challenge unjust systems and produce equitable adaptation more broadly.

2. Methods

[Fig. 2](#) maps out the methods used to complete this review. In alignment with a similar review of adaptation research on small island developing states, this review followed STARLITE principles, detailed in [Table 1 \(Robinson, 2020\)](#). The methods included a phase of identification, screening and exclusion, and then analysis of included articles. I systematically analyzed all peer-reviewed publications studying climate change adaptation in one or more U.S. territories from 2022 and earlier. First, peer-reviewed articles were found using the databases Scopus and Web of Science. Articles that included the following search terms as a part of their “Topic” or “Title, abstract, or keywords” were selected for initial assessment: (climat* AND (adapt* OR resilien*) AND (name(s) of territory)). For example, the search for the Northern Mariana Islands was (climat* AND (adapt* OR resilien*) AND (“Northern Mariana Islands” OR “Northern Mariana*” OR “NMI”).

Articles were screened and filtered to find only those that applied to the study: peer-reviewed articles that primarily or substantially focus on climate change adaptation in one or more U.S. territories. Examples of excluded articles are articles solely studying biological processes taking place within organisms, articles that briefly examined a territory in the scope of a larger geographical study, and articles that were not peer-reviewed, such as most graduate theses.

Following the initial screening of articles, 80 articles remained in the final dataset. Data analysis was then completed. The occurrences of the three major themes were tracked based on whether each article engaged with these ideas to any extent. Sub-themes of justice were tracked as well: distributive justice, procedural justice, recognition justice, restorative justice, and transformative justice. Thematic analysis was done by determining whether an article discussed any of these themes, as described in introduction section [1.1](#) of this review. To meet criteria for addressing a theme, the study had to discuss this in conversation with adaptation. The scale at which adaptation was studied was also coded as sub-national, national, regional, and/or global. Additional metadata on articles were also tracked, including author institutions, the territories studied, whether the research drew on social scientific or natural scientific approaches, and publication dates. In this review, multiple authors on the same paper who were based at the same institution were counted as one group; individuals or groups who authored more than one paper were counted for each paper they were involved in producing. Articles with multiple authoring institutions had each institution counted.

3. Results

Notable results were found that reveal insights and disparities regarding which territories are studied, where authors are based, how publication rates are changing over time, what scientific approaches are taken, which themes are most prevalent, and how researchers are using those major themes.

Table 1
Outline of literature search and review using STARLITE principles.

Principle	Description
Sampling strategy	Selective: Studies on climate change adaptation in one or more U.S. territories
Type of study	Any qualitative, quantitative, or mixed methods study
Approaches	Electronic subject searching only
Range of years	2009*-2022 (2009 is the first published article, but the search was conducted for all articles published before 2023)
Limits	English (Some articles were originally written in Spanish but had official translations published online)
Inclusion and exclusions	Inclusion: Studies primarily or substantially focused on climate change adaptation in one or more U.S. territories Exclusion: Articles that solely studied biological processes taking place within organisms, briefly examined a territory in the scope of a larger geographical study, or were not peer-reviewed
Terms used	(climat* AND (adapt* OR resilien*) AND (name(s) of territory)) appeared in title, abstract, or keywords
Electronic sources	Scopus and Web of Science

3.1. Territories studied and authoring institutions

This review reveals stark disparities in the number of articles being produced on each territory. Many more studies focus on Puerto Rico ($n = 53$) than the other territories, with American Samoa having the fewest studies ($n = 5$). This may be a result of Puerto Rico being the largest and most populous territory, but beyond Puerto Rico, there is no clear trend relating population size to the number of articles published on a territory. [Table 2](#) demonstrates the variation in articles focusing on each of the different territories. The total number of articles covering climate change adaptation in any U.S. territory trends upward over time, with the first article being published in 2009 ($n = 1$) and 2022 having the most articles of any year on record ($n = 25$). [Fig. 3](#) demonstrates how article publication has changed over time, visualizes each territory, and highlights major climate change-driven impacts including high-energy storms (cyclones, hurricanes, and typhoons) and mass coral bleaching ([Zimmerman et al., 2020](#)).

Puerto Rico stands out as the most studied territory by far, which has major implications for the visibility of that territory and the invisibilization of other territories and peoples that live in them. The research produced on Puerto Rico also included more social science studies that consider issues like the marginalization of different groups and social movements to enact change through activism or community-based adaptation. For example, Hayward et al. discuss community organizing to do "eco-social work" to recover following hurricanes in Puerto Rico ([Hayward et al., 2019](#)). Similarly, Powell et al. describe the effectiveness of social support networks and compassion in supporting healthcare and social services providers who are deeply important for hurricane recovery ([Powell et al., 2020](#)). An article studying both Puerto Rico and the USVI addresses another unique issue not covered in research on other territories: how young people's actions to process post-traumatic stress is a form of adaptation ([Guannel et al., 2022](#)). However, while this particular emphasis on youth voices and experiences was not discussed in other territories, multiple scholars focusing on both the Caribbean and the Pacific emphasize the importance of storytelling and fostering mental health as methods to achieving more equitable adaptation ([Na'puti, 2022](#); [Maldonado et al., 2021](#); [Ruddock and Green, 2011](#)). This selection of issues that are almost exclusively covered in Puerto Rico and sparingly or never studied in the other territories reveals the importance of more scholarship being produced across the five U.S. territories. The lack of research on youth education, for example, is not indicative of a lack of community programs existing in the other territories but rather a lack of scholarly investment in these crucial issues.

Related to the differences in geographic focus, there is also a disparity in where author institutions are located. [Fig. 4](#) reveals where authors are located and how the number of authors based in territories compares to the number of authors based in other locations. A disproportionately high number of authors are located in Global North countries, which aligns with trends on the production of climate change research more broadly ([Pasagaard et al., 2015](#)). While authors in the contiguous United States dominate the production of research in the articles reviewed here, there is a significant number of articles produced by authoring groups based in one of the U.S. territories. 112 authors are based in the contiguous United States, 19 in the state of Hawai'i, 36 in Puerto Rico, 7 in Guåhan, 4 in the NMI, 4 in the USVI, and 2 in American Samoa. Interestingly, research focusing on Puerto Rico is more dominated by scholars based in the contiguous United States as compared to the other territories, which have slightly more diversity in the locations of authors, with many being based in Australia and Asia. This can be related generally to the far greater geographic separation of the Pacific territories from the contiguous United States as compared to the close proximity of the Caribbean territories. Notably, the method taken in this review cannot account for authors who are members of a particular community but living elsewhere. These researchers, such as Pacific Islanders in diaspora, still provide unique culturally-informed perspectives due to their positionalities ([Baldacchino, 2008](#)).

Additionally, researchers are taking different disciplinary approaches to study climate change adaptation and are analyzing different geographic scales. Most studies (75 %, $n = 60$) incorporate a social scientific approach, while 44 % ($n = 35$) use a natural scientific or engineering approach, and 20 % ($n = 16$) draw substantially on both social and natural science disciplines. Most articles analyze adaptation at multiple geographic scales and levels of governance across the categories of sub-national, national, regional, and global ([Persson, 2019](#)). The most common level by far is the sub-national scale at 94 % ($n = 75$), which includes a variety of scales such as a territory, a city, a watershed, or a single ecosystem. National adaptation strategies were discussed in 39 % ($n = 31$) of articles. Regional strategies, such as collaborative planning with multiple Caribbean territories and nations, were discussed in 36 % ($n = 29$) of articles, and global strategies were discussed in 21 % ($n = 17$).

The dominance of Global North-produced climate change scholarship has been well documented on small island developing states and this review demonstrates that this disparity exists for U.S. territories as well. However, researchers based in U.S. territories are

Table 2

Approaches to adaptation (academic disciplines and scales of adaptation). Percentages are the percentage of articles covering a specific theme as a percentage of the total articles on that territory.

		Territory											
		All		American Samoa		Guåhan		Northern Mariana Islands		Puerto Rico		U.S. Virgin Islands	
Discipline	Total Articles	80	(100 %)	5	(6 %)	12	(15 %)	14	(18 %)	53	(66 %)	14	(18 %)
	Nat. sciences & engineering	35	(44 %)	2	(40 %)	6	(50 %)	6	(43 %)	20	(38 %)	5	(36 %)
	Social sciences	60	(75 %)	3	(60 %)	7	(58 %)	9	(64 %)	46	(87 %)	9	(64 %)
Scale	Both	16	(20 %)	0	(0 %)	1	(8 %)	1	(7 %)	13	(24 %)	0	(0 %)
	Sub-national	75	(94 %)	4	(80 %)	8	(67 %)	10	(71 %)	53	(100 %)	13	(93 %)
	National	31	(39 %)	2	(40 %)	4	(33 %)	4	(29 %)	24	(45 %)	6	(43 %)
	Regional	29	(36 %)	4	(80 %)	5	(42 %)	10	(71 %)	15	(28 %)	6	(43 %)
	Global	17	(21 %)	3	(60 %)	4	(33 %)	3	(21 %)	8	(15 %)	4	(29 %)

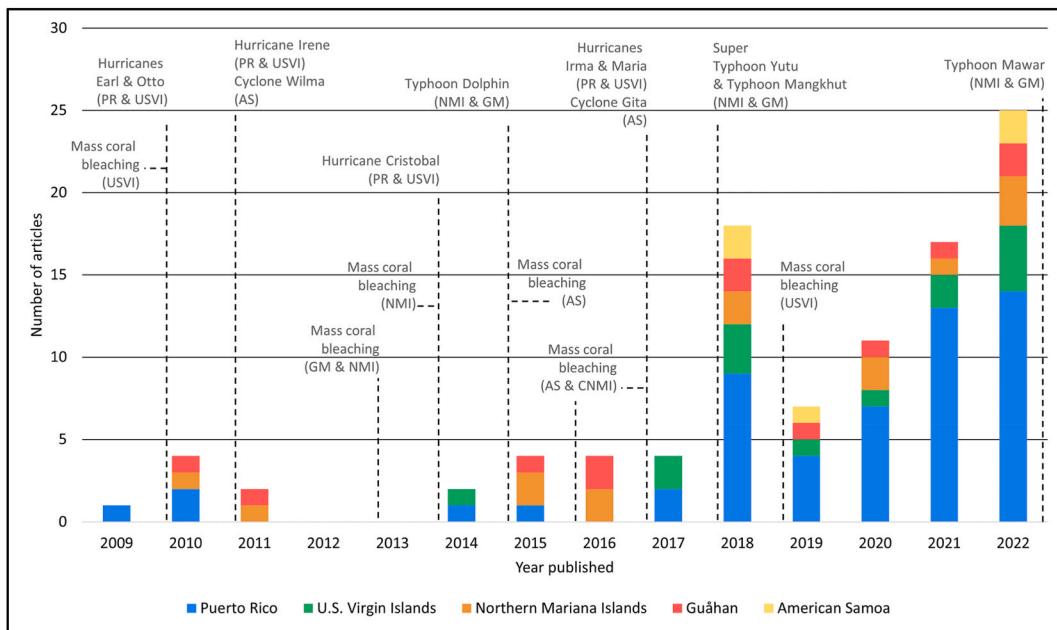


Fig. 3. Articles published per year. Includes major climate change-induced events that impacted the U.S. territories, including high-energy storms and mass coral bleaching.

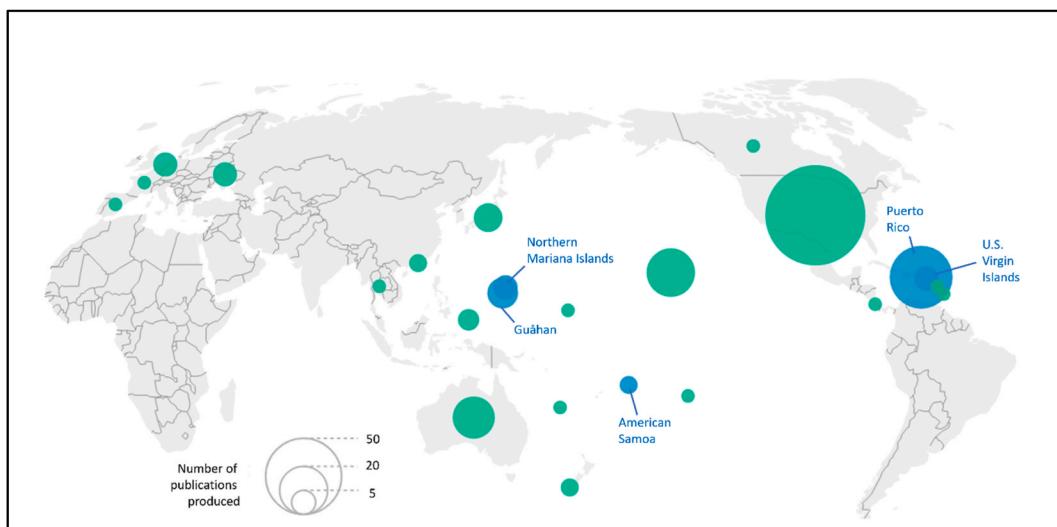


Fig. 4. Map of author institutions. U.S. territories are labeled and indicated in blue. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

increasingly publishing on adaptation. Research coming from academic institutions like the University of Puerto Rico and the University of Guam has often centered community-based approaches to climate change adaptation and has enabled greater context-specificity. Shelton and Richmond, based at the University of Guam and the University of Hawai'i, respectively, studied community-based approaches to climate-resilient watershed restoration in Guåhan and centered traditional Chamorro cultural practices when conducting community meetings to integrate local perspectives and cultural context into watershed management (Richmond et al., 2019; Shelton and Richmond, 2016).

Similarly, University of Puerto Rico-based researchers in collaboration with others from the contiguous United States used critical art-informed participatory action research to generate community-driven visions for adaptation and cultivate hope for the future (Deil-Amen et al., 2022). This type of work requires researchers to build deep levels of trust with participants, which is more likely to be possible when scholars are based in the locations where they are conducting research. An additional example from a collaboration with researchers at the University of Puerto Rico sought to take a public health perspective towards climate change adaptation and

generated priorities through extensive stakeholder engagement, knowledge sharing, capacity building, and health assessments ([Covert et al., 2022](#)). Ramsey et al. have also emphasized the value of informal knowledge systems and recognizing citizens as producers of valuable knowledge in Puerto Rico ([Ramsey et al., 2019](#)).

3.2. Occurrence of different themes

The prevalence of the different themes varies significantly overall and between the territories. As shown in [Table 3](#) and [Fig. 5](#), justice is discussed in 79 % (n = 63) of all articles while colonialism and political status are less prevalent at 45 % (n = 36), and Indigenous knowledge is not commonly discussed at 24 % (n = 19).

3.3. Colonialism and political status

The combined theme of colonialism and political status is the second most prevalent of the three major themes. The rates of this theme occurring are consistent across the territories, with the lowest rate seen in the USVI (43 %, n = 6) and the highest being in the NMI (64 %, n = 9). When disaggregating the discussion of colonialism from that of political status, it is apparent that while these ideas are discussed at similar rates, with colonialism studied in 34 % (n = 27) of articles and political status studied in 30 % (n = 24), articles often only mention one or the other. 19 % (n = 15) of all articles discuss both concepts, 15 % (n = 12) discuss colonialism only, and 11 % (n = 9) discuss political status only. Discussion of colonialism is more common in the Pacific territories where rates range from 40 % to 50 %, as compared to the Caribbean territories where rates range from 21 % to 36 %. In contrast, discussion of political status is more evenly distributed across the territories with a range of 25 %–40 %, and no clear distinction between the two regions.

The relatively minimal discussion of colonialism and political status across this body of work is concerning, and it is important to examine the implications of articles engaging with only one of these concepts at a time. Discussing these ideas in isolation from one another leaves gaps in understanding the totality of the marginalizing systems that are involved. Articles that solely mention colonialism without discussing political status often acknowledge colonialism as a historical process that had important impacts on the development of a territory and environmental degradation in the past, but not as a structure that is intertwined with present-day processes of climate change and adaptation ([Hunter-Anderson, 2010](#); [Wongbusarakum et al., 2021](#); [Yandle et al., 2020](#)). For example, Hunter-Anderson notes that Spanish colonialism in Guåhan forced Chamorros to hide or abandon their traditional forms of relating to environments and adapting to climatic changes ([Hunter-Anderson, 2010](#)). Through these processes of colonialism, Spanish rule imposed Western forms of interacting with nature ([Hunter-Anderson, 2010](#)). This research acknowledges how colonialism historically impacted Indigenous relationships with nature but stops short of discussing how present-day political statuses continue to support these power dynamics.

In contrast, some research discusses political status outside of the context of colonialism, which may serve to highlight inequities and power imbalances associated with the present relationship between the United States and its territories but can potentially produce an ahistorical study. For example, Lopez-Marrero and Yarnal studied adaptive capacity in flood-prone communities with an emphasis on highlighting potential non-technical solutions, such as community solidarity ([Lopez-Marrero and Yarnal, 2010](#)). This study thoroughly engages with how Puerto Rico's current political status impacts access to federal assistance for disasters, which hinders adaptive capacity ([Lopez-Marrero and Yarnal, 2010](#)). However, they do not historicize the flood hazards with consideration for how colonial land use practices and development may have contributed significantly to present vulnerabilities ([Clark and Wilcock, 2000](#)).

The articles that do engage with both colonialism and political status often provide deeply important insights into how these historical and ongoing structures have exacerbated climate change vulnerabilities and inform adaptation futures. Both Sheller and Rivera describe the slow violence that has occurred across the Caribbean over centuries of colonialism through processes like the

Table 3
Occurrence of themes.

		Territory					
		All	American Samoa	Guåhan	Northern Mariana Islands	Puerto Rico	U.S. Virgin Islands
Themes	Total Articles	80 (100 %)	5 (6 %)	12 (15 %)	14 (18 %)	53 (66 %)	14 (18 %)
	Colonialism or Political Status	36 (45 %)	3 (60 %)	7 (58 %)	9 (64 %)	26 (49 %)	6 (43 %)
	Colonialism	27 (34 %)	2 (40 %)	6 (50 %)	7 (50 %)	19 (36 %)	3 (21 %)
	Political Status	24 (30 %)	2 (40 %)	3 (25 %)	5 (36 %)	20 (38 %)	5 (36 %)
	Justice	63 (79 %)	3 (60 %)	9 (75 %)	10 (71 %)	47 (89 %)	9 (64 %)
	Distributive	43 (54 %)	3 (60 %)	4 (33 %)	6 (43 %)	35 (66 %)	7 (50 %)
	Procedural	47 (59 %)	2 (40 %)	7 (58 %)	7 (50 %)	34 (64 %)	6 (43 %)
	Recognition	47 (59 %)	3 (60 %)	8 (67 %)	8 (57 %)	34 (64 %)	7 (50 %)
	Restorative	14 (18 %)	1 (20 %)	3 (25 %)	4 (29 %)	11 (21 %)	1 (7 %)
	Transformative	20 (25 %)	1 (20 %)	2 (17 %)	3 (21 %)	18 (34 %)	3 (21 %)
	Indigenous knowledge	19 (24 %)	2 (40 %)	6 (50 %)	7 (50 %)	10 (19 %)	2 (14 %)

Major themes and the total article count for each territory are bolded. Percentages are the percentage of articles covering a specific theme as a percentage of the total articles on that territory.

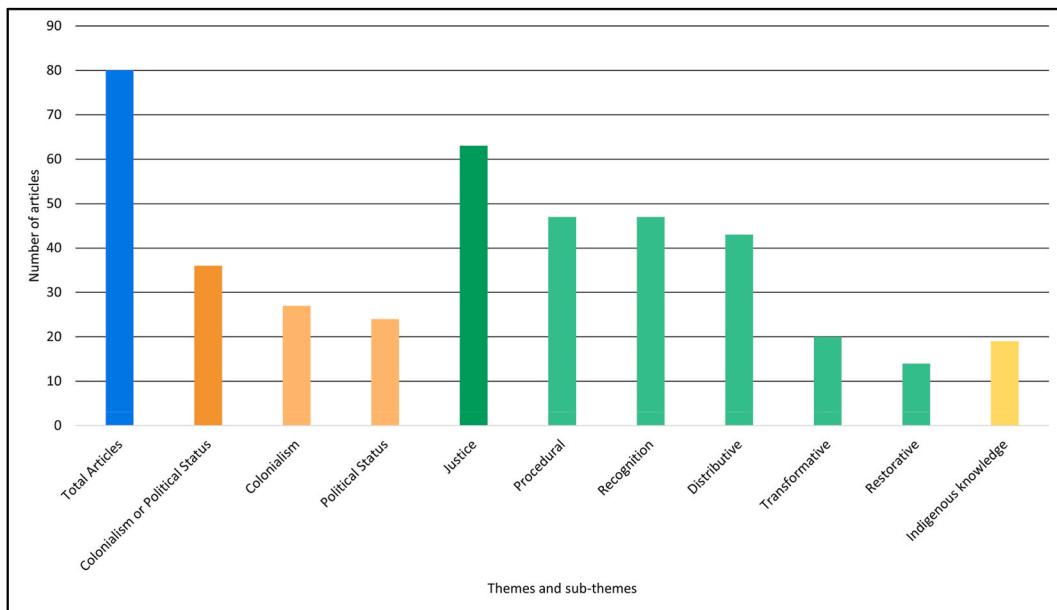


Fig. 5. Themes and sub-themes graph.

genocide of Indigenous peoples, enslavement of Black people, and ecological destruction through resource extraction (Rivera, 2022; Sheller, 2018). Sheller then demonstrates the legacies and ongoing processes of colonialism, including how the territorial political status of Puerto Rico and the USVI continues to marginalize the peoples that live in those territories by reinforcing spatialized difference and furthering economic marginalization through debt burdens that limit agency to adapt (Sheller, 2018). Na'Puti presents another analysis of these intersecting forces of colonialism, political status, and militarism as they impact Guāhan and the NMI (Na'puti, 2022). Through a focus on disaster militarism, she demonstrates how colonialism and the restricted political status of the territories create a feedback loop of environmental destruction, dependence on the military, and the prevention of self-sufficiency and local decision-making power (Na'puti, 2022).

Multiple studies also discuss how manufactured dependence and hindered self-sufficiency are entangled with food systems in territories. Researchers discuss how federal policies like the Jones Act of 1920, which regulates maritime commerce between U.S. Ports using protectionist restrictions on shipping vessels, maintain structures of dependency and increase vulnerability when climate change-induced disasters like high-energy storms strike (Rodríguez-Cruz et al., 2022; Stablein et al., 2022). Relatedly, researchers argue that climate disasters need to be primarily understood within the context of larger, ongoing systems of marginalization and harm, rather than as events that should be studied only in relation to the specific moments in which they occur (Stablein et al., 2022; Ocasio et al., 2021). Processes such as austerity measures and abandonment politics operate through colonial power dynamics to exacerbate climate vulnerabilities. However, multiple articles also describe how local action can work to resist colonial ties that aim to foster dependence. Primarily, smallholder farming has been highlighted as a form of political resistance to drive local self-sufficiency, reduce reliance on imports, bring down food costs, address food insecurity, and serve as a decolonizing process (Marrero et al., 2022; Rodríguez-Cruz et al., 2021).

3.4. Justice

Most articles include a discussion of some dimension of justice. Articles on American Samoa do so at the lowest rate (60 %, n = 3) with Puerto Rico having the highest rate (89 %, n = 47). Beyond the mention of justice overall, there is high variation in the types of justice discussed. Procedural justice and recognition justice are the most prevalent forms with 59 % (n = 47) of all articles discussing them. Distributive justice is also frequently considered at 54 % (n = 43). Transformative justice is less common, with 25 % (n = 20) of articles discussing it, and finally, restorative justice is sparsely discussed at 18 % (n = 14). These trends are similar across the different territories. However, there is a higher prevalence of transformative justice in studies on Puerto Rico (34 %) as compared to all other territories (17 %–21 %).

Justice is a broad concept that can refer to many different ideas, each having some alignment with the values of fairness, and making wrongs right. Environmental justice and climate justice have both become prevalent across scholarship, and justice is a common theme throughout adaptation research. The high prevalence of justice discourse in the body of work reviewed here demonstrates that scholars are making a clear commitment to incorporating discussion of justice in their work at levels that are significantly greater than the discussion of other themes analyzed in this review. Puerto Rico has the highest proportion of articles covering justice (89 %), which aligns with previously demonstrated engagement with equity-related topics like activism, mental health, and youth empowerment that are largely understudied in the other territories (Powell et al., 2020; Hayward et al., 2019; Guannel et al.,

2022).

American Samoa has the lowest rate of articles on justice at 60 % (n = 3). While this is likely skewed due to its very small number of total articles (n = 5), this still reveals a deficiency in research considering justice, which has negative implications for the attainment of equitable climate change adaptation planning and implementation in American Samoa. One of the major topics of interest in articles on American Samoa is the management of coral reefs in the face of climate change (Barker, 2018; Morikawa and Palumbi, 2019). Interestingly, most articles that focus on coral reefs throughout all territories do not contain a discussion of justice at all (41 %, n = 7). In contrast, articles focusing on high-energy storms, which is the other most commonly researched climate impact in this review, discuss justice much more frequently (86 %, n = 25). This demonstrates a distinction in how science and adaptation are being done when considering coral reefs as opposed to high-energy storms. This disparity may reveal how the management of coral ecosystems as a form of climate change adaptation de-centers people in the U.S. territories. This research may ignore the marginalization of local communities and treat this form of adaptation research as solely dealing with nature outside of its relation to the people who interact with and depend on these ecosystems (Barker, 2018; Morikawa and Palumbi, 2019; Palumbi et al., 2023). Often, when coral reef adaptation studies discuss the role of local communities, it is in relation to the pressures caused by fishing or how local management practices can be used to support more robust marine protected areas without considering the justice implications of restricting fishing in certain locations or how enforcement may disproportionately harm certain groups of people (Lindfield et al., 2016; Maynard et al., 2015).

Distributive justice analyses are being done across multiple geographic scales, from articulating how small islands are disproportionately vulnerable to climate change impacts as compared to other parts of the world to demonstrating local disparities concerning wealth and access to resources between rural and urbanized communities on the same island (McGinley et al., 2022; Ramos et al., 2022). Procedural justice is also used as a frame in multiple contexts. Most commonly, this is done in the conduct of participatory research, including studies that conduct extensive interviews to understand local perspectives (Hein et al., 2019; West et al., 2018). Procedural justice is also used as a lens through which to analyze whether local voices are being adequately heard and incorporated into adaptation planning, policymaking, and implementation (Ruddock and Green, 2011; Rudge, 2021b). Recognition justice is often considered alongside distributive or procedural justice dimensions, as when researchers emphasize the rights of local communities and acknowledge that systems of marginalization are impacting their lives, they often discuss decision-making processes and distributive inequities as well (Aguon, 2010; Ruddock and Green, 2011; Cox and Cox, 2020; Mango et al., 2021). Articles drawing on recognition justice also often articulate the validity of supporting diverse cultural practices when undertaking adaptation processes, such as access to traditional fishing practices and maintaining traditional relations to forests (Peau et al., 2022; Serrano and Tapu, 2022; Weijerman et al., 2016).

Beyond these three common justice concepts, transformative and restorative justice are discussed far less often. The minimal discussion of transformative justice (25 %, n = 20) indicates a preference towards adaptation efforts that are more reformative or incremental, as opposed to ones that aim to challenge inequitable power structures and systems that reproduce marginalization. While non-transformative adaptation is not inherently insufficient, previous work has demonstrated how these more reformative forms of justice and adaptation may legitimize institutions that are causing injustice (Goodman, 2009). Frain makes this danger evident when critiquing processes of "blue capitalism," where actions ostensibly are taken to adapt by conserving ocean environments but are done through neoliberal practices like top-down privatization of resources and restricting exclusive economic zones, which reinforces the economic systems of extraction that are causing climate change (Frain, 2018).

In contrast, transformative justice is articulated in many ways, such as by emphasizing the intersections of education and action. This is evident in multiple studies that seek to leverage intergenerational solidarity, incorporate youth voices to transform climate change curricula, and support decentralized community initiatives as forms of adaptation that shift decision-making paradigms and are not dependent on established government institutions (Guannel et al., 2022; McGinley et al., 2022; Leckey et al., 2021). Another pertinent form of transformative justice and transformative adaptation is exercised through the fight for decolonization and sovereignty for current territories (Corbin et al., 2021; Frain, 2018; Serrano and Tapu, 2022; Schwebel, 2018).

Restorative justice is the least frequently discussed justice concept of the five that were analyzed in this review. Restorative justice requires a historicization of current harm and a form of adaptation that specifically addresses processes of the past and the marginalization they are continuing to produce. When restorative justice is discussed, authors emphasize communities' rights to exercise practices that their cultures used to relate to environments and adapt to climatic changes throughout history (Serrano and Tapu, 2022; Maldonado et al., 2021; Wongbusarakum et al., 2021; Marrero et al., 2022). In doing so, scholars and practitioners can help to restore power to Indigenous and local communities (Serrano and Tapu, 2022; Maldonado et al., 2021; Wongbusarakum et al., 2021; Marrero et al., 2022). Restorative justice frameworks also draw on more immediate temporalities, emphasizing the need to "return to normal" following climate change-induced disasters or to restore environments to their previous healthy state before pollution and exploitation (Frain, 2018; Na'puti, 2022; Sheller, 2018; Lopez-Marrero, 2010).

3.5. Indigenous knowledge

Indigenous knowledge is the least commonly discussed of the three major themes analyzed in this review. There is also a significant disparity between articles focusing on the Pacific territories versus the Caribbean territories, with the Pacific territories ranging from 40 % to 50 % of articles covering Indigenous knowledge and the Caribbean territories ranging from 14 % to 19 %. This presents a similar disparity to that found concerning restorative justice, which in the reviewed articles is generally associated with traditional and Indigenous practices.

Some articles that do mention Indigenous peoples and knowledge emphasize self-determination and how these communities are

still excluded from exercising basic human rights (Frain, 2018; Serrano and Tapu, 2022; Ruddock and Green, 2011). An additional way researchers discuss Indigenous knowledge is by demonstrating the value of traditional ecological practices in stewarding environments and creating resilience that is crucial for climate change adaptation. These practices draw on Indigenous values like radical interdependence, relationality, reciprocity, flexibility, and community self-sufficiency (Na'puti, 2022; Peau et al., 2022; Hunter-Anderson, 2010). Indigenous knowledge is also commonly discussed as something that is necessary to integrate with Western scientific information, which has been emphasized in Indigenous climate change studies across different geographies (Wongbusarakum et al., 2021; Whyte, 2017). This can be achieved by centering processes of knowledge co-production that are more collaborative, non-hierarchical, iteratively revised with input from diverse communities, and led by Indigenous values and visions for what adaptation futures should look like (Reano, 2020). In the context of islands, it can be particularly important to conduct adaptation practice and research that is informed by islanders' relationships to the oceans and their visions for how power and climate change interact with the seas and not just the land (Fair, 2020). Research has demonstrated the importance of relationships with seas in Indigenous islander cosmologies, legal rights to fishing and protecting marine ecosystems, voyaging, and more (Chang, 2016; Hau'ofa, 2010; Peau et al., 2022).

Researchers rarely discuss Indigenous cultural practices solely in a historical context without mentioning modern practices and significant implications (Yandle et al., 2020). Although some historically focused research on Indigenous knowledge comes from archaeologists studying responses to climate disasters. Rivera-Collazo et al. demonstrate how Indigenous communities in Puerto Rico adapted to flooding and high-energy storms thousands of years ago through processes of settlement relocation and landscape modification (Rivera-Collazo et al., 2015; Rivera-Collazo and Declet-Perez, 2017). They demonstrate that both of these strategies likely included consideration for culturally and spiritually important places and relied on customs and social priorities to make decisions, rather than focusing on natural threats as separate from social systems (Rivera-Collazo et al., 2015; Rivera-Collazo and Declet-Perez, 2017). Their work and others' emphasize how environmental colonialism has sought to de-emphasize Indigenous knowledge and the successful ways in which Indigenous peoples have adapted to climate change, even thousands of years ago (Rivera, 2022; Rivera-Collazo et al., 2015; Rivera-Collazo and Declet-Perez, 2017).

Lastly, it is important to address and explain the disparities between the Pacific territories and the Caribbean territories with regard to the consideration of Indigenous knowledge. In Guåhan, the NMI, and American Samoa, Indigenous knowledge is mentioned quite frequently at rates of 50 % (n = 6), 50 % (n = 7), and 40 % (n = 2) respectively. Whereas in Puerto Rico and the USVI, only 19 % (n = 10) and 14 % (n = 2) of articles, respectively, discuss Indigenous knowledge. Conceptualizations of Indigeneity, race, and ethnicity vary greatly between the five U.S. territories, which have all been influenced by colonialism in different ways and have unique identities and relationships to traditional knowledge. One factor likely contributing to the disparity is that the majority of residents on each of the Pacific territories identify as a member of the Indigenous peoples of those islands (U.S. Census Bureau, 2020). While the Pacific territories faced genocide and violent dispossession through colonialism, their Indigenous populations presently make up a large proportion of the residents, which may contribute to the more frequent consideration of Indigenous knowledge in those locations. In contrast, along with genocide, the Indigenous populations in the Caribbean territories dwindled in proportion to African slaves and White settlers over centuries of colonialism. While many Indigenous communities survive and thrive in Puerto Rico and the USVI, the peoples living in these territories have a more internally contested relationship concerning Indigenous self-identification, which is not as prolific as in the Pacific territories (Feliciano-Santos, 2021).

4. Discussion

This review not only provides insight into the landscape of articles covering climate change adaptation in U.S. territories but also describes the reasons for and implications of the dearth of some ideas and the emphasis on others. The production of climate change adaptation scholarship and knowledge in this context must be understood as a political action that influences the practice of adaptation and either works to support or subvert normative, dominant systems of Western science and colonialism (Mahony and Hulme, 2018; Nightingale, 2017). This review began with the assertion that colonialism and political status, justice, and Indigenous knowledge are each important themes for adaptation research in U.S. territories to cover. Drawing on the literature in this review and the gaps that are still apparent I emphasize 4 issues that this field needs to more strongly engage with to address the core themes: (1) Geographic disparities in research production exist and need to continually be addressed, (2) local knowledge production should be encouraged because it enables Indigenous ontologies to be centered in adaptation, (3) more studies must integrate historical analysis of colonialism and political status together, and (4) adaptation research and practice must foster transformative justice.

First, the major disparities in the number of articles produced focusing on each territory reveal a great deal about what populations and geographies scientists, academic institutions, and funders see as most valuable. While Puerto Rico still faces incredible barriers and forces of marginalization much like the other territories, the disparity in research may be problematic for the attainment of climate change adaptation in the far less populous territories of American Samoa, Guåhan, the NMI, and the USVI. These geographic disparities in where research focuses reproduce the invisibility of climate harms, adaptation failures, structural injustices, and community-based solutions that are addressing these problems. This invisibility is deeply important for scholars of the U.S. territories to counter in particular, as these places are already marginalized due to their remote location away from the U.S.'s center of power, their "smallness" as islands, and their lack of support from the federal government (Hau'ofa, 2010; Immerwahr, 2020).

The disproportionately high number of articles coming from authors and institutions based in the contiguous United States can also reinforce the inequitable power dynamics that have produced climate change and marginalization of local and Indigenous knowledge systems in the territories. Research produced primarily from these colonial metropoles is less likely to be able to center locally produced and context-specific knowledge that is vital for equitable climate change adaptation research and practice (Okano et al., 2015). However, previous studies and this review have shown that climate change adaptation research produced by authors in the Global

South, including those based in small island developing states, has grown in proportion in recent years (Sietsma et al., 2021; Vincent and Cundill, 2022). By continuing to address these geographic disparities.

Second, knowledge production through community-based methods and Indigenous science aids in the progression towards anti-colonial climate change science and the decolonization of adaptation practice with an emphasis on the importance of locally driven knowledge production (Johnson et al., 2022). Scholar and poet Julian Aguon writes on how members of climate change-impacted communities like his in Guåhan understand the challenges they are facing, “We have no need for scientists to tell us things we already know like the sea is rising and the water is getting warm” (Aguon, 2022). This insight is a deeply important reminder that local knowledge is fundamentally important to any understanding of climate change impacts and to the development of effective adaptation knowledge and practice. Local-focused climate plans integrated with traditional knowledge, like that created by the Micronesian Conservation Trusts, have been able to make up for the gaps in understanding local perspectives that are common in larger-scale plans produced by institutions like the National Oceanic and Atmospheric Administration (Okano et al., 2015). By encouraging and opening space for Indigenous ontologies to be at the forefront of adaptation in U.S. territories, scholars and practitioners can deviate from the foundation that Western science has in marginalizing “other” perspectives and favoring an objective, modernized “one-world” viewpoint (de la Cadena and Blaser, 2018; Law, 2015). Rather, acknowledging Aguon’s statement, external researchers can seek to support communities where relevant rather than tell them how to adapt.

Third, the way that colonialism has historically acted to diminish Indigenous adaptation knowledge is deeply important to understand, but the omission of current political status while doing so leaves out a necessary critique of current systems of marginalization under the United States (Rivera, 2022; Whyte, 2016). By reckoning with the different articulations of colonialism and non-self-governing political statuses, climate change adaptation researchers can more holistically and accurately represent the threats communities are facing and the resistance they are generating related to structures that produce climate change and hinder the forms of adaptation they desire. Addressing the restrictive nature of territorial political status is important to achieving self-determination and therefore research and practice that aims to truly address procedural justice would benefit from considering transformative adaptation on the scale of dismantling non-self-governing colonial relationships (Bordner et al., 2020).

Last, this re-emphasizes that transformative justice requires greater attention. As stated previously, it is apparent that climate change adaptation research on U.S. territories needs to grapple with myriad ideas that require greater historicization, particularly surrounding the histories and ongoing processes of colonialism and their relation to the marginalization and genocide of Indigenous peoples and attempted epistemicide of their knowledge systems (Santos, 2016). Transformative justice is required to address these structural harms and ongoing processes of marginalization that are deeply connected to climate change and adaptation. This is not addressable by siloed adaptation actions alone and requires the re-shaping of power relations (Newell et al., 2021). In the context of climate change in the U.S. territories, transformative justice requires reckoning with different paths toward self-determination that local communities could pursue to challenge their inequitable relationship with the U.S. federal government because as it stands, they cannot shape adaptation in their own vision. When considering justice for American Samoa, Guåhan, the NMI, Puerto Rico, and the USVI, the role of the state in maintaining climate vulnerability and climate injustice must be addressed (Corbin et al., 2021). This requires grappling with the foundational legal structures put in place by the externally imposed legislative acts governing the territories, their ongoing asymmetrical power relations with the federal government, and the standing racialized *Insular Cases* that explicitly articulate that the territories and their residents are “alien” others (DeLima, 1901; Downes, 1901; Ponsa-Kraus, 2022). While there are differing viewpoints from local communities in the different territories on whether these cases should be overturned and whether they should pursue statehood, independence, or maintain their status, a transformative climate justice approach to adaptation must acknowledge these foundational processes creating the context in which adaptation is taking place, and therefore analyses and practices must change to address that.

5. Conclusion

This review analyzed peer-reviewed studies researching climate change adaptation in the U.S. territories of American Samoa, Guåhan, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. In addition to describing important insights from the small but growing body of research at this intersection, I demonstrated whether and how researchers are grappling with the three themes of colonialism and political status, justice, and Indigenous knowledge. While justice is frequently discussed, the theme of colonialism and political status is less commonly used, and Indigenous knowledge is rarely used. The disparities between these themes reveal what researchers and adaptation practitioners are currently valuing and what areas need to be further emphasized to ensure equitable climate change adaptation in the U.S. territories.

These islands and the communities that live on them are still subject to colonial control by the United States, which is fundamentally incompatible with climate justice and should therefore be challenged or at least considered by any researchers who advocate for climate change adaptation. For long-term adaptation to be successful in these territories and other islands and non-self-governing territories, the systems that historically and currently reproduce marginalization, injustice, and climate change must be transformed and replaced with structures that emphasize local and Indigenous self-determination concerning adaptation and all other decision-making processes.

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Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.envdev.2025.101353>.

Data availability

I have shared data as a supplementary file

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