Title: Researching natural hazards: the harmful legacy of colonialism in geoscience

Authors: Jazmin P. Scarlett

Affiliation: School of Environmental Science, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ

Email address: jazmin.scarlett@uea.ac.uk

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Abstract

Geoscience is a colonial science; its agenda was to survey and map landscapes in colonised nations which could be exploited to grow colonial empire's wealth at the expense of the local population. Natural hazard processes have been part of these landscapes, however their colonial legacy is sometimes neglected in discussions in how to live with them today. Former colonised nations' interactions with natural hazard processes are part of the legacy in geoscience that is ongoing. Geoscience's role in colonialism, interactions of colonial decisions and natural hazards with examples, and actions for the future will be explored.

Introduction

Geoscience is a colonial science; its agenda was to survey and map landscapes in colonised nations which could be exploited to grow colonial empire's wealth at the expense of the local population. Natural hazard processes have been part of these landscapes, however their colonial legacy is sometimes neglected in discussions in how to live with them today.

History and legacy of colonialism in geoscience

Although colonialism is supposedly historical, the ramifications are still felt. One aspect of this was the development of scientific disciplines, including Geoscience. It is often forgotten that Geoscience is considered a 'colonial science', which has been shaped by social and political issues and agendas of colonial expansion (Cartier, 2021). The imperial agenda was to survey and map landscapes, waterscapes, and natural resources in colonised and occupied lands by the various European colonial empires. This was done so that these lands and waters could then be exploited by the colonial powers to grow their own wealth at the expense of the local population (Driver, 1992; Stafford, 2017). Historically, local indigenous populations were intellectually and socioeconomically exploited to gain access and extract natural resources that benefitted the colonial powers, usually in violation of indigenous peoples cultural understanding and significance of a site to them (Whyte, 2016, 2018).

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Colonial legacy of surveying and mapping

Who benefitted (and still benefits) from the surveying and mapping of natural resources and land? It was part of the transfer of technical and specialist knowledge by European colonialism (e.g. Stone, 1987; Home, 2006; Atkinson, 2016) and a means to harmfully extract natural resources to increase colonial empire wealth (Byrnes, 1998; Garuba 2002). Many expeditions sought to document the landscape as a justification of who should live on and use the land, as well as using physical geography to designate the inferiority or superiority of human races that evolved in different landscapes (Pico et al., 2020). Today, the reasons are not as extreme however, surveying and resulting exploitation now takes the form of capitalism and transnational corporations. For example, the Diavik Diamond Mine in Canada was 'discovered' in 1992 and opened in 2003. However, there is a clear difference in socioeconomic status and inequalities of the settlers compared to the First Nations people in the area.

The British colonialists practice of surveying and mapping the volcanic fertile soil in areas that were originally "reserved" by the colonialists for the indigenous peoples in St. Vincent in the Caribbean led to obtaining land through encroachment, voluntary sale and military force. This eventually led to two civil wars (The First and Second Carib War) and the forcible removal of the Garifuna to present-day Honduras. These maps in turn led to the establishment of some of the largest sugar plantations on the island, using enslaved African labour to produce sugar, molasses and rum to meet the demands of the British Empire in what we now know is in the high-risk zone of the volcano La Soufrière. The establishment of these plantations that turned into settlements post-emancipation that endure today, and the forced land settlement leads to greater risk from a variety of natural hazards, including volcanic eruptions, landslides, flooding and tropical storms (Scarlett, 2020). However, colonialism and its harms are neglected in natural hazard research within geoscience.

Colonialism and natural hazards

Colonialism created a social hierarchy that marginalises particular social groups who are made vulnerable to natural hazards in a variety of ways, such as the limited accessibility to resources to recover from natural hazards events and disasters. Often, marginalisation forces those who are not as socially, economically and/or politically mobile into high-risk areas such as floodplains, due to marginalised/low productive land, uneven development, economic barriers and natural hazard susceptibility (Collins, 2009, 2010; Sultana, 2011). This creates an environment where 'resilience' building has also been created under – and are thus a reproduction of - colonial and post-colonial strategies (Cheek and Chmutina. 2021).

Many island nations are exposed to a wide range of natural hazards and traditionally, pre-colonial communities coped relatively well and remained resilient. Inter- and -intra community cooperation on the small Indonesian volcanic Archipelago islands of Siau Tagulandang Biaro for example, allowed for the sharing of food resources and for the knowledge exchange of adapting to volcanic and meteorological hazards (Rampengan et al. 2014). However, the processes of contact, colonisation, and independence caused many of the facets of resilience that once existed to decline. This is attributed to three processes:

1) The provision of relief food reduced the need to store famine food,

2) Diminished need to store food and the introduction of a cash economy and imported foods - colonial governments and missionaries worked to reduce the significance of traditional ceremonies and rituals that were viewed as “wasteful” or “un-Christian”,

3) As more cash crops were planted, the amount of land set aside for subsistence food production was reduced. Rotation periods dropped and, soil fertility decreased therefore leading to increased dependency on remittances and imports (Campbell, 2009).

These culturally embedded behaviours were developed over many cycles of experiencing natural hazards. However, the behaviours were undermined by colonists because they did not fit the ‘ideals’ of colonial behaviour, leading to financial, education and scientific knowledge shortcomings, which post-colonial societies struggle to overcome. The changed behaviours also mean that local people can be more affected by natural hazards. In the case of Peru, colonialisation diminished pre-Columbian cultural adaptations to earthquakes. Urban planning concentrated indigenous peoples in new settlements for the purpose of social control and indoctrination, within structures using inappropriate construction materials that made them more vulnerable (Oliver-Smith, 2016).

For geoscientists to effectively mitigate natural hazard processes today in a world where climate change is making these inequities worse, there needs to be more interrogation of the past – the connections between society and the changing of the environment.

The ideologies and philosophical framework of colonialism have been influencing our understanding of the environment and natural hazard phenomena, including the physical aspects of geohazards, without the inclusion of indigenous knowledges from people who lived in the environments and were experiencing natural hazard phenomena. For example, it was noted that despite deep Māori information and knowledge on earthquakes in Christchurch, Aotearoa New Zealand, their knowledge is eliminated from booklets and brochures (McBride, 2017), however there are increasing effects of Māori’s inclusion in urban recovery (Hobbs et al. 2022). Colonialism influences development as well as,

socioeconomic and political mobility, which in turn, influenced risk, exposure, vulnerability as well as, disaster response and recovery (Rivera, 2020; Gahman et al. 2021).

The indigenous population becomes invisible, their own knowledge and experience silenced and diminished for the benefit of advancing the 'debate' on Western sciences' own constructed knowledge systems (e.g. Pouchepadass, 1995; Ojala and Nordin, 2015). This creates a dichotomy of two different knowledge systems, and leads to the question: who gets to decide what is and is not 'useful' knowledge to understand the environments we research and live in?

Despite the examples given, it is important to acknowledge that the various ways colonialism impacts natural hazard risk varies from country to country, and there are many issues that are difficult to address.

Actions for the future

Colonialism continues to block local geoscientists from researching natural hazard phenomena that they live with. This is done by removing agency in their own knowledge and understanding of natural hazard phenomena, the lack of resources to train 'homegrown' geoscientists and to support the research of local geoscientists, who in some cases, must rely on the collaboration of overseas partners to access the funding. 'Western' geoscience has historically excluded different types of knowledge. But these excluded perspectives and voices would be just as, or even more so, valuable; this is highlighted by Feminist Standpoint Theory. The theory states that members of marginalised groups can become subjects and authors of knowledge that speak from a certain location, experience and standpoint (Harding, 2004; Arnot and Reay, 2007).

There are multiple approaches to address the colonial legacies in geoscience, such as through teaching, research, strong collaborations. One would be to implement teaching the next generations of geoscientists to break the cycle - to have courses, lectures and resources like Geocontext. *Geocontext* provides resources that integrate topics on racism, colonialism, imperialism, environmental damage and exploitation of natural resources into subjects commonly taught within geoscience programs. Whilst these resources are aimed for the US curriculum, inclusion of *Geocontext* studies can also be supported more broadly, especially since many geoscientists work overseas. This is starting to be addressed in the UK by acknowledging the lack of diversity in geoscience in scientific special interest groups, research and approaches to decolonising the geology curriculum (Gibson et al. 2020; Dowey et al. 2021; Rogers et al. 2021).

An additional approach is the acknowledgement that the historical development of geoscience and the people that conducted it, should no longer be separated and

importantly, that it is okay to change. For example, the University of Glasgow recently acknowledged and renamed a building originally named after the geologist John Walter Gregory, who documented the East African Rift (also known as the Gregory Rift), after learning he supported white supremacy and called for racial segregation (Horne, 2021). In depth work can be done not only on Gregory's contribution to geology, but also demonstrating the social and political contexts that shaped Gregory's views. This approach would be a way to introduce positionality in research conducted today.

Positionality is fundamental for a researcher to consider. Positionality requires the researcher to acknowledge and pinpoint their own views, values, beliefs, biases, and the social and political context of the study in relation to research design, process and interpretation of research findings. This has been important to consider in my research investigating the historical volcanic eruptions of La Soufrière on St. Vincent. Understanding my positionality as a researcher led me to find meaningful ways to include a diverse range of local voices in sharing their experiences and knowledge who in the past, had been neglected. I utilised Feminist Standpoint Theory to rebalance whose knowledge systems where present and absent, in understanding one of the most active volcanoes in the Caribbean. I was not just a scientist studying a place I had a distant connection to, but rather a scientist who could provide different perspectives to understand the historical and social context of living with a volcano in the Caribbean.

Another option is to recognise and avoid 'parachute' science (the practice of side-lining local researchers on field studies conducted in their own countries, Watson, 2021) by working meaningfully with local knowledge. The ideologies of colonialism ran deep and touched all aspects of society that are both tangible and intangible, and therefore require the same level of scrutiny into understanding how people have lived and continue to live with natural hazards. This is not to say that geoscientists must now also be social scientists and historians, but instead develop equitable partnerships from research inception and design, especially in natural hazards research – involve local social scientists and historians who have local knowledge in the creation of hazard and risk assessments.

There is also the opportunity to learn from indigenous and cultural knowledge in living with natural hazards. For example, there is an interconnectivity among human, non-human and the metaphysical in making sense of disasters in Zamboanga Peninsula, Southern Philippines (Quilo et al. 2015). While indigenous knowledge of earthquakes in Indonesia has led to adaptation of house construction that have endured for centuries (Kurnio et al. 2021). These examples and more, have seen a mixture of success from research into implementation however, if to be incorporated into the postcolonial society, they will require

a large cultural shift and retrofitting of infrastructure that may not be possible for some countries at present.

It may be easy to dismiss colonialism as something that 'happened in the past'. But for many people living in once occupied locations, it is generational trauma that cannot be so easily forgotten, as there is a continued perpetuation of colonialism. Being complicit to these knowledge systems touched by white supremacy and imperialism is violence. There is no shame in acknowledging the tainted roots of our disciplines and there should be celebration in wanting to do and be better, as that is a benefit for all, not just the privileged few.

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