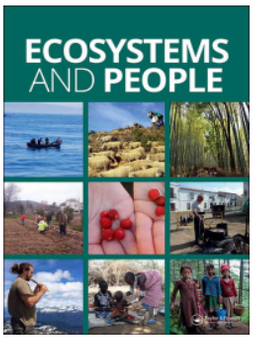

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LETTER TO THE EDITOR

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Scale in studies of pre-colonial forests: a reply to Armstrong et al.

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In their recent paper, Armstrong et al. (2023) presented a historical-ecological study of the Gitselasu village of Gitasaex in Laxyuubm Ts'msyen, northwestern British Columbia, highlighting pre-colonial land use by the Indigenous peoples of the Pacific Northwest (PNW), including the creation of local forest gardens.

We were surprised by the reference to our paper (Oswald et al. 2020a) in this paragraph from their Introduction (other references removed):

> A final challenge to overcome is that settler-colonial narratives about Indigenous peoples' land-use tend to either erase or minimize the legacies of people within their lived environments. For example, in global land-use literature, some scholars hold that Indigenous peoples had little to no effect on their lived landscapes (Oswald et al. 2020a) or that they generally exhausted and degraded it. Increasingly, and with thanks to Indigenous teachers and researchers, these previously attributed (and racist) tropes have been thoroughly debunked.

We fully reject this characterization of our scholarship as 'racist' and as 'eras[ing] or minimiz[ing] the legacies' of the Indigenous peoples of southern New England (SNE). Amid their otherwise useful contribution, Armstrong et al. (2023) misrepresent the findings of our study, trivialize the significant diversity of human-environment interactions across space and time, and undermine our good-faith efforts to inform land management in SNE with interdisciplinary, retrospective science. Moreover, as was the case with an earlier critic of our work (Roos 2020), Armstrong et al. (2023) fail to recognize the agreement of their findings with ours: while Indigenous subsistence activities occurred throughout our study areas for millennia before European arrival, the ecological impacts of those activities were primarily local in scale.

Oswald et al. (2020a) tested the long-standing hypothesis that, prior to European colonization, the Indigenous peoples of SNE exerted regional-scale ecological impacts via burning, forest clearance, and intensive agriculture (e.g. Day 1953; Cronon 1983). Our analyses of paleoenvironmental and archaeological records from numerous sites across the region lead to a consistent interpretation of the pre-colonial landscape: closed-canopy forests of long-lived tree species dominated upland areas, which are known in SNE Algonquian oral histories as *táuohkómuk* or 'wild lands' (Cachat-Schilling 2018); variations in climate drove changes in forest composition and fire; and Indigenous societies were widespread and highly adaptable, shifting activities seasonally within well-established homelands, but without engaging in broad-scale deforestation. In the seventeenth century, European colonists began to clear forests, purposefully creating openland vegetation for farming and grazing across the region.

Oswald et al. (2020a) identified climate as the primary driver of ecological change at the regional scale (~100s of km^2) and over millennia, but we did not state or conclude that Indigenous peoples 'had little to no effect' on the landscape, as falsely asserted by Armstrong et al. (2023). In fact, we highlighted cultural activities at > 1800 archaeological sites across SNE and described multiple fine-scale ecological impacts, including hunting, fishing, plant gathering, horticulture, and fire (see maps and text on page 243). Such impacts occurred at the local (<10 km^2) 'scales at which people lived' (Roos 2020), but were not pervasive at the regional scale (Abrams and Nowacki 2020). These findings may be at odds with the 'settler-colonial narratives' relied upon by Day (1955), Cronon (1983), and others (e.g. Abrams and Nowacki 2020; Entrup and Calijouw 2022), but they are consistent with many studies of SNE paleoecology, archaeology, and biogeography (e.g. Chilton 2010; Tulowiecki et al. 2022), and with SNE Algonquian oral histories (e.g. Cachat-Schilling 2018, 2023).

The scale issue, which seems to be central to the misunderstanding of our analysis (Roos 2020; Oswald

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et al. 2020b), also applies to the PNW. Postglacial variations in climate were also the primary driver of long-term, regional-scale changes in PNW ecosystems (e.g. Hallett et al. 2003, Giuliano and Lacourse 2023), including the western hemlock forests in which the forest gardens described by Armstrong et al. (2023) are embedded. The fact that climate drove ecological changes at the broad scale does not 'erase or minimize the legacies of people within their lived environments' (Armstrong et al. 2023). Numerous paleoecological, archaeological, and ethnographic studies, including work by Armstrong and colleagues, demonstrate the myriad ecological impacts of pre-colonial Indigenous societies in the PNW. On some landscapes burning by Indigenous peoples was likely important (e.g. Walsh et al. 2015), especially to promote culturally important plants, including camas (e.g. Lepofsky et al. 2005). Fire likely favored Garry oak communities in some areas (e.g. Pellatt and Gedalof 2014). However, those impacts were generally local in scale, as Oswald et al. (2020a) found to be the case in SNE.

This is not to say that the findings of local ecological impacts (Oswald et al. 2020a; Armstrong et al. 2023) apply globally, as Indigenous peoples clearly had diverse and substantial impacts in other parts of the world. In Meso-America, for example, ancient Mayan peoples transformed the landscape, utilizing deforestation and agriculture to support a large, urban population (e.g. Canuto et al. 2018). Even within eastern North America we can see how human-environment dynamics varied across space and time given differences in natural resources and human agency. In inland parts of the region, the Haudenosaunee cleared forests with fire, farmed maize intensively, and lived in large, sedentary villages for at least the few centuries before European arrival (e.g. Snow 1996). In SNE, in contrast, horticulture supplemented the great diversity of food resources obtained from upland, freshwater, estuarine, and marine ecosystems. That the Indigenous peoples of SNE and the PNW did not practice widespread forest clearance does not disaffirm the longevity, continuity, and complexity of those societies (e.g. Chilton 2010).

The value in understanding the scale and variability of Indigenous peoples' ecological impacts extends well beyond academia. As Oswald et al. (2020a) explained, the long-standing misinterpretation of pre-colonial human impacts on SNE landscapes has resulted in modern conservation and land management strategies centered on human disturbance and prioritizing species of plants and animals that require open vegetation, which only became widespread in the centuries following European arrival. While many public and private land stewards have adjusted their thinking and strategies to align with the region's ecological history and in recognition of the many benefits of mature forests, some land managers continue to utilize mechanized harvesting and forest clearance, prescribed fire, and herbicide treatments under the misguided assertion that such approaches mimic Indigenous land use (e.g. Entrup and Calijouw 2022). We encourage Armstrong and colleagues to continue their important work on the history and legacies of Indigenous forest gardens in the PNW, but we urge them to reflect on the consequences of their framing for the collective efforts of our scholarly community to understand and appropriately steward the earth's diverse ecological systems (Figure 1).

Figure 1. Forest clearance by the Massachusetts Division of Fisheries and Wildlife (MassWildlife), as part of a ~ 200-ha 'barrens restoration project' in the Muddy Brook Wildlife Management Area, central Massachusetts, March 2020. MassWildlife commonly uses logging, prescribed fire, and herbicide treatments on public lands across Massachusetts, despite the fact that paleoecological records show closed-canopy forests prior to European colonization and deforestation (Oswald et al. 2020a). Photo by Chris Matera.

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