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IN PRACTICE

Building a Geospatial Archive of Species Loss as Response to Local Caribou Extinction

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Abstract This article offers a critical assessment of *Storying Extinction: Responding to the Loss of North Idaho's Mountain Caribou*, a public-facing digital environmental humanities project produced by a team of University of Idaho Library researchers following the 2019 extirpation of mountain caribou from the South Selkirk Mountains of the Inland Northwest (the last caribou to inhabit the contiguous United States). The project has been conceptualized as a community response to the specific species loss, and it takes the form of a deep map, or geospatial archive, where users can inhabit and explore the region's multispecies landscape in the aftermath of caribou extirpation through trail camera footage, nonfiction narrative, and georeferenced oral history videos of North Idaho community members narrating mountain caribou encounters. This article begins by offering a critical assessment of *Storying Extinction*'s methodology and formal architecture as it relates to representing human and more-than-human dimensions of species loss within a public and virtual setting. It then explores the importance of material practice for the environmental humanities and the specific contributions that performative cartographic processes can offer traditional EH scholarship. The article concludes by arguing that a multidisciplinary synthesis of GIS, digital, and narrative approaches is critical for communicating and exploring shifting spatial relations in the era of the Anthropocene and sixth mass extinction, and that *Storying Extinction*'s formal and methodological approaches can serve as a model for environmental humanities projects concerned with extinction geographies and environmental justice.

Keywords extinction, multispecies storytelling, critical GIS, public humanities, digital humanities, Anthropocene

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Prologue

A little over a year after Idaho's mountain caribou were declared functionally extinct (2019), we began collecting video-recorded oral histories from residents of Idaho and Washington (USA) whose lives had in some way intersected with the large and rarely seen creatures.[1] We talked with Jon Nylund, a Sandpoint-area local who invited us to his house after seeing our newspaper call for caribou encounter stories. Jon recalls encountering "six or eight caribou" in the summer of 1990 at the top of Schweitzer Mountain Resort, a popular ski area located in the Idaho's Selkirk mountains, then home to the critically endangered South Selkirk subpopulation of mountain caribou:

> I looked up and saw six or eight caribou. I wasn't sure that's what they were at first, but I knew they weren't deer or moose or elk, and they were just peacefully grazing there. . . . I was all by myself and there was no equipment running so it was really, really quiet. I just looked up and they were there. They hung around for a half hour before I ate lunch, then I ate lunch, and they were still there for another half hour or so after lunch and then they just wandered off.

The video of Jon's story is georeferenced on a high-resolution satellite base map of North Idaho, producing a superposition of story and landscape at approximately the same latitude and longitude where Jon encountered the caribou "peacefully grazing" (see fig. 1).[2] Legible outside the video's frame is the place-specific setting of Jon's story: a pockmarked geography of looping grooves and striated forests that form Schweitzer's ski runs and lifts along with the service roads that support them. More than the setting of a story, their presence is indicative of the larger political-economic forces that precipitated Jon's chance encounter by disrupting the local environment in a way unfavorable to the old-growth-dependent caribou. The video then cuts to a sequence from the perspective of a skier being ferried up a mountainside on a chairlift. "But it's just one of those things," concludes Jon, "they're gone."

The georeferencing situates the story of Idaho's mountain caribou at the intersection of competing and overlapping spatial relationships, desires, and histories—those of translocated mountain caribou attempting to survive in their now fragmented former range and those of a capitalist-driven recreational industry that, perhaps unwittingly, helped cause their demise. Representing this political-ecological story requires a "place-specific attention to the unfolding of extinction" at both its material and immaterial locales.[3] Jon's story is one node within a larger narrative and performative web that

1. Barker, "What Extinction in Idaho Looks Like."

2. The project *Storying Extinction: Responding to the Loss of North Idaho's Mountain Caribou* is online at https://cdil.lib.uidaho.edu/storying-extinction/ (accessed October 1, 2023). For the video of Nylund seen in figure 1, see "Schweitzer Mt. Encounter," *Storying Extinction*, https://cdil.lib.uidaho.edu/storying-extinction/mapitem.html?id=schweitzer-mt-encounter (accessed October 1, 2023).

3. Garlick and Symons, "Geographies of Extinction."

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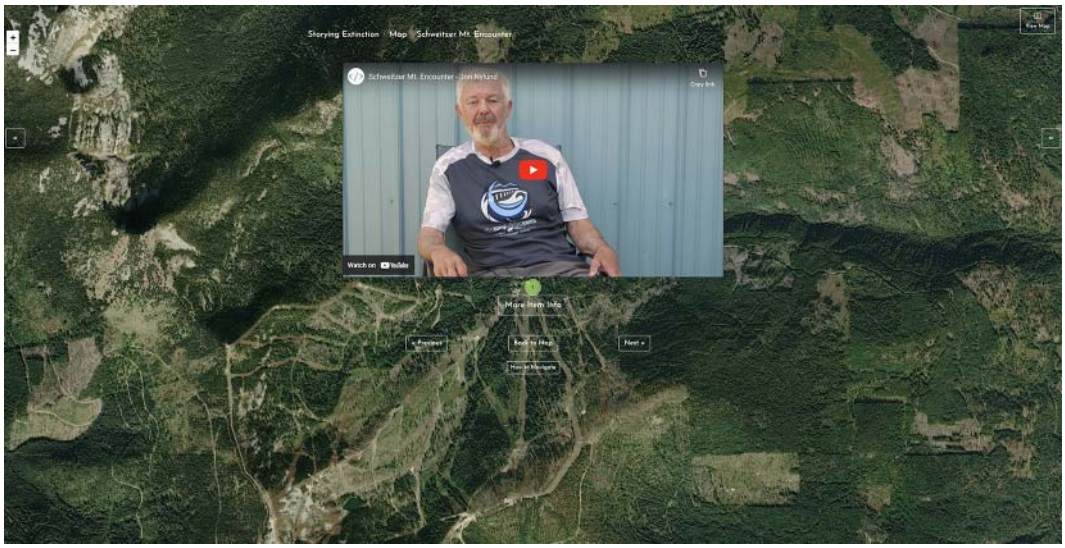

Figure 1. Video of interviewee Jon Nylund superposed on the location of his caribou sighting, on the *Storying Extinction* website.

seeks to substantiate the affective as well as geographic dimensions of caribou absence. The result is *Storying Extinction: Responding to the Loss of North Idaho's Mountain Caribou*: a multimodal and interactive extinction cartography that publicly engages and responds to the loss of mountain caribou.

In this article we provide an overview of the project's origins, methodology, and formal architecture as it relates to representing human and more-than-human dimensions of a local extinction in a public and virtual setting. We conclude by looking at how a synthesis of GIS, digital, narrative, and performative approaches can serve as a model for environmental humanities projects concerned with spatial relationships, extinction, and environmental justice in the Anthropocene.

Ecology, History, Response-Ability

The Southern Mountain Caribou, commonly referred to as mountain caribou, is a deep-snow ecotype of boreal woodland caribou (*Rangifer tarandus caribou*) adapted to the montane rainforests of the US Inland Northwest (where they are extinct) and interior British Columbia, Canada (where today's critically imperiled population is limited). Unlike their woodland counterparts that gather in large herds and dwell primarily in forested valley bottoms, mountain caribou live in small family groups (six to ten individuals) and follow a distinct seasonal migration pattern between different elevation bands and old-growth forest types.[4] In what likely evolved as a predator avoidance strategy, mountain caribou migrate to the high-country shortly after the onset of winter using their large,

4. Bergerud, "Rareness as an Antipredator Strategy"; Apps et al., "Scale-Dependent Habitat Selection."

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snowshoe-like hooves to float on the deep montane snowpack.[5] In addition to forming a barrier against predators, the six to ten feet of lift provided by the snowpack gives them access to arboreal hair lichens in the lower limbs of trees, which they subsist on for the duration of winter.[6] Of all North American members of the deer family (*Cervidae*), mountain caribou are the most closely associated with old-growth forests.[7]

Idaho's mountain caribou are culturally and historically significant to the Kootenai Tribe of Idaho, the Kalispel Tribe, Confederated Salish and Kootenai Tribes, and other Indigenous peoples. Prior to Euro-American settlement, Idaho's caribou—known to wildlife managers as the South Selkirk subpopulation—ranged throughout Kalispel and Kootenai Territories in present-day North Idaho, northeastern Washington, and northwestern Montana and may have extended as far south as the Salmon River in Idaho.[8] In the late nineteenth century market hunting driven by local mining booms and the arrival of railroads caused the population to rapidly decline, resulting in a ban on hunting in 1913. Extensive old-growth logging throughout the twentieth century continued to exert pressure on Idaho's caribou, which numbered twenty-six to twenty-eight individuals when the local subpopulation was listed under the Endangered Species Act in 1984.[9] From 1987 to 1990, a total of sixty caribou were translocated to Idaho from British Columbia in three augmentations conducted by state, federal, and tribal agencies. These efforts ultimately failed to reverse the decline, and by 2016 mountain caribou had become one of the most endangered animals in the continental United States, earning the moniker "gray ghosts" for their vaporous existence in the remote old-growth forests and jagged peaks of Idaho's South Selkirk Mountains.[10] Finally, in January 2019, the sole surviving member of the South Selkirk subpopulation, a female, was airlifted to a holding pen near Revelstoke, British Columbia, before being released to join another herd.[11] The quiet event marked the loss of the last wild caribou herd to inhabit the contiguous United States.

The loss of Idaho's mountain caribou reveals a complex web of ecological, political, sociocultural, and economic interaction. Yet rather than address mountain caribou and their extirpation in terms of cause and effect (e.g., What went wrong?) or future restoration and conservation efforts (e.g., What can we do?), our project is oriented toward dwelling with the phenomena, traces, and ruins of caribou in the now caribou-less multispecies landscapes of North Idaho and the greater Inland Northwest. How is their absence processed, negotiated, forgotten, or reflected in the human as well as more-than-human communities that were and continue to be entangled with the lives of Idaho

5. James et al., "Spatial Separation of Caribou from Moose."
6. Servheen and Lyon, "Habitat Use by Woodland Caribou."
7. Wittmer et al., "Changes in Landscape Composition."
8. Evans, "Preliminary Investigation of Caribou."
9. Scott and Servheen, *Caribou Ecology*.
10. Robbins, "America's Gray Ghosts."
11. Stinson and Wiles, *Draft Periodic Status Review*.

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caribou? And what does the gathering of storied remains and artifacts—as an archival body but also as a process or performance—inform us about living in an age of mass extinction?

These types of questions—questions formed where social and biophysical systems meet—call for modes of inquiry and representation, along with project infrastructures, that combine disciplinary approaches. In response, we produced a web-based deep map, or geospatial-narrative archive, using an interdisciplinary synthesis of GIScience, field ecology, web design, and multimodal narrative. Conceptually framed by Thom van Dooren and Deborah Bird Rose's notion of "lively ethography," the project enlists storytelling or "storying" as a practice that calls attention to ("becoming-witness"), and cultivates an ethics of response toward ("response-ability"), species on the brink of (or in this case beyond) extinction. Through our interactive deep map, users participate in a virtual multispecies landscape that stories mountain caribou and their extinction through georeferenced oral histories from local community members, trail camera footage, multimedia trail systems, scientific literature about caribou life history, and nonfiction narrative. As a work of collective and public-facing ethnographic expression, our hope is that the stories make absent caribou "fleshy and thick on the page, exposing readers to their lives and deaths."[12]

Deep Mapping and Designing for Absence

Rose and van Dooren's lively ethography insists on response as a process of inhabitation. For them responding to the loss or potential loss of a species demands action, action that is not merely aimed at the completion of a product but where production itself opens space for new and different ways of being in and relating to the world. Central to this approach is an understanding that the practice of storying is also a process of orientation, of resituating ourselves in relation to the multispecies histories that are always-already unfolding and coevolving into the world we inhabit. In a time of extinction these histories are both beautiful and violent; they are deep histories of old-growth forests and complex ecological communities, of long-standing and sophisticated human-animal relationships, of coinhabitation; but they are also histories of colonization, of resource extraction, and often messy attempts at conservation. Telling these stories demands an openness, as Rose and van Dooren write, to being "drawn into new connections, and with them new accountabilities and obligations."[13]

We've adopted deep mapping as a method for storying caribou extinction because it lends itself to this kind of openness and accountability. Contrary to the totalizing, fixed, and atemporal quality of traditional maps, deep maps are defined by their resistance to closure and their insistence on contingency and process over fixed product.[14] As geographer Les Roberts writes, "Very little of what deep mappers are *doing* is in fact oriented

12. Van Dooren and Rose, "Lively Ethography," 263.
13. Van Dooren and Rose, "Lively Ethography," 264.
14. Roberts, "Deep Mapping and Spatial Anthropology," 3.

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towards the production of maps so much as immersing themselves in the warp and weft of a lived and fundamentally intersubjective spatiality."[15] Deep maps do not seek clean endings or smooth narrative arcs but instead pursue multiplicities, interruptions, and contradictions; that is, they encourage "partial perspectives" that disrupt universalist cultural narratives by emphasizing "embodied" and "situated" practices of storytelling and knowledge production.[16] Rather than adhere to a predetermined cartographic form, they foster a reflexivity that allows us to reflect on and repurpose the normative forms of traditional European-style maps with their disembodied, "unlocatable," and so "irresponsible" truth claims. In doing so, deep maps both highlight and hold accountable diverse sites of knowledge production so that, as Donna Haraway writes, "we become answerable for what we learn how to see."[17]

For us, lively ethography and deep mapping are theoretical and methodological tools for orienting ourselves and participants in the disorienting world of caribou extinction. This approach is cognizant of the colonial history of mapping, GIS, and digital technologies, recognizing that maps are mechanisms of power that have been instrumental in the formation of settler ecologies and the consequent erasure of Indigenous, non-Western spatialities. But rather than eschew these technologies our aim was to proceed from a materialist framework and practice that reprocesses their formal and ideological constraints, allowing for critical reflection while exploring the liberatory possibilities of mapping and digital technologies. To this end the deep map of *Storying Extinction* is woven throughout with Space Age and Cold War–derived military surveillance technologies—GPS, satellite imagery, radio telemetry, camera traps—that as remote sensing products came to dominate the practices of wildlife research and management in the latter half of the twentieth century.[18] Underpinning what Etienne Benson has referred to as the "wired wilderness" of North American wildlife management is an "imperialist nostalgia"[19] that seeks to conserve and "save" species threatened by the history of its progress using the very same instruments of that progress. On a formal level *Storying Extinction* embraces these dominant and domineering modes not in order to wield their considerable sensory powers in a search for "lost" species (as if detecting the presence of a sole surviving Idaho caribou would alter the material conditions of extinction) but rather to repurpose its technical apparatus, with its empirically-biased onto-epistemology of presence, to account for and help give substance to Idaho caribou in their absence. The digital remote sensory apparatus for us thus becomes the means by which viewers can "see" extirpated caribou, if only indirectly and ipso facto, and come to know where exactly on the shared landscape these animals are absent from.

15. Roberts, "Deep Mapping and Spatial Anthropology," 6.
16. Haraway, "Situated Knowledges," 192.
17. Haraway, "Situated Knowledges," 191.
18. Benson, *Wired Wilderness*.
19. Rosaldo, "Imperialist Nostalgia."

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Design and Disorientation

What we are calling a deep map refers to the totality of *Storing Extinction*'s web environments, items, and interactions (as opposed to denoting the site's more conventional GIS/mapping elements). In terms of content, the site consists of 34 video and audio-recorded oral histories, 685 trail camera images and videos, a collection of excerpts pertaining to mountain caribou from regional newspapers and other print sources, contextual summaries on mountain caribou science and conservation history, and two longform nonfiction narratives. While the majority of these 781 items can be individually recalled/referenced using a traditional search function ("Collection" tab), the UX (user experience) architecture of the site was designed to encourage less deliberate and more exploratory modes of interaction in order to encourage reflective and intentional navigation through the overwhelming and often disorienting reality of caribou extinction.

In designing the site we took inspiration from a wide variety of digital humanities projects. Stanford's recent *Feral Atlas: The More-Than-Human Anthropocene* and both of the digital scholarship platforms called StoryMap—ESRI's GIS-driven StoryMaps application and the Knightlab's JavaScript application StoryMapJs—provided engaging contemporary models for and of digital geospatial environments that are geared toward presenting interpretive (and often narrative) content. More evocatively, *Slave Voyages*, one of the oldest extant digital humanities projects still in active development, inspired us to think about the ways data represents and reflects on loss. *Slave Voyages* "compiles and makes publicly accessible records of the largest slave trades in history," presenting databases, interpretive features, and curricular resources related to the transatlantic and intra-American slave trade.[20] The project's website derives much of its effect from the interaction between the disembodied nature of data and the troubling specter of individual bodies its data represents. *Slave Voyages*' effect emanates from a user's interactions with the 1 and the 0 in the way its multiplications and accumulations present human negations. These 1/0 interactions inspired the design of *Storying Extinction*, specifically in our attempt to make the absence of the project's subject increasingly present as a user traverses the site's assembled contents.

In this privileging of absence and in our other design choices, we intended to challenge and disorient the user, an instinct that is anathema to modern web design's insistence on making the user experience as seamless as possible but consistent with our subject matter, since disorientation is a defining aspect of extinction and of climate change more broadly. We also hoped to challenge the impulse to overcome or avoid disorientation and discomfort, an impulse we've recognized in Western conservation practices, especially attempts to conserve mountain caribou via translocation, wolf culling, and the designation of inadequate critical caribou habitat—all of which seem to avoid the difficult work of radically rethinking multispecies ethics in the age of extinction. In this sense we align ourselves with Catriona Sandilands's approach of "loving the

20. *Slave Voyages*, https://www.slavevoyages.com (accessed October 5, 2023).

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difficult" and staying with the disturbed ecologies of a settler-colonial land ethic in order to better understand "the very particular entanglements in which we find ourselves with" them.[21] Such an approach recognizes the quick fixes of caribou conservation as what Eve Tuck and K. Wayne Yang describe as a "settler move to innocence"[22]—a process by which, as Sandilands writes, "the key problems—disruptive and dispossessive settler-colonial property relations and accompanying Euro-Western environmental understandings—are ignored as settlers focus on trying to make the land look like it was never disturbed, primarily by [addressing] a symptom rather than addressing a larger cause."[23]

This approach is most obvious in our incorporation of a fake 404 page. Typically a user hits a 404 page when their browser is off-line or they click on a broken link; we wanted to incorporate that sense of brokenness into the initial introduction to the site so that users would be challenged and prepared for the general topic more broadly. In the final iteration a user now enters the site on a splash/title page (itself a throwback feature to earlier web design standards) that limits them to clicking on a button at right or on the project title, both of which lead to the next page, "error.html." While wanting to give the impression of something going wrong, we were also careful to communicate in both the design and the descriptions on that page that there were ways to move forward with the site. This reflects a productive understanding of disorientation (and absence) similar to that theorized by Jonathon Turnbull, Ben Platt, and Adam Searle, who hold disorientation to be "tentative, cautious, unstable, yet imbued with potential."[24] While users are confronted initially with an obstacle, not finding what they expected to find and likely overcome by an impulse to turn away, it is nevertheless a space of possibility: Once a user clicks the same right-hand button that got them to this page or the title listed below the ASCII drawing of a caribou (see fig. 2), they will move on to the "About" page for the larger project, which then becomes the centering page for navigation as one continues to interact with the site.

With the exception of the trails function, there is no logical or linear approach to navigating the site's content. The process of navigation is instead meant to be a more organic orientation within the map, jumping from one node to the next, potentially viewing a moose, mule deer, wolf, bumblebee, or an "empty" scene through a trail camera, or landing on an oral history (fig. 3). The nonlinearity of this user experience reproduces the complexity and the disorienting quality of caribou extinction, presenting seemingly disconnected and unorganized expressions that are nevertheless interconnected storylines in a shared narrative geography. Making sense of how it all fits together is the responsibility of the viewer, but the oral histories facilitate this process of

21. Sandilands, "Loving the Difficult," 36.
22. Tuck and Yang, "Decolonization Is Not a Metaphor," 10.
23. Sandilands, "Loving the Difficult," 36.
24. Turnbull, Platt, and Searle, "For a New Weird Geography," 1212.

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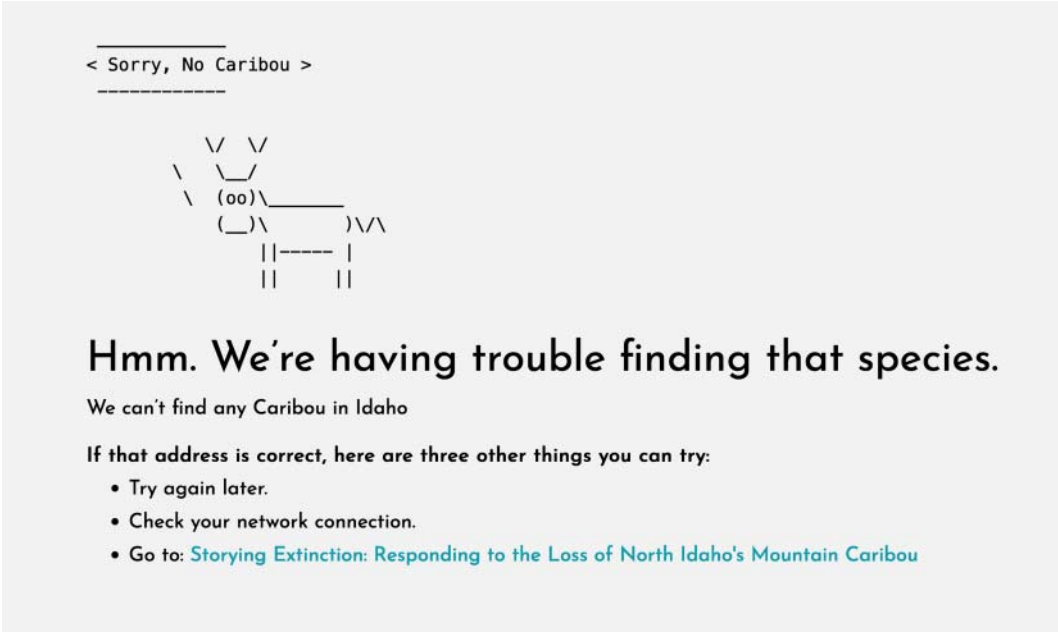

Figure 2. The fake 404 page on *Storying Extinction*.

orientation; some discuss the ecology of mountain caribou extinction, highlighting how the altered habitat has increased the number of deer, elk, and moose as well as their predators (all of which are present on the map); others refer to locations where trail camera footage was gathered, such as Rich Landers's story about encountering radio-collared caribou at Two Mouth Lakes that, days later, were reportedly eaten by a grizzly. Landers's story draws connections between animals represented via trail camera and the absent mountain caribou, highlighting inadequacies in conservation practices (the ESA critical caribou habitat is also a grizzly recovery zone) that do not address the larger spatial and sociocultural conditions leading to extinction. Through the process of navigation, the seemingly disparate elements of the map cohere into a user-specific encounter with the biocultural landscape of extirpation.

Encounter as Method

While the website is the ultimate manifestation of *Storying Extinction*, our hope is to highlight how the site's production led to unexpected modes of engagement that both employ and simultaneously go beyond traditional research methods and that facilitate new connections and thus new modes of representing important issues grounded in localized participation and investigation. While maintaining a spatial focus on Idaho's environmental history, political ecology, and the lived experience of local environmental change, the deep map also allows for the incorporation of creative methods that bring to the fore a variety of "partial perspectives" to critically engage the environmental imaginaries of North Idaho.

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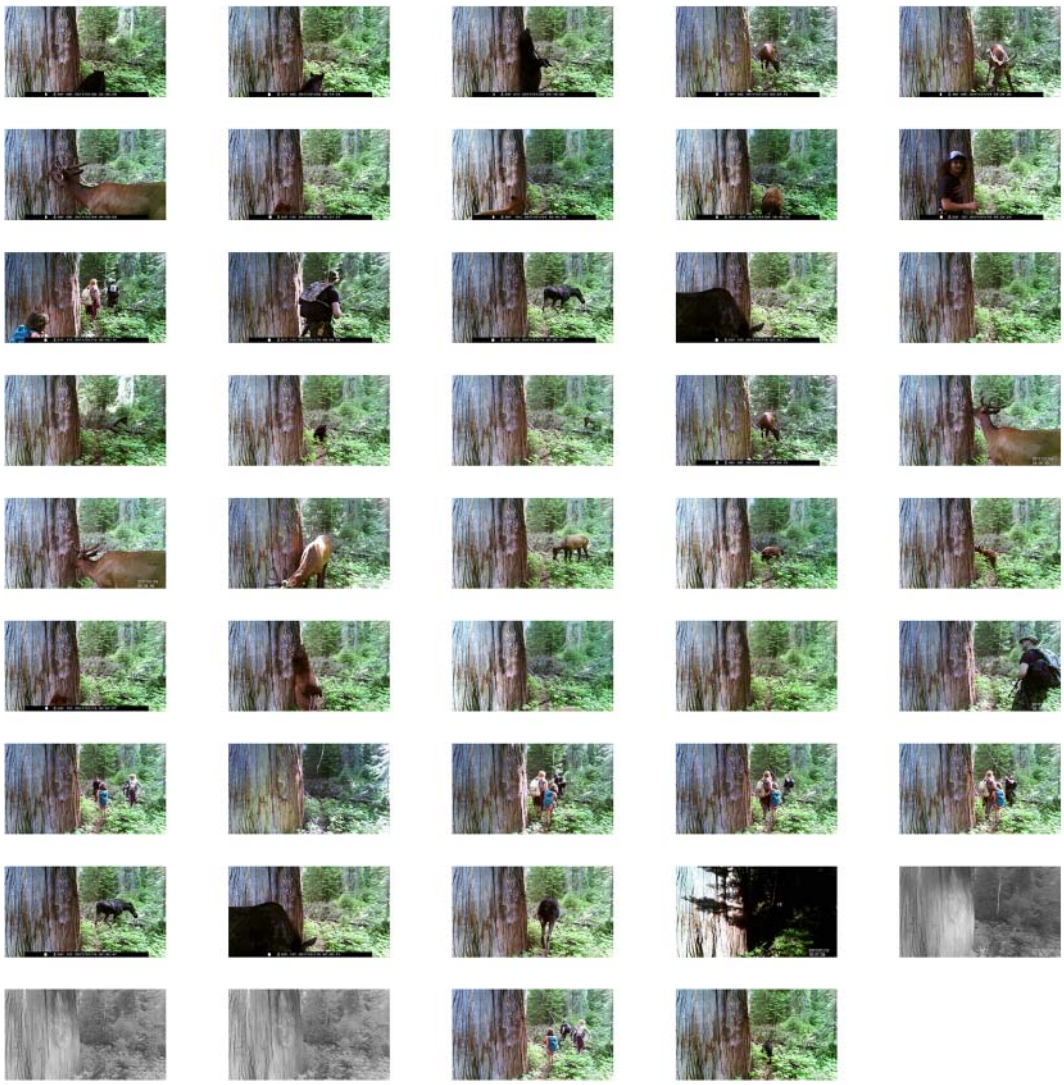

Figure 3. A gridded representation of forty-four trail camera images taken near Ball Creek and given the idiosyncratic name "Cedar Rub" for metadata and web-building purposes on *Storying Extinction*.

The incorporation of oral histories from Idaho locals was an important part of this process, as it not only allowed for a diversity of voices/perspectives to be represented on the website but also drew us into unexpected moments of encounter and collaboration. Through the process of collecting these stories, of driving to various reaches of the state to meet with the individuals whose lives had intersected with caribou in unique and meaningful ways, we began to realize that creating the space for the stories to be told was just as important as the recorded stories themselves. It was in these spaces that the potential for alternative futures became most tangible, as we exercised our capacity to collectively imagine and create something that would extend the geographies of mountain caribou into the future. For us this reinforced the importance of storying

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from a variety of perspectives for situating ourselves within the unfolding ecologies of extinction, and it highlighted how deep mapping as a practice functions to draw these stories together in new and consequential ways, facilitating material encounters that give rise to critical reflection/creative action.

Coming to terms with extinction in North Idaho means acknowledging how our own narratives and their material practices have contributed to it. Recognizing the role that our stories and technologies (in this case Euro-Western environmental imaginaries and their conservation methods) have played in creating a North Idaho absent of mountain caribou is a necessary first step in the process of considering what to do next. Shedding light on the power that narratives and their technologies hold for place-making allows for approaches that repurpose those powers to both call normative practices into question and imagine alternative modes of engagement. *Storying Extinction* seeks to hold space for absence by taking seriously the potential for sites of loss to facilitate a process of critical reflection and a reimagining of the very notion of community in the aftermath of extinction.

Conclusion

Storying Extinction combines digital humanities and GIS methodologies to produce a multimodal postextinction cartography, or deep map, that allows users to navigate the affective as well as geographic dimensions of mountain caribou absence. While framed and supported by the conventions of traditional Euro-Western cartography, the project was designed around nonlinearity, performativity, brokenness, disorientation, and an overall experience of loss. This type of project does not attempt to overcome or to collapse into a single narrative or conceptual frame the histories of violence that characterize complex social-ecological issues like species loss. For scholars of the environmental humanities the "creative coalescence" of multidisciplinary approaches that make up *Storying Extinction* offers the ability to represent multiple overlapping scales and their social-ecological modalities within the same rhetorical and place-specific context. Formally the most valuable element of *Storying Extinction* is the production of a collaborative and boundary-spanning interspace that allows cross-scale interactions and linkages between individual-emotional, multispecies, and landscape scales. By layering oral history videos of human-caribou interaction over a satellite base layer of North Idaho, map users become implicated in an experience of transspecies "proximity and ethical entanglement" nested visually among the Anthropogenic disturbances and landscape changes—clear-cuts, roads, developments, ski resorts, agriculture—which contributed to caribou extirpation. *Storying Extinction*'s deep map therefore encourages us to story our relationship to nonhuman communities in their otherness while simultaneously implicating us in the material practices and pleasures that threaten them existentially.

In contrast to conservation projects that seek to reintroduce species that have been extirpated from an area by anthropogenic forces, which as Dolly Jørgensen has pointed

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out are almost[25] always grounded in a desire to overcome (or escape) the guilt that such losses give rise to, our approach is interested in the fertility of the opening created by loss.[26] This is not to take issue with the desire to reintroduce a species or rewild a region but rather to point to the way in which this desire elides the potential productivity for sites of loss to facilitate a process of (re)orientation toward more-than-human geographies in an age of extinction. As a process of performative orientation, *Storying Extinction* is an approach toward environmental humanities scholarship that offers this kind of (re)orientation through its insistence on practice as product and through its conviction, alongside Rose and van Dooren, that "storytelling is an ethical practice . . . and that the stories we tell are powerful contributors to the becoming of our shared world."[27] Under this approach digital deep mapping and lively ethography are guiding frameworks for interdisciplinary practices that, beyond drawing attention to matters of environmental injustice, seek to enact new ways of inhabitation, encountering, storying, and thus making sense of multispecies worlds in the Anthropocene.

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25. This is primarily true for settler conservation projects. Arguably Indigenous conservation efforts are grounded in a different set of affective responses that complicates this claim considerably.

26. Jørgensen, *Recovering Lost Species*, 20.

27. Van Dooren and Rose, "Lively Ethography," 264.

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