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Scales of Suffering in the US-Mexico Borderlands

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Abstract
Since the 1990s, US border policies have worked to funnel undocumented migration into remote stretches of the Sonoran Desert, where deadly terrain and temperatures make border crossing most dangerous. This weaponization of the desert finds some cover, we argue, behind the scalar projects of state-centered maps emphasizing vast geography and gross statistics over personal pain and trauma. Counter-mapping against these projects, we draw on archaeological and ethnographic data from the Undocumented Migration Project (UMP), and geospatial data for thousands of deceased migrants across southern Arizona, to witness how migration, as both socio-historical process and humanitarian crisis, emerges from human-scale strategies and experiences of suffering.

Keywords Undocumented migration · US-Mexico borderlands · Counter-mapping · Scalar projects

A thousand footprints in the sand / Reveal a secret no one can define
–Bruce Springsteen

Introduction

As we write in mid-2019, the United States, led by the Trump administration, continues to push a "zero tolerance" policy toward the unauthorized entry of migrants and

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refugees from Latin America—leading first to the separation of children from their parents, and now to the detention of entire families in privately-run prisons scattered across the southwestern US (Jordan and Nixon 2018). Although this policy violates international human rights law, including the Convention Relating to the Status of Refugees, signed by the US in 1968, there is no indication that the US federal government plans to relent from tactics designed to terrorize and ostensibly dissuade people from crossing the US-Mexico border. The political rationale for this policy is the false perception, promulgated by conservative news media and the Trump administration, that lax immigration enforcement allows gang members and terrorists to pour into the US from Mexico (USDHS 2018). Often describing immigrants and refugees as a "flood" (Strom and Alcock 2017), this discourse works to equate them with natural catastrophes that destroy lives and property on a tremendous scale. At the same time, this discourse is a scalar project: a few immigrants, like drops of rain, might be welcomed, but a seemingly innumerable mass of people, like rising flood waters, would need to be held back by whatever means necessary. The exaggerated *scale* of undocumented migration then gives (flimsy) cover to border policies that are both unlawful and inhumane.

The current "zero tolerance" policy is just the most recent expression of US border strategies deploying the threat of physical pain and psychological trauma to deter migrants from Latin America. Beginning in the mid-1990s, American cultural and economic anxieties, including fears about illegal traffic in drugs, firearms, and people across the US-Mexico border, prompted the development of new policies that eventually became known as *Prevention-Through-Deterrence* (PTD) (Andreas 2009; Dunn 2009; Nevins 2010). By investing in security infrastructure and personnel in and around urban ports of entry such as El Paso, Nogales, and San Diego, these policies aim to "funnel" undocumented migrants into the surrounding wilderness where the risks—extreme temperatures, rugged terrain, and cartel violence—would supposedly deter them from crossing into the US (Martínez et al. 2013; Rubio-Goldsmith et al. 2006). At first glance (Fig. 1), these policies appear to have achieved their stated goals: over the past three decades migrant apprehensions by the US Border Patrol have declined in the more urban San Diego, El Centro, and El Paso Sectors and increased in the more rural Tucson and Rio Grande Valley Sectors. And yet, a closer look at the context of these apprehension statistics, in addition to interviews with migrants themselves, clearly demonstrates that neither PTD policies (Massey et al. 2014) nor anti-immigrant discourse and mobilization (Martínez and Ward 2017) strongly influence undocumented movement, particularly when compared to broader forces of labor demand in the US, demographic changes in Mexico, and violence in Central America.

Whether or not US border policies actually influence rates of undocumented migration, they unquestionably have a number of costs, including a massive increase in federal spending on border enforcement (Andreas 2009), the loss of civil rights for American citizens living near the border (Seibert 2013), the degradation of the natural environment (Meierotto 2012), and a migrant death toll likely numbering in the tens of thousands (Cornelius 2001; Doering-White et al. 2017; Martínez et al. 2013; Rubio-Goldsmith et al. 2006). Thus, PTD policies *do* achieve their tacit goal of shaping the US-Mexico borderlands into a "space of exception," where the state works to suspend or ignore the rights of individuals, and especially the rights of undocumented migrants (Slack and Whiteford 2011; Sundberg 2015). As described by Roxanne Doty (2011),

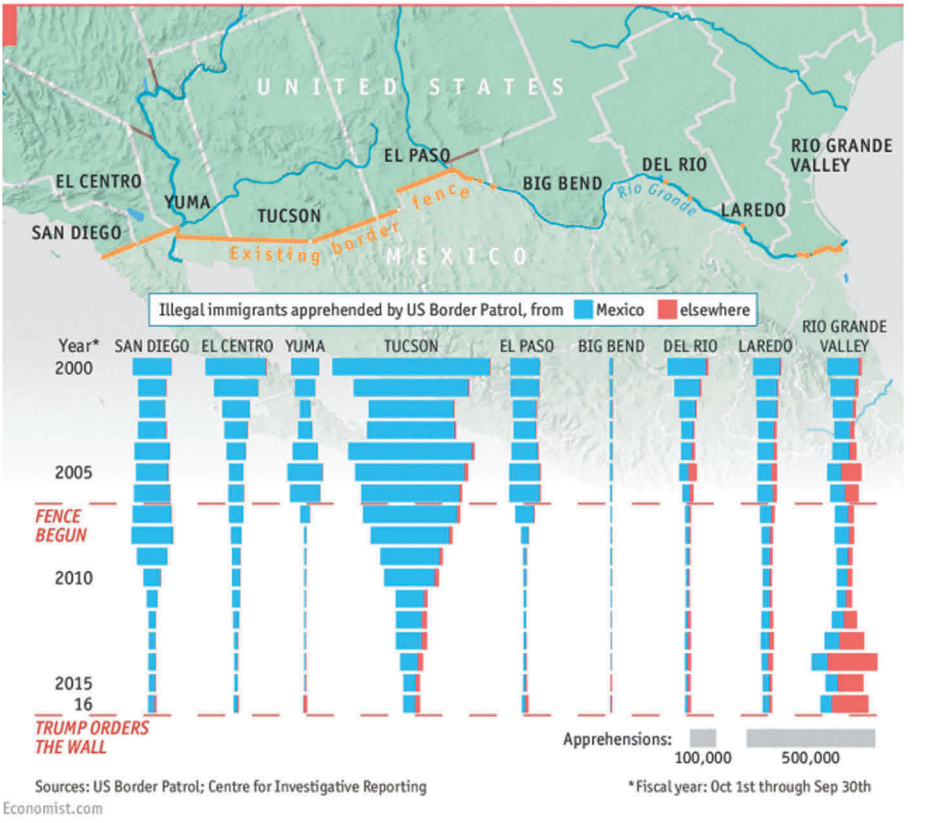

Fig. 1 A typical map representing the apprehensions by the US Border Patrol along the southwestern US border (Economist 2017)

these spaces provide a "moral alibi" for the US insofar as the high temperatures, rugged terrain, and hostile vegetation of the desert landscape become the agents of migrant suffering and death, while the trauma induced by US border security remains largely hidden from public view.

Building on these critiques, we argue that the structural violence of US border policies finds further cover through map-making as a sort of *scalar project*—defined as one in which social actors construct their worlds through "strategies that centrally involve manipulating accepted relations of scale so as to achieve particular ends" (Carr and Lempert 2016:11). For organizations such as US Customs and Border Protection, the policing of the US-Mexico border both develops and depends on systems of measurement, including counts of apprehended people and the spatial arrangements of migration routes and Border Patrol personnel and infrastructure (Chambers et al. 2019; Stewart et al. 2016). At a microscale, undocumented migrants often encounter these systems as one of the many oppressive forces whose physical, emotional, and/or psychological weight make for the subjective experience of suffering (see Pollock 2016). At the macroscale of US statecraft and politics, these systems belong to what James Scott (1998) calls a scientific ideology of control by simplifying and making legible an otherwise complex social process—namely clandestine border crossing. In

other words, the collection and publication of apprehension statistics, particularly as maps, ultimately works to scale from migrants, and their experiences of suffering, to a gross "body count" more palatable to the general public and the politicians who vote on funding for federal agencies. Of course, maps and other media can then be spun into the scalar projects of politicians themselves through the language of migrants "flooding" into the US from Latin America.

In this paper we examine how scalar projects of map-making intersect with the PTD policies, physical terrain, and surveillance infrastructure organized to harm and kill migrants in the US-Mexico borderlands. We begin with a discussion of political power in the mapping of national borders and international migration, as well as the growing use of counter-mapping techniques to challenge such knowledge/power configurations. After exploring some critical issues of scale in counter-mapping, we draw on the archaeology of contemporary migration in southern Arizona to chart some of the routes—and ambiguities—through which individual experiences of border crossing do or do not "scale up" to long-term processes of migration and a humanitarian crisis of thousands dead and missing. In so doing, we emphasize the complex ways in which maps and other scalar projects both produce and hide the role of the Sonoran Desert as a weapon of structural violence against migrants.

Scalar Projects: Mapping and Counter-Mapping Undocumented Migration

Maps are scalar projects *par excellence* insofar as they inherently move from on-the-ground realities to depict broader spatial patterns: the trees can be labelled as a forest. But map scaling is not an entirely objective process. First, scale strongly shapes our ability to conceptualize and study the social processes underlying spatial patterns in the world (Harvey 1968). A map depicting archaeological sites across a region often calls our attention to social processes unfolding at broader spatial and temporal scales than a map depicting the distribution of artifacts within a single site. Second, the choices made in map production, including scale, are bound up with the exercise of power (Harley 1989; Wood 2010)—a feature of scalar projects more broadly in which "some positions and perspectives are privileged at the expense of others as scales are institutionalized" (Carr and Lempert 2016:9). This is nowhere clearer than in state-sponsored maps of borders and borderlands which authorize claims to vast territorial sovereignty at the expense of the people residing in and moving back and forth across these spaces (Tazzioli 2015).

Figure 1 is a typical map representing undocumented migration across the US-Mexico border in the news media. The map ostensibly aims to evaluate how border fencing impacts migration from Latin America by presenting gross apprehension statistics for each of the nine US Border Patrol Sectors, as well as natural (e.g., Rio Grande) and human-made (e.g., border fence) boundaries. Quite obviously, the scale of the map emphasizes the perspective of the United States over that of any local community or person. Border cities such as Nogales and El Paso are not shown, and the lives and troubles of millions of undocumented migrants are condensed into 153 blue and red histogram bars. For American publics and politicians, the scale of this map plays into narratives equating undocumented migration with a catastrophe to be contained through greater investment in infrastructure, such as a border wall. Moreover, the graphics work to dehumanize people while sanitizing policy, a strategy that has

proven successful in other violent white-collar contexts (see Cohn 1987). What the scale of this map conceals, and thus silences, is the suffering of migrants that ultimately results from US border infrastructure and policies labelled in such a seemingly benign way: *Fence Begun*.

How can we more effectively expose the relations of power hidden within maps of the US-Mexico border? One strategy is to simply "flatten" these scalar projects by discussing the borderlands as a network or assemblage of dynamic relations among diverse human and nonhuman actors (e.g., Marston et al. 2006). Geoffrey Boyce (2016), for example, adopts a post-humanist perspective to examine how the physical geography of southern Arizona undermines high-tech border policing efforts, such as the SBInet "virtual fence" (Fig. 2), and the human actors behind them (also see Sundberg 2011). Ieva Jusionyte (2017) draws on ethnographic research to reveal how tactical infrastructure of the US Border Patrol, including fences and checkpoints, work to normalize migrant suffering as "accidental" injury, and thereby enlist emergency responders as additional agents of border enforcement across southern Arizona. Most broadly, De León (2015) tacks between the evolution of PTD policy and infrastructure in southern Arizona, the accounts of migrants, and the material traces of their suffering to demonstrate how US border enforcement works to weaponize the Sonoran Desert in an ongoing "war" on migration.

A parallel strategy that we develop here draws on recent trends in critical cartography to engage in *counter-mapping* of the US-Mexico borderlands (Walsh 2013). Following a seminal essay on "deconstructing the map" by John Harley (1989), a number of geographers have set out to explore methods for visualizing and mobilizing spatial data in ways that undermine dominant power structures enforced by institutional maps (e.g., Harris and Hazen 2006; Wood 2010). Counter-mapping techniques are particularly useful where disenfranchised groups reject imposed geographies and develop their own maps and visualizations to stake claims on land rights, resource access, and historical narratives (Bryan and Wood 2015; Peluso 1995). Importantly, these techniques do not simply critique the use of geospatial technologies in bolstering projects of the state (Neocleous 2003); they actively involve local knowledge to foster alternative forms of understanding, visualizing, and producing space—a theoretical and practical move that mirrors recent archaeologies of the contemporary past (e.g., González-Ruibal 2008).

As noted above, clandestine migration takes place and makes place across heterogeneous, elusive, and shifting geographies mediated by the infrastructures of border control and state-level governmentality and by the strategies and disruptions of migrants themselves (Casas-Cortes et al. 2017; Tazzioli 2015). Meanwhile, state-sponsored representations of migration often rely on a violent simplification of these geographies, in part through the production of macro-scale maps that naturalize borders and erase the experiences of individuals and communities (see Edney 1994 and Harley 1992 for examples from colonial projects). In response, counter-mapping can help to make visible the otherwise invisible effects of authority, including the physical harm and psychological trauma meted out by immigration policies and border security practices (Casas-Cortes et al. 2017; Tazzioli 2015; Walsh 2013), otherwise hidden behind the raw numbers of apprehension statistics.

Counter-mapping also demands that we question the very possibility of representing these effects in a straightforward manner because the suffering of undocumented

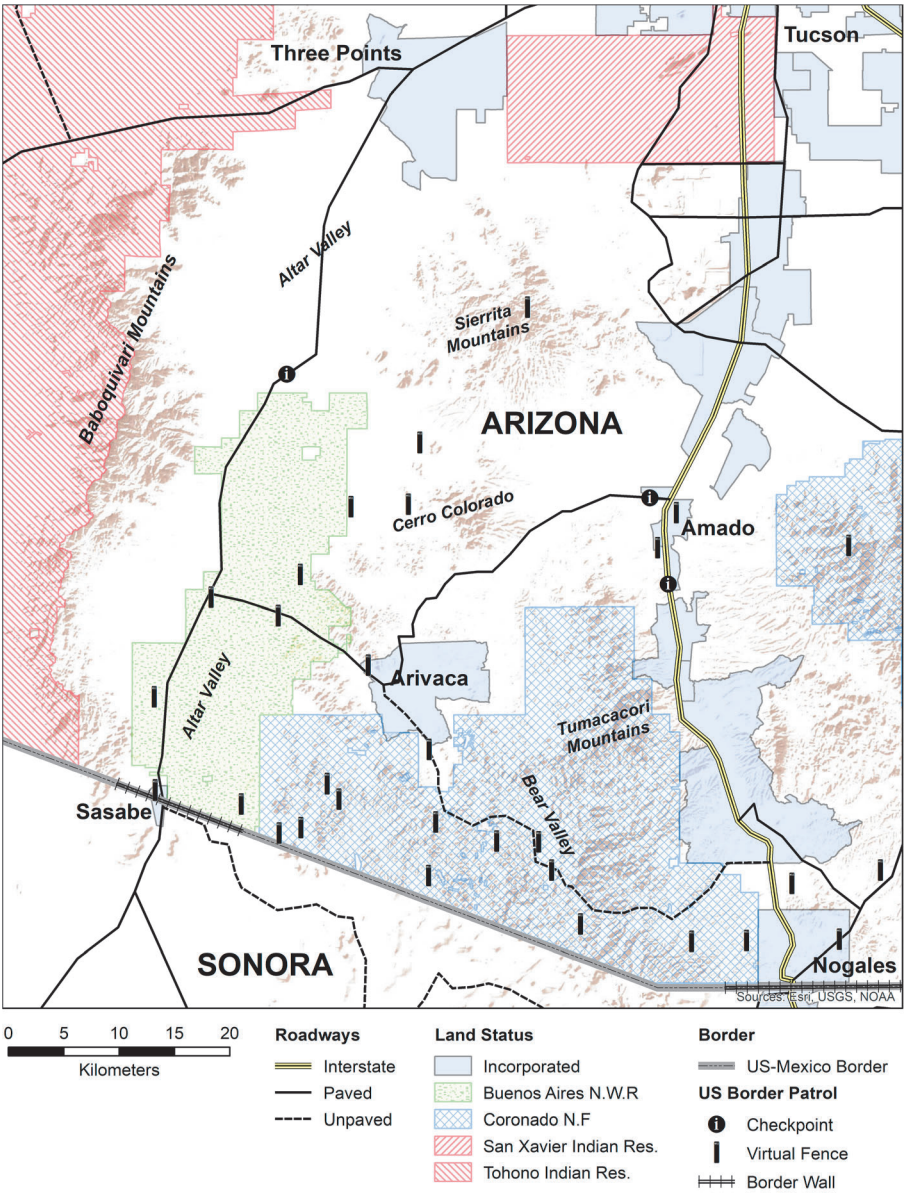

Fig. 2 Map of the Nogales-Sasabe corridor (UMP study area) in southern Arizona

migrants will always far exceed the scalar abstractions inherent to cartography (see Tsing 2012 for a discussion of "nonscalability"). This means attending to the intimacy of suffering as nested within (and caused by) various scalar projects, while recognizing that no single map nor single scale can wholly redress the gaps and elisions in state-centered representations of migration. This is not simply an issue of countering macro-scale data with micro-scale data, or of using personal narratives to undercut the power of statistics to support a scientific ideology of control. As Tazzioli (2015:12) argues,

"counter-mapping engages in the effort of not fixing in advance the spatial units and spatial scales on which migrants act." So while we must be attuned to the spatial data and scales mobilized in state-sponsored cartographies, our critiques should deploy diverse methods and data to explore alternative scales and the frictions between them.

Our counter-mapping of the US-Mexico borderlands ultimately moves to expose the structural violence normalized by the scalar projects of authoritative maps. We propose to pursue this complex, reflexive, and multi-scalar endeavor through an archaeological approach drawing on the intimacy of narratives and the materiality of objects. Over the past decade, archaeologies of the contemporary world have proven useful for critical social analysis through the study of artifacts and sites that structure and are structured by our everyday interactions, and at the same time materialize social processes unfolding at broader spatial and temporal scales (González-Ruibal 2008; Harrison and Breithoff 2017; Harrison and Schofield 2010; Holtorf and Piccini 2009). Archaeological data, when put in dialogue with ethnographic accounts, offer a practical basis for counter-mapping because they generally lie outside the official cartographies of state-making projects, and because they materialize social realities and relations simultaneously at multiple scales, even when these scales are in tension with one another. Archaeology thus allows us to move back and forth between individual suffering and broader social processes to both highlight and challenge the weaponization of macro-scalar maps (and other representations) of the US-Mexico borderlands in the context of American immigration policies and policing.

Deadly Terrain: Undocumented Migration in Southern Arizona

Our counter-mapping efforts are part of the Undocumented Migration Project (UMP), a long-term research program using ethnography, archaeology, visual anthropology, and forensic science to study clandestine migration as a somatic experience and social process (see De León 2015). Regionally, we focus on a corridor of unauthorized travel between the official ports-of-entry at Nogales and Sasabe in southern Arizona where the Sonoran Desert has become unevenly inscribed with the material traces of undocumented migrants, drug smugglers, Border Patrol agents, local citizens, humanitarian volunteers, environmental activists, armed vigilantes, and, now, anthropologists. Against the backdrop of this complex landscape, we aim to cast light on the simultaneous suffering and agency of migrants—or what Slack and Whiteford (2011) call "post-structural violence." We consider both the harmful effects of PTD policies and the dynamic resilience of people crossing through the Nogales-Sasabe corridor, all in relation to global political economic forces and patterns of violence across the US and Latin America.

Geographies of Deterrence and Death

The Nogales-Sasabe corridor (see Fig. 2) features a physical geography of jagged mountain ranges, sun-parched valleys, and aggressive fauna and flora. It also features a state geography of surveillance infrastructure, implemented by PTD policies over the past two decades, whose purpose is to further expose migrants to these hazards. Supported by advanced geospatial technologies such as satellite imagery and GIS (e.g., Latek et al. 2012), this infrastructure includes the strategic deployment of steel

fencing around Sasabe and Nogales, three Border Patrol checkpoints on paved roads in and out of the region, and a series of virtual fence towers centered on the town of Arivaca (Boyce 2016; Newell et al. 2017; Nieto-Gomez 2016). Additional measures include the deployment of Predator B drones and increasing numbers of Border Patrol agents to heavily monitor the most accessible routes through this corridor. Together, the Sonoran Desert and surveillance technology form a common strategy of border enforcement recorded by anthropologist Rocío Magaña (2008: 37–38) in a candid interview with a Border Patrol agent:

> [Border Patrol] have a tactic in which they let the migrant walk. They let him walk for two or three days so he would suffer hunger and heat. They have them very well localized, they know where the crossers are. [And they say,] "Well, this [crosser] is going to be there, he is going to walk for two to three days. I am going to go home and sleep; tomorrow, when I come back, I'll get him underneath a tree while he is tired or waiting. I am not going to need to chase him. Why? Because he is not going to run, the migrant is already too tired." I'm telling you . . . two to three days. They have it well studied. They know when they are going to pick them up, they know the area and know where [the crossers] are going to try to get into. They have everything very well monitored.

Of course, these security interventions do not stop unauthorized border crossing insofar as they face the natural resistance of the desert landscape (Boyce 2016) and the strategic resilience of migrants themselves (e.g., Cornelius and Salehyan 2007; De León 2012; Newell et al. 2017).

What then *are* the effects of these PTD interventions? According to US Customs and Border Protection (2018a), migrant apprehensions along the 281 miles (450 km) of border in the Tucson Sector, which includes the Nogales-Sasabe corridor, increased more than fourfold between the advent of the PTD policy known as Operation Safeguard in 1994 (139,473 apprehensions) and a peak in 2000 (616,346 apprehensions). These numbers have steadily declined following an economic recession in 2008 and a shift in migration to the Rio Grande Valley in south Texas (Massey et al. 2014), but the number of apprehensions in 2018 (52,172) suggests that the Tucson Sector continues to be the second most heavily trafficked avenue of unauthorized entry into the US (but see Andreas 2009 for a critical discussion of these statistics).

Much grimmer is the total number of migrant deaths recorded in the Tucson Sector between 1998 and 2018. US Customs and Border Protection (2018b) puts this count at 2785 people, but the *Coalición de Derechos Humanos* (2018), a non-governmental organization in Tucson, compiles data from Arizona county officials, as well as the consulates of Mexico, Guatemala, El Salvador, Honduras, and Brazil, to provide a more accurate count of 3199 (see also Ortega 2018). And yet, this figure no doubt *underestimates*, perhaps dramatically, the number of people killed each year by the Sonoran Desert in the service of US border policies (Martínez et al. 2013). For example, several UMP experimental studies on the taphonomy of euthanized pigs demonstrates how quickly the environmental conditions of southern Arizona can skeletonize the bodies of migrants and scatter their belongings (Beck et al. 2015). As a result, we anticipate that the migrant death toll will only become more accurate, and thus more horrific, as geospatial technologies and forensic techniques for recovering and identifying the dead

continue to improve. Moreover, the skeletonization of bodies in the desert, and the subsequent undercounting of migrant deaths, is itself a question of the interplay between scale and natural processes. Searches for missing migrants lack the resources (or the inclination of the Border Patrol) to find and recover any remains smaller than a complete human body.

Along with these taphonomic processes, we would argue that map-making, including decisions about scale (e.g., see Fig. 1), tacitly works to "get rid of the bodies" left by US border enforcement policies and practices. Attracting public scrutiny to this humanitarian crisis, the volunteer organization Humane Borders (2018), in collaboration with the Pima County Medical Examiner's Office, maintains an online database of more than 3,000 migrant deaths in southern Arizona from 1998 to the present. A searchable map interface, the Arizona OpenGIS Initiative for Deceased Migrants, allows the public to view the discovery date and location for each migrant body and, if known, their name, sex, age, and cause of death (Table 1). Humane Borders also uses this database to publish a series of map posters informing migrants about the lethal risks of border crossing and the availability of water stations (Fig. 3). Recently, the Undocumented Migration Project has drawn on this database to create a global exhibition

Table 1 Summary of the causes of death for undocumented migrants recovered in the Nogales-Sasabe corridor (Humane Borders 2018)

Cause of death	Years			Total
	2001–06	2007–12	2013–18	2001–18
Environmental Exposure	***108***	***93***	***19***	***220***
Heat Exposure	92	72	17	181
Dehydration	1	8		9
Cold Exposure	9	3	2	14
Unspecified	6	10		16
Bodily Injury	***25***	***24***	***2***	***51***
Blunt Force Injury	15	7		22
Gunshot Wound	8	14	1	23
Other Injury / Homicide	2	3	1	6
Disease	***6***	***5***	***1***	***12***
Diabetes	1			1
Heart Disease	5			5
Other Disease		5	1	6
Accident	***4***	***1***	***1***	***6***
Motor Vehicle Accident	4			4
Drowning		1		1
Drug Overdose			1	1
Undetermined	***43***	***113***	***65***	***221***
Skeletal Remains	7	62	59	128
Undetermined	36	51	6	93
Total	**186**	**236**	**88**	**510**

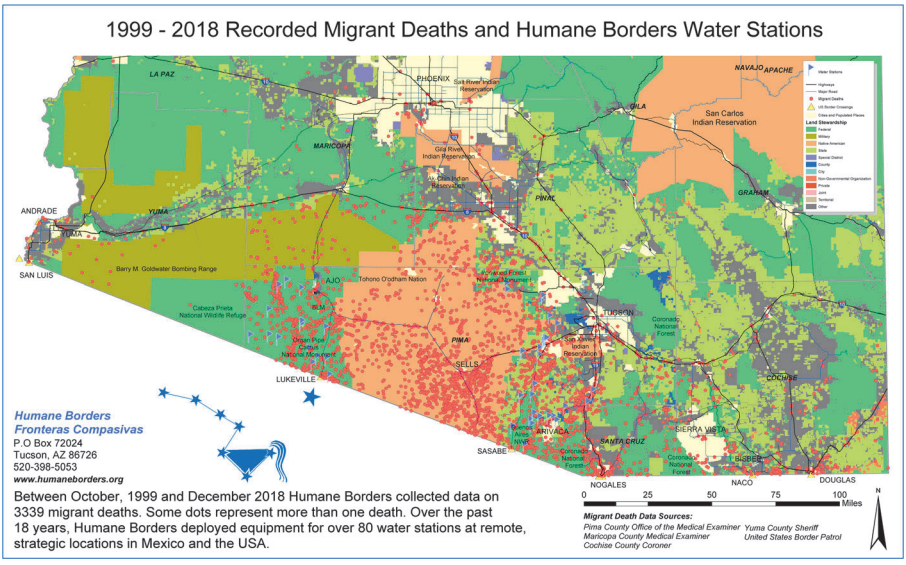

Fig. 3 Humane Borders (2018) poster illustrating the migrant death toll in southern Arizona; cartographic design and data development by John F. Chamblee, Michael Malone, and Matthew Reynolds

called "Hostile Terrain 94" that creates 3D maps of the Arizona border with hand-written toe-tags geolocated in the location where bodies were found (www.hostileterrain94.org). These cartographic practices, in critical contrast to many maps drafted by federal agencies and news media, offer the public an accessible view of scaling between the pain and death of individuals and the humanitarian crisis unfolding along the US-Mexico border.

A number of recent studies further undermine PTD policies' "moral alibi" by demonstrating their culpability in the spatial production of violence against border crossers (Boyce et al. 2019; Chambers et al. 2019; Giordano and Spradley 2017; Lawrence and Wildgen 2012; Slack et al. 2016; Soto 2018; Soto and Martínez 2018; Stewart et al. 2016). Relying largely, though not exclusively, on the Humane Borders database, these studies use an array of geospatial tools (e.g., least cost paths, cluster analyses, kernel density analyses) to chart the combined "funnel effects" of border security infrastructure pushing migration routes into the most hazardous desert terrain where people face a greater risk of injury and death. Importantly, the maps of these results help to illustrate the regional contexts of migrant suffering, and thus challenge the scalar projects of state-centered maps that paper over the weaponization of the Sonoran Desert by PTD policies. At the same time, they raise questions about the ethical implications of publishing spatial analyses that could aid border enforcement agencies or armed nativist groups, and also the challenge of representing migrant pain and trauma in ways that do not necessarily end in death. Moving forward, we propose a more explicit engagement with counter-mapping to scale between the complex geography and human experience of US border enforcement strategies, and to critique the limits of cartographic projects (including our own) to portray undocumented migration.

Toward an Archaeology of Migrant Suffering

Human experiences of undocumented border crossing through southern Arizona are, of course, as diverse as the border crossers themselves, but common themes include physical pain and psychological trauma, as well as resilience, in the face of extreme hardship (e.g., Annerino 2009; Urrea 2004). For example, one of us (De León) undertook ethnographic interviews in Nogales and Altar (northern Mexico) from 2009 to 2013 with numerous migrants who explained how they prepare mentally, physically, and materially for the desert and how they experience emotional and bodily harm during and after a crossing event (see De León 2015). These accounts offer a powerful portrayal of undocumented migration at the microscale of individual lives, but their affective power does not easily "scale up" to the millions of people represented in apprehension and death statistics from the Tucson Sector (see Slovic and Slovic 2015).

Drawing on our fieldwork with the UMP, we propose to bridge these scales through a counter-mapping project that brings ethnographic accounts together with the archaeological study of objects lost or discarded by migrants *en route* through the Sonoran Desert. Because these artifacts are shaped both by global forces of commoditization and standardization and the intimate local practices that individuate them (e.g., Kopytoff 1986), they materialize the multiscalar engagements of migrants with the desert, with security infrastructure, and with political-economic processes at play in the US-Mexico borderlands (De León 2012). This is not to present these migrant belongings as the subjects of structural violence (Fowles 2016), but rather to "let suffering speak" (as best we can) through the ambiguity of object narratives framed by contexts of pain and oppression (Pollock 2016). Scaling outwards, an archaeological approach to these migrant artifacts can, we suggest, help to evoke the personal experience of suffering within the broader social processes and humanitarian crisis of undocumented migration across southern Arizona.

From 2009 to 2013, the UMP recorded more than 30,000 contemporary artifacts during archaeological survey and surface collection in the Nogales-Sasabe corridor. Some of these objects are personal possessions, but most are migrant-specific technologies developed to meet the contradictory goals of surviving a trek across the Sonoran Desert (ranging from three days to two weeks) and evading the US Border Patrol and nativist paramilitary groups (De León 2012, 2013; De León et al. 2016). For example, people typically wear dark-colored clothes and carry black water bottles to provide camouflage; these then increase their risk of heat-related illness and death. Migrants also carry modest-sized backpacks laden with water, salt-rich foods, and first aid items to mitigate against dehydration and injury, though these supplies are never enough for walking distances of 50 miles (80 km) or more through the desert. Many also bring a toothbrush, deodorant, and other hygiene products to clean up and "blend in" after they are picked up by human smugglers in the US (De León et al. 2015). Individually, the biographies of these artifacts bear witness to ethnographic tales of border-crossing: use wear (e.g., breaks and tears, sweat and blood stains) speaks to the pain endured by people who wore and carried them across the desert, while modifications (e.g., repairs, inscriptions) speak to the agency of migrants within this space of exception.

Collectively, these artifacts enable the UMP to situate the microscale experiences of migrants within the macroscale processes of political economy and structural violence unfolding across southern Arizona. A trend towards the standardization of migrant

clothes, backpacks, bottles, and food wrappers, for example, underscores the consolidation of cartels, human smugglers, and vendors into a powerful techno-industrial complex profiting from migration through Nogales, Altar, and other towns in northern Mexico (De León 2012). Meanwhile, the accumulation of these artifacts at contemporary archaeology sites across the Nogales-Sasabe corridor (Fig. 4) opens a window onto the spatial strategies of undocumented migrants and their unseen interactions with US Border Patrol agents, drug smugglers, humanitarians, environmental activists, and even ourselves as anthropologists. The artifacts from 341 locales recorded by the UMP during systematic survey from 2010 to 2013 enable us to distinguish between isolated finds, US Border Patrol turn-offs, humanitarian water drops, and migrant camps, rest areas, pick-up sites, and shrines (Gokee and De León 2014). The distribution of these sites in turn reveals how migrant routes have shifted into more remote areas in response to PTD strategies over the past two decades (Stewart et al. 2016). What remains to be seen is how the physical terrain and security infrastructure of the borderlands together mediate—that is, do the (dirty) work of scaling—between the personal experience and social process of migration.

To answer this question, our counter-mapping efforts move between US border policies, the spatial ideology and implementation of these policies in southern Arizona, and the lived experiences and material strategies of undocumented migrants themselves. Importantly, these scales are not arbitrary; they derive from ethnographic accounts and archaeological traces of border crossing documented by the UMP. Our following analysis thus moves to connect personal narratives with material signs of death and suffering, specifically human remains and aid-related artifacts, across the deadly terrain of the borderlands.

Suffering in Context: The Sonoran Desert

Building on our previous efforts to counter-map the geography of US border enforcement (Stewart et al. 2016), we first draw on open-access spatial data and satellite

Fig. 4 A small migrant pickup site near Cerro Colorado (UMP 2013)

imagery to scale between the individual experiences and social processes of undocumented migration in the Nogales-Sasabe corridor. Specifically, we model two aspects of the landscape most remembered by migrants as sources of pain and suffering—ruggedness and vegetation. After integrating these models into a GIS database, we consider how they relate to the migrant camp, rest, and pickup sites we surveyed in 2010–13 and the migrant deaths recorded in this region (see Table 1). While we draw on the same geospatial technologies used by the US Border Patrol to weaponize the Sonoran Desert, we reflexively acknowledge the limitations engrained within these technologies. Our goal is neither to poke holes in state-centered maps, nor to fill in their gaps, but rather to develop our own multi-scalar approach that evokes the interplay between structural violence and suffering without doing further harm to migrants themselves. Accordingly, we limit the public dissemination of our data, including maps of surveyed sites, for fear of their use by vigilante groups operating in southern Arizona.

Ruggedness

The variable topography of the Nogales-Sasabe corridor (see Fig. 2), as elsewhere across southern Arizona, defines several routes more and less amenable to clandestine movement (see Chambers et al. 2019; Lawrence and Wildgen 2012). For example, the wide bottom of the Altar Valley (800–1,000 m elevation) in the west gradually descends from an official port-of-entry at Sasabe on the US-Mexico border towards the suburban edge of Tucson, while winding trails through the rugged peaks of the Tumacacori and Sierrita Mountains (1,600–1,900 m elevation) parallel I-19 in the east. Of course, two decades of investment in border security infrastructure, including metal fences, surveillance towers, and roadside checkpoints now "funnel" migration into these latter, more dangerous, routes (Boyce et al. 2019; Soto and Martínez 2018; Stewart et al. 2016). This is not to deny the agency of migrants, but simply to acknowledge they are stuck in a double bind as explained by two informants (Fig. 5) during an interview with De León:

> *Jason:* Do you think you learned some stuff on that third crossing before this one?
> *Lucho:* Yeah, we learned a lot.
> *Memo:* Walk off the trails as far as you possibly can.
> *Lucho:* You need to put yourself into the most difficult places that you can where people can't get to. You understand? Where there are lots of trees, mountains, rocks . . . off the trail. That's where you need to go. If you walk in the easiest places, they will catch you quick.
> *Jason:* But that's gotta be harder for you guys.
> *Lucho:* More difficult, but more difficult for them too.

The difficult terrain described by Memo and Lucho contributes directly to migrant injury and exhaustion (Jusionyte 2017), but it also acts as an accomplice to the extreme temperatures of the Sonoran Desert, where daytime highs can dip to a near-freezing 40 °F (5 °C) in December and soar to more than 110 °F (43 °C) in June and July. Simply put, mountainous routes take longer to hike, so they increase migrant exposure

Fig. 5 Mountain climbing in the US-Mexico borderlands (Photo by Memo)

to these temperatures and the fatal risks of dehydration and heat-related illnesses. Indeed, these latter are the single most common cause of migrant death in the Nogales-Sasabe corridor from 2001 to 2018 (see Table 1). The high number of "skeletal remains" and "undetermined" cases also points, in part, to the discovery of migrant bodies in ever more difficult-to-access places, where taphonomic processes have more time to obscure the proximal cause of death (see discussion in Martinez et al. 2013).

For mapping the treacherous physical geography of the Nogales-Sasabe corridor, and its potential role in migrant suffering, we adapt the "ruggedness index" developed by Boyce et al. (2019) to measure the cumulative cost of traversing the Sonoran Desert landscape in terms of three variables: steepness, jaggedness, and temperature. (We consider vegetation as a separate variable for reasons discussed below). Using ArcGIS 10.5 (ESRI), we first processed four tiles from the ASTER Global DEM v2 released by METI/NASA to model elevation in 30-m cells across the UMP study area. We then transformed these elevations into a percentage surface slope to model the steepness, and thus exponential difficulty, of hiking across each cell. Second, we calculated the range of slopes within a 90 × 90 m window around each cell to model the relative jaggedness of local terrain, following the assumption of Boyce et al. (2019:27) that abrupt changes in steepness are more difficult to traverse than gradual ones. Third, we used ENVI 5.3 (Harris Geospatial) to model land surface temperature by applying a split-window algorithm (Du et al. 2015) to Landsat 8 OLI-TIRS imagery from June 19, 2016—a time of year when desert temperatures, and the rate of migrant deaths, reach their highest levels. Finally, we normalized these variables and combined them into an index estimating the "ruggedness" of terrain along a scale from 0 to 100 in 30-m cells.

As illustrated in Fig. 6, this index helps us to visualize the Nogales-Sasabe corridor as a context of migrant suffering, particularly as US border enforcement policies and infrastructure have pushed migration into more treacherous routes over the past two decades. From 2001 to 2006, for example, the bodies of migrants were largely found in areas of lower ruggedness throughout the Altar Valley and the basin stretching between

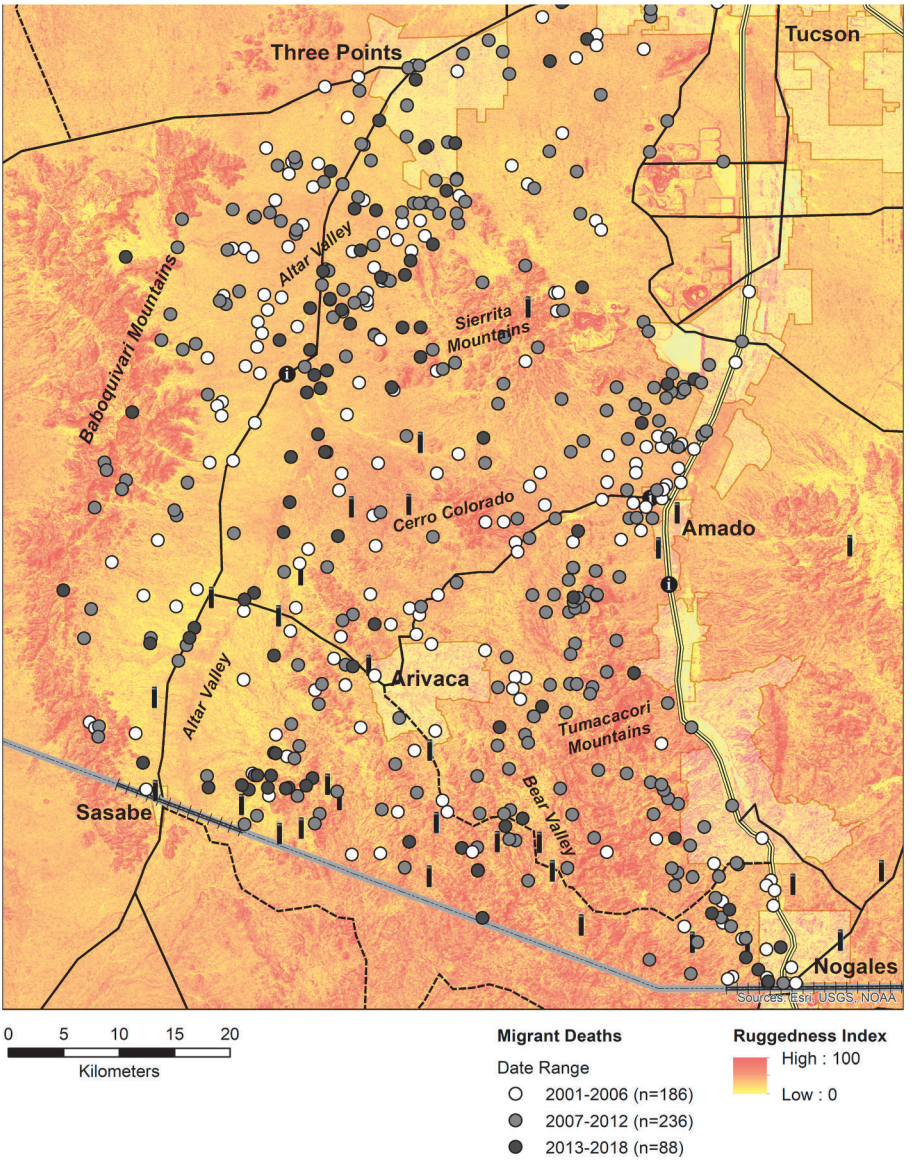

Fig. 6 Map of normalized ruggedness index and migrant deaths (2001–18) in the Nogales-Sasabe corridor

Arivaca and Amado (Table 2). From 2007 to 2012, migrants continued to die in these areas, but also increasingly in the higher elevations and steep slopes of the Tumacacori Mountains northwest of Nogales. Of course, the remoteness of these areas means that many more of the bodies of people who die there may never be found. From 2013 to present, the number of migrant deaths at lower elevations has grown, particularly along the eastern side of the Altar Valley, though these continue to occur in more remote and rugged locations than they did in 2006. One complicating factor, however, is the lack of public access to federal lands, such as the Buenos Aires National Wildlife Refuge and

Table 2 Summary of mean (μ) and standard deviation (σ) for ruggedness index and land cover classes within a 500-m radius of migrant death sites recorded by Humane Borders (2001–18) and migrant sites surveyed by the UMP (2009–13)

Site type		Ruggedness		Vegetation									
				Semi-Desert Grassland		Semi-Desert Scrubland		Shrubland		Woodland		Urban & Developed	
	n	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
Migrant Deaths	***510***	***35.40***	***3.33***	***43.9***	***37.1***	***39.3***	***38.8***	***2.3***	***9.5***	***9.3***	***18.6***	***4.7***	***16.6***
2001–2006	186	35.04	2.83	42.0	38.1	44.6	40.5	2.6	11.0	4.2	10.9	6.2	20.8
2007–2012	236	35.98	3.78	43.6	36.1	35.0	36.8	2.5	9.7	14.1	22.6	4.3	14.5
2013–2018	88	34.64	2.78	48.8	37.6	39.3	39.3	1.6	4.0	7.5	17.1	2.1	9.7
Migrant Sites	***165***	***37.55***	***3.62***	***48.1***	***24.8***	***27.0***	***15.6***	***2.1***	***2.1***	***22.2***	***18.6***	***0.3***	***4.1***
Camp Site	81	38.82	3.32	44.5	22.7	24.6	12.8	0.7	0.7	29.9	16.2	0.0	0.0
Rest Site	36	38.66	3.47	41.3	23.6	26.7	12.0	2.4	2.4	29.6	16.0	0.0	0.0
Pickup Site	48	34.59	2.31	59.4	26.0	31.5	21.0	4.2	4.2	3.8	8.9	1.1	7.7

the Barry M. Goldwater Air Force Range (see Figs. 2-3). This limits the discovery of migrant bodies, results in skewed maps of the cumulative death toll, and makes some areas appear "safe" for migrants, even when people have been dying there for decades (see Annerino 2009). Indeed, our UMP surveys have found camp and rest sites from 2001 to 2013 in areas more rugged, on average, than those with confirmed deaths (see Table 2), thus demonstrating that migrants often encounter, and likely suffer, terrain even more dangerous than the places where they die.

Vegetation

The flora of the Sonoran Desert can alternatively aid or impede migrants crossing the Nogales-Sasabe corridor. Tree and shrub foliage, for example, can provide some cover from the midday sun and from surveillance by the Border Patrol. In fact, most of the migrant sites located by the UMP were concentrations of artifacts lying beneath mesquite, pine, and scrub oak trees, and some sites even had shelters made of interwoven branches (Grabowska 2016). However, the desert is also home to numerous cactus and sedge species whose sharp or spiny leaves easily rip through the shoes, clothes, and skin of border crossers, particularly while walking at night with limited visibility. For these reasons, we consider vegetation as a variable separate from ruggedness (compare with Boyce et al. 2019).

Our mapping of the vegetation makes use of the openly available National Gap Analysis Program Land Cover V2 dataset (USGS 2011), which classifies 30-m cells according to the National Vegetation Classification System. Although the Nogales-Sasabe corridor encompasses 13 vegetation macrogroups associated with differences in climate, geology, and hydrology, we have lumped these into five broad land cover classes, each with a different impact on foot travel through the Sonoran Desert:

1) *Semi-Desert Scrubland* is characterized by moderate groundcover (10–50%) of diverse evergreen or drought-deciduous shrubs, such as mesquite and creosote, and xeromorphic and succulent species of cactus, agave, and yucca. This light canopy offers little daytime shade, while a continuous floor of shrubs and cacti are almost impossible to avoid while walking day or night.
2) *Semi-Desert Grassland* is characterized by warm-season (C4) grasses interspersed with groves of drought-deciduous shrubs (<10% ground cover) and xeromorphic and succulent species, such as cactus, agave, and yucca. This sparse canopy offers less shade than Semi-Desert Scrubland, and more of the shrubs and cacti that impede walking by day or night.
3) *Shrubland* is characterized by an open to moderate canopy (10–50%) of evergreen shrubs (< 3 m tall) dominated by scrub oak, mountain mahogany, manzanita, and mesquite. Seasonal washes and seeps also host willow and juniper bushes. A low canopy offers less daytime shade than woodland, but fewer cacti and agave can make for easier walking at night.
4) *Woodland* is characterized by an open to moderate canopy (10–60%) of deciduous broad-leaved trees, such as scrub oaks, and evergreen conifers, such as junipers and Ponderosa pines. The canopy offers modest daytime cover from the sun and surveillance, though ever-present succulent shrubs and cacti can be difficult to avoid at night.
5) *Urban and Developed* land cover includes irrigated agricultural fields and vegetation disturbed or introduced by houses, roads, quarries, and so forth. For undocumented migrants, these areas may pose the least physical danger for walking, but they also increase the risk of surveillance and capture by the US Border Patrol.

Mirroring some of the patterns observed for ruggedness from 2001 to 2018, the relative distribution of land cover classes around migrant death sites (Fig. 7) shows a gradual movement away from urban and developed areas and, to a lesser extent, shrubland (see Table 2). At the same time, the greater proportion of woodland near the 2007–12 death sites likely corresponds to the surge in PTD strategies designed to channel migration through more difficult routes in the Tumacacori and Sierrita Mountains. Most of the migrant camp and rest sites recorded by the UMP were in use during this period, and these likewise reveal a preference for woodland and semi-desert scrubland environments where a loose canopy of scrub oak, pine, and mesquite offers some shade and camouflage, despite the more rugged terrain. The hundreds of deaths in mountainous areas, however, prove that the limited shade of Sonoran foliage is by no means sufficient for offsetting the risks posed by hiking for longer periods of time on difficult slopes. Moreover, denser vegetation can impede the recovery of migrant bodies, thus prolonging their exposure to the destructive environmental processes of animal and insect scavenging.

Signs of Suffering: Aid-Related Artifacts

The move to scale up, from individual accounts to the macroscale analysis of migrant mortality rates in the Sonoran Desert, comes with its own uncertainties and frictions. Not least is the implicit equation of migrant suffering with the finality of death. For every recorded body in southern Arizona, there are hundreds of thousands of people who survive the border crossing each year (Martinez et al. 2013), while also

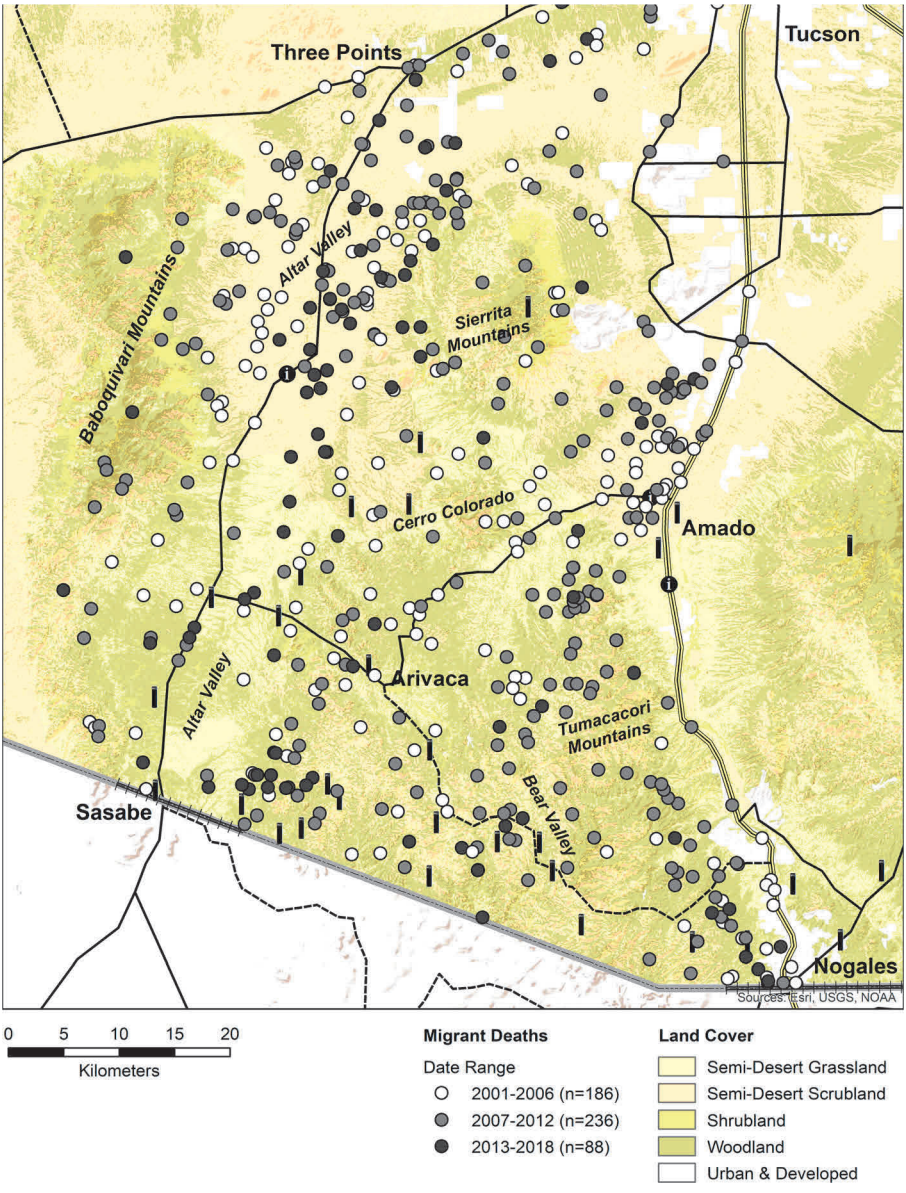

Fig. 7 Map of land cover classes and migrant deaths (2001–18) in the Nogales-Sasabe corridor

experiencing the same dangerous desert terrain. How can we evoke their suffering, too, as we counter-map against the political and news media maps drawn at the scale of these gross statistics?

One answer, as we outlined above, is to engage with the material traces of suffering left by migrants in the desert. Archaeologist Susan Pollock (2016) argues that the objects entangled with people in moments of physical pain and psychological trauma offer a way to express these experiences as suffering, and then to critically reflect on and fight against the social structures responsible for this violence. Although these objects come with their

own ambiguities—Who used them and why? How did they enter the archaeological record?—this allows them to "let suffering speak" in ways that evade the production of objectified knowledge, and a consequent feeling of indifference (Pollock and Bernbeck 2016: 30). Similarly, we suggest that migrant artifacts, as ambiguous signs of suffering, can help us to scale between lived experiences in the desert and the objectified knowledge of apprehension statistics and state-centered maps that ignore these experiences to hide the ever-growing humanitarian crisis along the US-Mexico border.

Pain and Perseverance

Migrant artifacts, including dark clothes, water bottles, and related gear sold in Mexican border towns such as Altar, are all bound up with the experience of suffering in the US-Mexico borderlands (De León 2012, 2013; Grabowska and Doering-White 2016). For this counter-mapping exercise, however, we focus on the bandages, ointments, and pills purchased by migrants to offer various forms of first aid and pain relief. Because most of these items are small and lightweight, individual choices about what to purchase are often based on cost and personal experience from previous crossing attempts or mandated by the cartels and guides (*coyotes*) controlling any given route. In many cases, they also reflect personal histories of chronic illness (e.g., asthma, diabetes) or age- and sex-specific health issues (e.g., birth control, vaginal infection). The nuance or mystery of what these artifacts can tell us about individual and collective suffering means listening to migrants who have used them to persevere over pain in the desert. For example, the experiences of Lucy, a woman in her 30s, reveal how first-aid items relate to personal trauma in a sea of shared misery:

> *Interviewer*: How much water did you bring?
> *Lucy*: I had three bottles that held 1.5 liters of water and three *sueros* [electrolye beverages marketed for infants]
> *Interviewer*: And was that in powder or liquid form?
> *Lucy*: No, *suero* in a bottle.
> *Interviewer*: Did you bring any first aid items? Like any medicine or bandages?
> *Lucy*: I had pills
> *Interviewer*: For what?
> *Lucy*: For pain, for... well when I took the pill when my legs were really hurting it made them hurt less.
> *Interviewer*: What is your worst memory from the desert?
> *Lucy*: Well, it was when I was dying. Because of the water. They gave us dirty water. Water from a lagoon, like where horses drink. We got dirty water there. And then when we drank it and it made us dizzy…I don't know what it did to me… When I started to walk again, I felt very bad and I could not walk anymore…[W]e were so tired and…I couldn't sleep the whole night. My leg was hurting so much that I couldn't sleep. And I didn't sleep for one night and one day.

As material traces of suffering by Lucy and millions of others in the Sonoran Desert, the first-aid supplies and pharmaceuticals discarded at migrant sites (Fig. 8) can speak to the ways in which the pain and injury intersect with the geography of US border

Fig. 8 Aid-related artifacts from a migrant backpack documented by the UMP (2012)

enforcement. During survey in the Nogales-Sasabe corridor, the UMP collected 591 of these aid-related items from 64 different sites, though most artifacts came from migrant pick-up sites (61.3%), camp sites (23.1%), and rest sites (7.7%). Our archaeological study of these artifacts began with deceptively simple task of classifying them. First-aid artifacts, for our purposes, are those carried specifically for treating physical injuries; these include gauze and adhesive bandages, plastic braces, and rubbing alcohol bottles. Although we note that food, beverages, and nicotine products can all ease pain and hunger, we consider pharmaceutical artifacts to be all those associated with substances applied or ingested to treat a disease or pain; these include plastic medicine bottles, blister packets, and tubes of ointment. Following this initial sort, we employed an attribute-based approach to describe these aid-related artifacts according to variables such as container type (e.g., bottle, pill packet, box), active ingredient, brand name, and use and depositional wear (e.g., lid present/absent, dosage, original quantity, remaining quantity). For pharmaceutical products, we consulted an online database (WebMD 2017) compiling information from Micromedex, Cernum Multum, and Wolters Kluwer. Here we identified the therapeutic effects associated with their active ingredients, and then classified them according to a modified version of the Anatomical Therapeutic Chemical Classification System (WHO 2012). We classified those drugs with two or more therapeutic effects (e.g., cold medicine) according to their marketed use.

Altogether, these aid-related artifacts (Table 3) offer us a glimpse of the role that health issues play in the strategies and experiences of migrants walking for several days across the Sonoran Desert. Anti-infective agents ($n = 71$) included tubes of ointment for treating Athlete's Foot, minor cuts, and abrasions acquired while walking for several days across rugged terrain. Analgesic agents were mostly pills with anti-inflammatory ingredients ($n = 171$), such as aspirin, acetaminophen, and caffeine, for managing pain and achy muscles. These also included EENT (ear, eyes, nose, and throat) preparations ($n = 41$), such as over-the-counter cold medicines whose active ingredients combine to suppress allergies, relieve pain and inflammation, and combat drowsiness—all of which may help push the body to its limits when crossing the desert. Along with these

Table 3 Summary of aid-related artifact types systematically collected from migrant sites in the Nogales-Sasabe corridor

Artifact Type	N	Use	Examples
First-Aid Supplies			
Adhesive Bandage	12	Stop blood loss from lacerations	Band-Aid wrapper
Gauze/Fabric Bandage	37	Stop blood loss from abrasions or stabilize sprained limbs	Gauze role, Tenser bandage
Anti-Infective Agents			
Antibacterials	45	Treat bacterial infections	Ampicilin, Chloramphenicol, Trimethoprim
Antiseptics	26	Treat fungal and other microbial infections	Clotrimazole, Ethyl alcohol
Analgesic Agents			
Anti-Inflammatory Drugs	171	Relieve pain and inflammation	Acetaminophen, Aspirin, Diclofenac, Ibuprofen, Naproxen
EENT Preparations	41	Relieve pain and symptoms of cold and flu	Agrifen, Sedalmerck, Tabcin
Other Agents			
Anticonvulsants	3	Prevent seizures	Carbamazepine
Psychotherapeutics	1	Treat the clinical symptoms of depression and mental disorders	Diazepam
Dermatological Agents	9	Treat acne and other skin conditions	Roaccutan
Antidiarrheals	7	Treat excessive diarrhea	Lomotil
Antiemetics	22	Treat nausea, vomiting, and motion sickness	Dramamine, Pepto-Bismol
Histamine H2-Antagonists	12	Treats ulcers, indigestion, and gastritis	Ranisen
Antihistamines	2	Relieve allergy symptoms	Chlorpheniramine
Cardiovascular Drugs	1	Lower blood pressure and reduce the risk of heart failure	Captopril
Other/Unknown	201	Unidentified	

pharmaceuticals, a number of adhesive and gauze/fabric bandages ($n = 49$) documented the treatment of minor lacerations, blisters, and puncture wounds on the one hand, and more serious abrasions, lacerations, and/or sprains on the other.

Though fewer in number, those pharmaceuticals for treating heart disease, seizures, depression, extreme acid reflux, diabetes, and asthma allude to health and fitness issues that some individuals must overcome above and beyond the injuries and exhaustion inflicted by the desert. What's more troubling is that migrants cannot necessarily predict how the physical stress of walking several days through this landscape will expose or aggravate their pre-existing health conditions, sometimes with lethal consequences. For example, two of us (De León and Stewart) encountered the body of a 31-year-old Ecuadorian woman, Maricela Zhagui Puyas, while on survey with UMP field school students in 2012. An autopsy by the Pima County Office of the Medical Examiner later revealed that she likely died from a combination of hyperthermia and a pre-existing kidney condition.

Suffering and Scale

Where the intimate experience of suffering can be difficult to put into words (Pollock 2016), the remains of bandages and pharmaceuticals can help to evoke the very real pain of someone crossing the US-Mexico borderlands. Collectively, they also offer a material pathway for scaling between individual stories and experiences and the

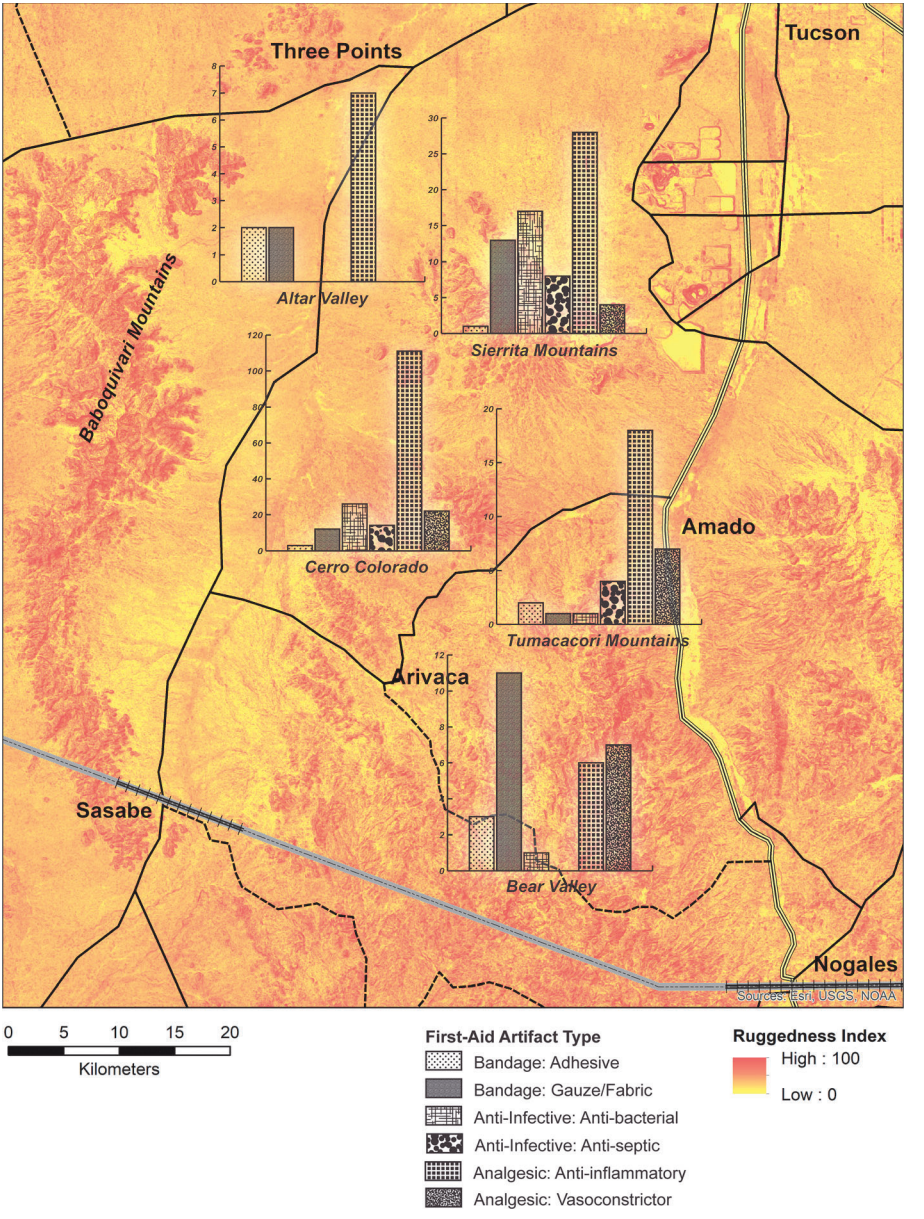

Fig. 9 Map of normalized ruggedness index and aid-related artifacts documented in zones surveyed by the UMP (2009–13) in the Nogales-Sasabe corridor

broader (and brutal) physical and social landscape of undocumented migration directly shaped by US border policies. The intimacies and collectivities congealed in migrant artifacts then make possible the "counter" in our counter-mapping project, which hinges on our ability to move between the macroscale of border-length maps and the microscale of harrowing personal accounts.

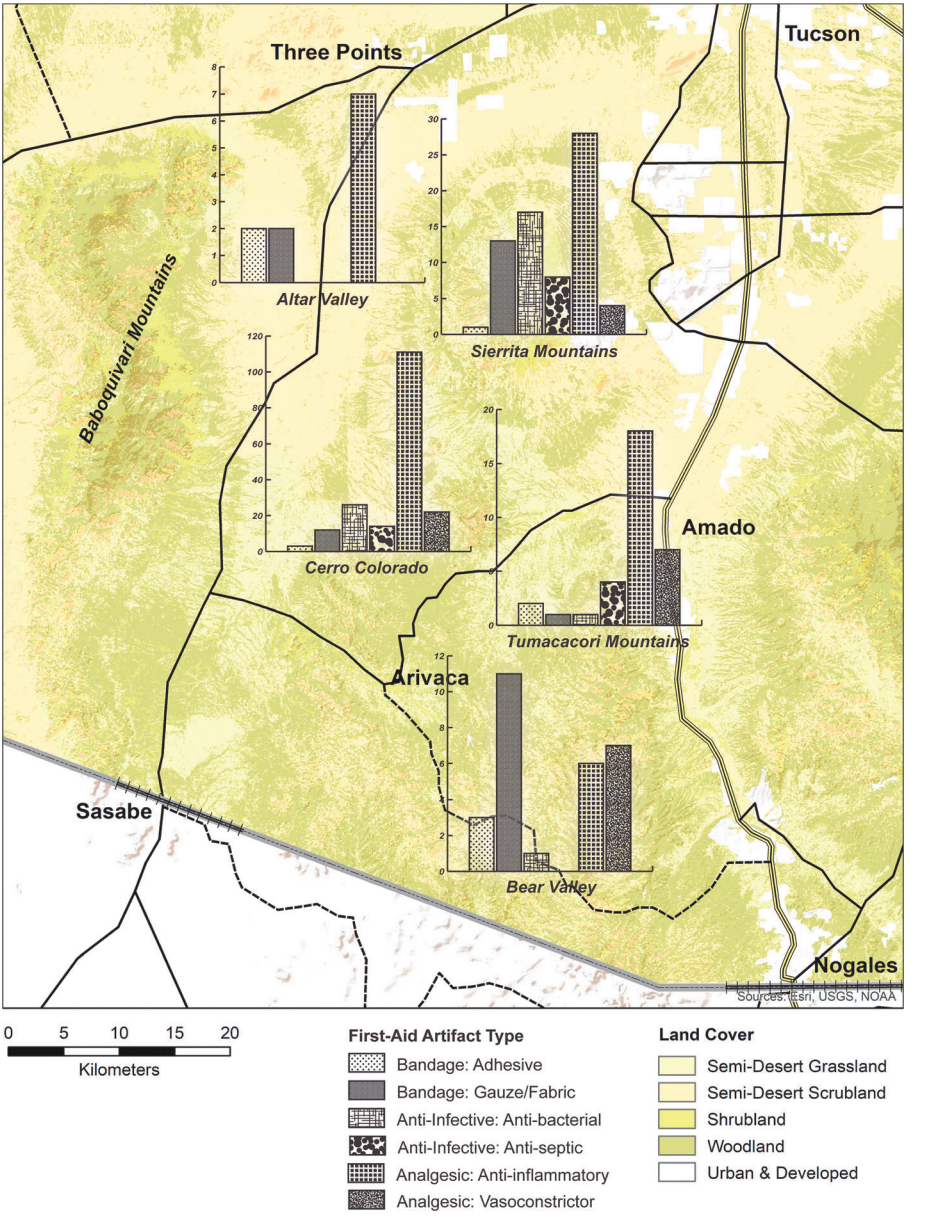

Fig. 10 Map of land cover classes and aid-related artifacts documented in zones surveyed the UMP (2009–13) in the Nogales-Sasabe corridor

Figures 9-10 map the distributions of first-aid artifacts recorded by the UMP, revealing three trends in migrant experiences of, and responses to, the combined harms of ruggedness and vegetation across fiver different zones surveyed by the UMP in the Nogale-Sasabe corridor (Table 4). First, the frequent discard of adhesive bandages near semi-desert scrubland/grassland in areas such as the northern Altar Valley could result from their use for treating blisters and/or injuries from ever-present cacti, while the gauze/fabric bandages found more often in the rugged landscape and shrubland/woodland vegetation of Bear Valley and the Tumacacori Mountains could signal more falls, cuts, and abrasions sustained while climbing through steep, rocky terrain. Second, the discard of anti-infective agents in rugged areas further north, such as the Sierrita Mountains, would seem to support this interpretation; these include pharmaceuticals and topical ointments for treating scrapes, as well as the cuts and puncture wounds inflicted by cacti and sharp-leaved succulents in semi-desert grassland/scrubland. Third, the consumption of analgesics, including both anti-inflammatory drugs and vasoconstrictors, appears to increase as one moves further north from the US-Mexico border, a pattern consistent with suppressing aches and providing additional energy after hiking for several days straight. Although future research will consider discard rates, associations with other artifacts, and variability between sites, these broad trends in aid-related artifacts hint at how people would have experienced, and then responded to, the pain and suffering meted out by vegetation, topography, and temperature in the Sonoran Desert (see Figs. 6-7). Moreover, they address how the social processes of migration shape depositional patterns—directly contradicting the popular notion that contemporary artifacts are random garbage deposited by migrants.

As a sort of counter-map, these patterns also speak to issues of scale. Scaling down, the spatial distribution of aid-related artifacts becomes a material means to quantify and differentiate the ways in which PTD policies turn the desert into a weapon of structural violence against individual migrants. They also help us to temporalize the embodied

Table 4 Summary of mean (μ) and standard deviation (σ) for ruggedness index and land cover classes within a 500-m radius of aid-related artifact types documented on sites surveyed by the UMP (2009–13)

Artifact Type		Ruggedness		Vegetation									
				Semi-Desert Grassland		Semi-Desert Scrubland		Shrubland		Woodland		Urban & Developed	
	n	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
Bandage	***49***	***37.69***	***2.51***	***43.7***	***34.1***	***20.3***	***12.4***	***13.7***	***24.8***	***20.1***	***21.0***	***2.3***	***10.8***
Adhesive	12	37.37	2.87	62.2	22.5	19.2	14.9	2.9	7.9	15.7	18.0	0.0	0.0
Gauze/Fabric	37	37.79	2.43	38.0	35.3	20.7	11.8	17.0	27.3	21.4	21.9	3.0	12.3
Anti-Infective	***70***	***38.23***	***1.72***	***52.1***	***27.9***	***20.4***	***9.7***	***4.5***	***11.1***	***23.0***	***21.9***	***0.0***	***0.0***
Anti-bacterial	43	38.24	1.71	51.0	28.8	21.2	10.3	4.6	10.8	23.2	22.8	0.0	0.0
Anti-septic	27	38.20	1.77	53.8	26.9	19.3	8.9	4.3	11.8	22.7	20.7	0.0	0.0
Analgesic	***213***	***38.32***	***2.14***	***62.3***	***25.6***	***20.2***	***12.9***	***4.4***	***13.1***	***12.9***	***14.4***	***0.3***	***4.0***
Anti-inflammatory	172	38.29	2.10	63.9	26.0	20.0	13.6	4.5	13.3	11.5	13.8	0.0	0.0
Vasoconstrictor	41	38.39	2.31	56.8	23.9	20.7	10.6	3.7	12.5	17.5	15.5	1.3	8.3

experience of border crossing alongside the finality of death evoked by thousands of human bodies. This attention to detail offers a critique of current political and popular discourse (including maps), in which overgeneralization glosses over the causes and consequences of undocumented migration as a social process and leads to antipathy towards the humanitarian crisis of migrant trauma and death still unfolding along the US-Mexico border. Scaling up, the UMP study of migrant sites and artifacts aims to bridge individual stories—whether the death of Maricela, the pain of Lucy, or the hard journey of Memo and Lucho—to the otherwise faceless statistics of apprehension rates and body counts in Border Patrol reports and the news media (see Fig. 1).

Conclusion

News organizations and US federal agencies both disseminate maps and statistics that drastically simplify on-the-ground complexities of undocumented migration. This simplification is not innocent; it furthers those strands of political discourse that describe migration as a "flood" threatening the US economy and national identity (Strom and Alcock 2017), and it obscures the violence meted out against migrants by an assemblage of PTD policies, border infrastructure, and desert terrain. This simplification works, we argue, as a scalar project to naturalize the US-Mexico border as an authoritative scale of undocumented migration, and thus to ignore the rights of migrants and their experiences of suffering. Taking a cue from Humane Borders (2018; Walsh 2013), our critical response to this simplification has drawn on techniques of counter-mapping to develop representations of the borderlands at different scales. Focusing on the Nogales-Sasabe corridor of southern Arizona, we have made use of ethnographic, archaeological, forensic, and environmental data to trace the contours of structural violence too often out of focus in maps of the entire US-Mexico border (see Fig. 1). We do not claim that our analysis yields a definitive, or even straightforward, "counter-map" to this space of exception (Doty 2011). Rather, we see this study as part of an ongoing and reflexive project to present migrant artifacts and sites in ways that challenge the power of institutional map-making and emphasize the fatal consequences of US border enforcement.

How does this ever-growing humanitarian crisis scale to the physical and psychological trauma suffered by individual migrants? In southern Arizona the needless deaths of at least 3199 people, and surely countless more, offer us one heart-breaking answer, and we argue that archaeological remains offer us another. First-aid artifacts collected by the UMP, for example, each attest to the aches and wounds of a border crosser—hundreds of thousands of whom attempt to cross the desert each year. By tacking between regional geography and these material traces of migrant suffering, our analysis further illustrates how PTD policies and Border Patrol infrastructure funnel migrants into more mountainous terrain where longer hiking times, high temperatures, and vegetation combine in complex ways to increase migrant suffering. Here the spatial variability of artifact types suggests how migrant health regimes and survival strategies become adapted to the diverse conditions of routes across the Sonoran Desert. Our analysis also works as a sort of counter-map to critique common representations of the US-Mexico border in popular and political discourse. This involves, first of all, pointing to biases in the public statistics on migrant mortality that result from the

unique challenges of preservation and legibility in a desert landscape. Second, it provides a contrast to institutional maps of the borderlands, thus demonstrating how these implicitly silence certain narratives or make them unthinkable.

The analysis of migration through the Sonoran Desert has no objective scale, so no single counter-map can fully unsettle the power hidden within state-centered cartographies and their taken-for-granted scales of the US-Mexico borderlands. For this reason, our goal has been to counter political and popular maps of undocumented migration by exploring the multiple scales of migrant suffering through diverse sets of data, themselves situated in particular social and political contexts. From the stories of migrants themselves, to solitary plastic bottles slowly crumbling away beneath the desert sun, to backpacks crammed with water bottles, socks, and family photos, to long-term assemblages of migrant artifacts dispersed across diverse terrain and vegetation—each brings into focus some aspect of the relations between undocumented migrants, border security, and non-human actors that compose this complex landscape. These scales of analysis offer to let the suffering of migrants "speak" in different ways, but they also contain their own silences and elisions. The frictions exposed by moving between these scales are not flaws; they are critical to countering the scalar projects, including maps, that obscure decades of migrant suffering at the hands of PTD policies along the US-Mexico border.

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