

1 **Activating uncertainty: Scientific evidence and ethical values in wildlife management**

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6 *DRAFT – This document is being circulated for review by members of the community of Carlisle,*
7 *MA. Please do not share this manuscript beyond members of the community. For more details*
8 *about the project and community review process, and to provide feedback on this draft, please*
9 *visit <https://sites.bu.edu/urbanwilds/carlisle/>*

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11

12 **Introduction**

13 In May 2019, a group of residents of Carlisle, Massachusetts brought a petition to the town’s
14 annual meeting to ban the hunting of white-tailed deer (*Odocoileus virginianus*) on town lands.
15 Just one year earlier, the town Select Board (SB) had begun issuing permits for archery hunting
16 on public lands, framing this as a science-based wildlife management program to mitigate the
17 impacts of deer overpopulation on forest ecosystems. The petitioners raised multiple concerns
18 about the hunt, including public safety and animal welfare, but their criticism centered around
19 questioning the effectiveness of hunting as an ecological management tool. They argued that
20 hunting on town lands had very little impact on deer numbers and thus “almost no benefits,” and
21 they questioned the underlying motivations for the hunt, asserting that the town actions were
22 “not about hunting as a tool for deer management.” They thus framed their opposition in terms of
23 care for the environment, with one resident saying, “please put nature and our environment first.”
24 The town’s Conservation Commission, in contrast, positioned hunting itself as an act of
25 ecological stewardship and care in the context of ecologically damaging deer numbers; as they
26 argued, “our main concern is the health of the forest” (The Mosquito, May 8, 2019).

27 The 2019 petition failed, and archery hunting continued on town lands that fall. However, the
28 hunt “remain[ed] controversial” (The Mosquito, 2020), as the town’s Deer Committee argued for
29 expanding the program in 2020. Opponents again questioned the scientific basis of the program,
30 as well as the motives of the state wildlife agency (MassWildlife), which had encouraged
31 Carlisle as well as other nearby municipalities to allow hunting. At a May 2020 SB meeting, one
32 resident argued that MassWildlife is “pushing to increase hunting for recreational purposes, not
33 to protect the understory.” At least one SB member, who had previously supported the program,
34 changed their view to oppose hunting, noting that “the science isn’t there and people don’t feel
35 safe.” The conflict grew increasingly divisive. In July, following the resignation of the chair of
36 the Deer Committee amid what an SB member would later describe as increasingly “nasty”

37 discussions, the SB announced it would suspend the hunt, initially for one year. Nonetheless, the
38 issue continued to vex the community. In an August 13th letter to the editor, one resident
39 expressed dismay that a “small but vocal minority have caused a valuable and well thought out
40 program to be derailed,” while another countered that “no one knows how many deer we have in
41 Carlisle nor do we know the trend [in population],” and argued that “we cannot make good
42 decisions as a town about this issue without knowing what the science is telling us.” Despite the
43 ongoing discussion, the SB did not take up the issue again. SB members have cited the absence
44 of clear scientific evidence as a key reason for not re-initiating the hunt, alongside the intensity
45 of the debate and personal acrimony. As of this writing (March 2023), hunting on town lands in
46 Carlisle has not resumed.

47 How did a debate over a relatively technical question of ecological management in a suburban
48 community turn into such an acrimonious and divisive situation, and what is at stake in residents’
49 repeated appeals to scientific data and evidence to resolve the conflict? While wildlife
50 management is often framed as a technical, objective, science-based, and expert-driven field,
51 decisions about management—especially *lethal* management—of animal populations also entail
52 significant questions of human values and ethics. Hunting in particular raises significant public
53 concerns, provokes strong emotional responses, and can trigger significant controversy.
54 Recreational hunting is a common tool for managing wildlife populations and is often used as
55 part of broader ecological management efforts; indeed, hunting is commonly encouraged by state
56 wildlife agencies across the United States (including MassWildlife) as a tool to manage deer
57 populations and to protect forest ecosystems. In this paper, we take the debate in Carlisle over
58 deer hunting as a case study through which to examine the entanglements of science and
59 rationality with ethics, values, and emotions in environmental management.

60 We engage with a growing critical literature in human geography and related disciplines that
61 examines the social and political dimensions of wildlife management, with the recognition that
62 understanding the sociopolitical and emotional context of wildlife management may be as
63 important as understanding the biological context (Dickman 2010, Baruch-Mordo et al 2009,
64 Margulies & Karanth 2018, Epstein and Haggarty 2022). Through interviews with key
65 stakeholders, observation of public debates and discussions, and analysis of documents and
66 videos related to Carlisle’s deer management debates, we examine how different actors
67 conceptualize what constitutes good decision-making with respect to deer, and how they
68 variously think about and distinguish the roles of science (including data, evidence, and
69 uncertainty), emotions, and ethics in environmental decision-making. Our case study reveals how
70 debates over wildlife management come to depend upon the language and logics of positivist
71 science, but this preeminence of science-based decision-making obscures and prevents
72 engagement with the emotions and ethics of wildlife management. This analysis of the
73 entanglement of data, uncertainty, values, and emotions reaches beyond this case study and the
74 question of wildlife management, with far-reaching implications for environmental management

75 amidst political (and emotional) division and volatility, and (real and perceived) uncertainties
76 about the scientific facts on which management decisions are often based.

77 **Rationality, uncertainty, and ethics in environmental decision-making**

78 Wildlife management in the United States is commonly presented as a highly scientific and
79 technical practice overseen by wildlife agencies, composed of professionals “trained in the
80 wildlife sciences, leaning heavily on biology” (Sullivan et al 2022, p.3). In this manner, wildlife
81 management, and environmental decision-making more broadly, are grounded in scientific
82 rationalism and technocratic expertise, which are defining characteristics of high-modern efforts
83 to control and manage nature in the 20th century (Scott 1998, Mitchell 2002, Li 2014, Morgan
84 and Orloff 2017). As Sullivan et al. (2022) write, “emerging at the height of the technocratic era,
85 wildlife agencies in North America embraced expert models of conservation, positioning the
86 prolific loss of wild species as a technical problem to be solved with the application of scientific
87 principles” (p.3, see also Bocking 2006). This “technocratic mentality” (Putnam 1977) of
88 governance emphasizes the premise that objective, evidence-based science rises above the fray
89 of politics (Baber and Bartlett 2001; Spicer 2010). Such “administrative rationalism” has been
90 the basis for American public policy, and the foundation of science-based management of natural
91 resources, since at least the early 20th century (Bocking 2006; Dryzek 2013; Sullivan et al 2022).

92 In the context of this technocratic management regime, environmental decision-making is framed
93 and rationalized by expert scientific knowledge. Meanwhile, uncertainty about scientific
94 knowledge plays a significant role in the translation of science into policy. Colloquially, the term
95 “uncertainty” is frequently used to refer to an absence of information or “not knowing,” but in a
96 more technical sense, *scientific* uncertainty refers to a lack of clarity or confidence around what a
97 particular body of evidence or data shows (Brown and Damery 2009). Such uncertainty is often
98 considered to be a driver of further scientific inquiry, with what remains unknown or uncertain
99 conceptualized as “undone science” (Hess 2007, Frickel et al 2010), or “knowledge gaps” to be
100 filled by future research (Frickel and Vincent 2007). In the context of science-based
101 management, such uncertainties or gaps in information are seen primarily as obstacles to be
102 overcome by further research and drive better policies and practices.

103 At the same time, a significant body of research (particularly in science and technology studies)
104 addresses the *social production* of uncertainty, ignorance, and other forms of “nonknowledge,”
105 where not-knowing is not simply the precursor to future knowledge, but a complex social
106 condition deserving of close attention to its causes and effects (Proctor and Schiebinger 2008,
107 McGoey 2012, Frickel et al 2010, Boschen et al 2010). This literature pays attention to the power
108 dynamics that drive where and how knowledge is produced, and how ignorance is cultivated and
109 deployed to serve strategic purposes, including via the omission and dismissal of scientific
110 evidence and/or the production and circulation of false information (e.g., Oreskes and Conway
111 2010, Proctor 2008, Vallee 2021, Michaels 2008, Rayner 2012).

112 Critical human geographers have taken a growing interest in these issues, clarifying the disparate
113 and conflicting uses of terminology around uncertainty and nonknowledge and their implications
114 for environmental management and decision-making (Senanayake and King 2021, Birkenholtz
115 and Simon 2022). In the latter case, nonknowledge often functions as a “strategic ploy” (Proctor
116 and Schiebinger 2008, p. 15), with scientific uncertainty leveraged “strategically to increase
117 ambiguity, cause controversy and/or delay action” (Birkenholtz and Simon 2022, p. 157). For
118 example, industry has mobilized uncertainty to hinder regulatory actions and displace
119 responsibility for the impacts of climate change and carcinogenic products (Senanayake and
120 King 2021; Michaels, 2008; Oreskes and Conway, 2010; Proctor and Schiebinger, 2008).
121 Uncertainty about facts, including both legitimate and strategically manufactured uncertainties,
122 can influence decision-making processes by making it more difficult to evaluate the likely
123 outcomes of a management or policy action (Birkenholtz and Simon 2022). In this way,
124 uncertainty is not merely an obstacle to effective science-based management, it also can serve as
125 a *resource* for those who wish to delay or prevent certain actions, particularly regulations and
126 policies (Birkenholtz and Simon 2022).

127 Indeed, uncertainty and nonknowledge may even be strategically embraced by decision-makers
128 themselves in contexts where ignorance can serve as a “tool for managing risks and exonerating
129 oneself from blame” (McGoey 2012, p3). Bringing this insight to bear on the practices of
130 wildlife management, Martin (2021) notes that having less information about animal populations
131 and ecological conditions—what he describes as “illegibility” (c.f., Scott 1998)—can be a
132 survival strategy for management agencies facing simultaneous reductions in capacity and
133 political controversy over management decisions. Nonknowledge thus arises from both
134 biophysical environmental conditions that resist human measurement, as well as the
135 sociopolitical processes that actively produce some phenomena as illegible—what Kroepsch and
136 Clifford (2021) describe as “inscrutable” spaces and circulations.

137 Questions of scientific uncertainty are thus often difficult to disentangle from other factors that
138 may play a role in social conflict over environmental management, including ethical or value-
139 laden considerations. In the context of conservation and wildlife management, the killing of
140 some animals to support human interests, the well-being of that species, or the health of broader
141 ecosystems raises moral considerations (Gamborg et al 2012). Work in environmental ethics and
142 critical geography has examined the ways that conservation and wildlife management practices
143 entangle ideas of killing and caring (Mazhary 2021, Gibbs 2020). In this context, the killing of
144 undesirable, overpopulated, or threatening species is often framed as an act of care for other
145 desirable populations or ecosystem dynamics (Ginn et al. 2014; Srinivasan 2014; Parrenas 2018).
146 Drawing on the Foucauldian concept of biopolitics to elucidate the logics behind such models of
147 conservation, geographers have examined how lethal interventions are used as tools for the
148 management of wildlife at the level of the population or ecosystem, “making live” desired forms
149 of life (Biermann & Anderson 2017; Chrulew and Wadiwel 2016, Casellas Connors and Short

150 Gianotti 2021). This biopolitical management relies on the production of social norms about
151 which forms of life are desirable and ought to be fostered.

152 In contrast to the notion that scientific management is neutral or devoid of politics, the field of
153 conservation biology has long recognized that it is a values-driven discipline with explicit
154 normative goals based upon an understanding of the inherent value of biodiversity (Soule 1985).
155 The killing of animals identified as threats to those goals is therefore often justified and
156 normalized in conservation practice. Conservation practitioners must routinely negotiate these
157 ethical dilemmas, seeking to balance the objectives of biodiversity conservation against the
158 suffering and death of individual animals. From this perspective, the dilemmas discussed in the
159 literature on animal ethics are part and parcel of the contested process of formation of the various
160 environmental subjectivities entangled in contemporary conservation. For example, a growing
161 movement, self-described as “compassionate conservation” (Ramp and Bekoff 2015), challenges
162 the norms of treating care for the individual as secondary to that of the species or population,
163 reiterating that “conservation is a practice with ethics at its core” (Wallach et al 2018, p. 1) while
164 also highlighting the plurality of values at work in conservation.

165 Contrary to the high modernist idea that technical expertise and scientific rationalism will enable
166 decision makers to avoid political conflict, these ethical contestations contribute to frequent
167 controversy about wildlife management in the United States. Contemporary wildlife
168 management must grapple with significant value pluralism regarding wildlife, as well a growing
169 public distrust for expertise, especially in cases where expert managers’ values are perceived to
170 misalign with the values of the public (Bocking 2006, Sullivan et al 2022). Resistance to the
171 actions taken by technocratic management agencies has frequently led to efforts by activist
172 stakeholders to shift decisions back to the public, such as via ballot initiatives or stakeholder-
173 based collaborative models (Nie 2004, Martin 2021). Critics of the technocratic model of
174 wildlife management have pointed to such initiatives as evidence of the reluctance of managers
175 to engage with values and resistance to changes to their established practices (Beck 1998).

176 Moreover, both scholars and practitioners of conservation are often reluctant to speak of
177 *emotions*, steeped in the “pervading perception... that human emotions are irrational and
178 subjective” (Stinchcomb et al 2022). The ethical dilemmas of conservation often raise strong
179 emotional responses, including feelings of sympathy and grief for killable animals and related
180 anger toward those involved in such killing, as well as anger toward those people seen as
181 obstructing ecological management (Godoy 2020, Batavia et al 2020). The tendency to treat
182 wildlife decision-making as purely rational and scientific obscures and delegitimizes both these
183 emotions and the contested values that underlie them (Buijs and Lawrence 2013, Wynne-Jones
184 2022). Recent work in the field of “emotional political ecologies” (Sultana 2015, González-
185 Hidalgo and Zografos 2020), by contrast, draws attention to the important role of emotions in the
186 politics of environmental management, including the significant emotional and affective labor
187 that wildlife managers and decision-makers often do in attempting to align their work with public
188 perceptions and values (Epstein and Haggerty 2022).

189 Tensions between science, values, and emotions are characteristic of the challenges of deer
190 management in the suburbs of the northeastern United States. Deer are highly charismatic
191 animals, evoking high levels of concern and compassion among some people even as others may
192 deride them as pests or vermin. Deer have long been enrolled in the production of nonhuman
193 charisma in the American environmental movement, as well as in anti-hunting discourses and
194 generally anthropobic environmentalist narratives described as the “Bambi complex” (Lutts
195 1992). Deer populations and impacts, though perhaps not entirely “inscrutable,” are difficult to
196 precisely quantify, and can be called into question by those opposed to practices of deer
197 population management. As Casellas Connors and Short Gianotti (2021) have noted elsewhere,
198 opposition to deer hunting in the suburbs has often coalesced around “concerns about the
199 legitimacy of science underlying the characterization of deer as overabundant and the efficacy of
200 the approaches in reducing the threats stemming from the deer population,” and has “challenged
201 the rationale for the hunt by suggesting uncertainty in the science or even falsification of results”
202 (p. 12). In this way, scientific uncertainty has been strategically deployed to prevent the
203 implementation of deer hunting, but significantly intersects with opposition to hunting that is
204 also motivated by ethical and emotional considerations.

205 Despite recognition of the existence of diverse human values related to human-animal relations
206 (Callicott 1990, Manfredo et al 2018), social scientists have long observed that the emphasis on
207 science-based decision-making tends to hide the political and ethical dimensions of such
208 decisions “beneath a veil of the legitimacy of science” (Decker et al 1991, p. 525; see also
209 Wagner 1995, Beck 1998, Doremus 2005, Sullivan et al 2022). In this paper, we engage with
210 questions of how scientific (non)knowledge, values, and human emotions interact and entangle
211 in shaping environmental decision-making processes. As we will show, the emotional intensity
212 of the debate over deer management in Carlisle, MA is indicative that the debate cannot be fully
213 understood simply as a question of rational or purely scientific management. Without
214 discounting the importance of scientific knowledge for making environmental management
215 decisions, we recognize that “the categories ‘political’ and ‘scientific’ often overlap”
216 (Birkenholtz and Simon, p. 156), and that appeals to scientific management should not
217 “necessarily preclude politics from coming to bear on decision-making” (Bocking, 2006). By
218 examining the emotional and ethical political ecologies of deer management in the
219 Massachusetts suburbs, our work aligns with calls for deeper attention to the role of varying
220 environmental values and desires in environmental decision-making (Sullivan et al 2022;
221 Biermann and Anderson 2017, Robbins and Moore 2013).

222 **Methodology**

223 This paper draws on seven years of sustained engagement by our research team with issues of
224 deer management and hunting controversies in Massachusetts. In this paper, we give particular
225 attention paid to Carlisle, MA and a conflict over hunting that flared there in 2019-20. Our
226 analysis focuses on how the parties to that conflict framed their arguments for and against
227 hunting, attending to how questions of science-based management (including appeals to data and

228 evidence, and uncertainty in that evidence) arose alongside or in juxtaposition to questions of
229 ethics and values in decision-making. We attended or reviewed videos from town committee and
230 public meetings relevant to deer management over the period of 2017 to the present, and
231 reviewed related management and planning documents and reports. We also conducted 16 semi-
232 structured, in-depth interviews with stakeholders in deer-related decision-making in Carlisle
233 (including members of the town’s deer committee, Conservation Commission, and Select Board)
234 and community members (including hunters, hunting advocates, those opposed to the hunting
235 program). With the goal to represent a diversity of perspectives, we purposefully selected
236 interviewees based on their familiarity and experience with deliberations about deer management
237 in Carlisle over the period of approximately 2017 to present. After coding and analyzing the data
238 from these interviews and developing a draft manuscript, we returned to the community to
239 conduct a community peer review process (Liboiron et al 2018), asking participants to provide
240 feedback on the perspectives included in this paper and our interpretations of events and
241 dynamics in Carlisle. We thereby aimed to ensure the accuracy of our representation of events
242 and opinions in Carlisle, and to afford the community the opportunity to provide consent and/or
243 express concerns about the research process and findings.¹

244 Via this process, and throughout our research, we aim to examine the competing viewpoints and
245 values regarding deer management (in Carlisle, and beyond) in a way that works to build
246 increasing mutual understanding between parties. In this paper, we attempt to accurately reflect
247 diverse perspectives and attitudes while largely avoiding endorsing one position or another; that
248 is, we examine how scientific uncertainty is deployed as a political tool while remaining agnostic
249 on whether that uncertainty is well-founded or not. While we make no claim to complete
250 objectivity or neutrality, recognizing the limits of scientific objectivity (Haraway 1988) and the
251 inextricably power-laden nature of research, we nonetheless strive to reflect the dynamics of the
252 debate from an outside perspective. In this way, our work does not seek to adjudicate the
253 multiple positions within the debate, but offer a reflection on the process of decision-making that
254 may help to build mutual understanding among participants, as well as contributing to broader
255 discussions on the politics of environmental governance and management.

256 **Debates over deer hunting in Carlisle, Massachusetts**

257 **a. History and context**

258 White-tailed deer are often discussed as both a conservation success and a management
259 challenge. Hunted nearly to extinction during the latter half of the 19th century, deer populations
260 rebounded across North America in the 20th century (Westerfield et al. 2019). In recent decades,
261 this growth has been particularly pronounced in the suburbs, where deer move easily between

¹ Note to readers of unpublished draft: this paragraph will likely be updated to reflect the community peer review process as realized, once complete.

262 forest patches and residential backyards, and benefit from the absence of predators, plentiful
263 food, patchworks of edge habitat, and limited hunting pressure (Gaughan and DeStefano 2005).

264 While some people welcome the presence of deer in their neighborhoods, the growing deer
265 population in the suburbs is often a significant concern for residents, wildlife managers, and
266 municipal officials, and a source of contention (Curtis 2020, Westerfield et al. 2019, Edelblutte
267 et al. 2021, Casellas Connors and Short Gianotti 2021). At high densities, deer can transform
268 forest ecosystems in dramatic and long-lasting ways, reducing understory regeneration and
269 changing the composition of species with cascading impacts on other mammals, birds, and
270 insects (Rooney and Waller 2003, Adams et al 2006). There are also significant concerns about
271 impacts on people, including damage to agriculture and residential landscaping and human safety
272 regarding vehicle collisions (Edelblutte et al. in review, Curtis 2020, Westerfield et al. 2019).
273 Finally, residents and town officials often raise concerns about Lyme disease and other tick-
274 borne diseases, though the relationships between deer, ticks, and disease are complex and
275 contested (Levi et al 2012, Kugeler et al 2015, Kilpatrick et al 2014).²

276 These concerns have prompted many municipalities to consider more actively managing deer.
277 Under the North American Model of Wildlife Conservation, the management of wildlife as a
278 public trust leads to the reliance on volunteer hunting as the primary approach for wildlife
279 population management (Heffelfinger et al 2013). The discussions that surround these local
280 decisions are often contentious, however, with significant public resistance to hunting. Deer
281 management has been described as a “wicked problem” due to complexity and intractability of
282 competing attitudes and values toward deer (Curtis 2020, citing McCance et al. 2017, see also
283 Westerfield et al 2019). This is perhaps especially the case in the suburbs where mutualistic
284 attitudes supporting human-wildlife coexistence held by a growing proportion of the American
285 public may clash with traditional perspectives on wildlife as a natural resource managed for
286 utilitarian ends (Manfredo et al 2017).

287 In Massachusetts, active management of deer occurs through volunteer hunting opportunities,
288 since culling and nonlethal reproductive control measures are not used (Edelblutte et al. 2021,
289 Edelblutte et al. in review). These town-level or property-specific programs are supported by the
290 state wildlife agency, MassWildlife, as part of their efforts to manage deer and other wildlife
291 populations across the state under the public trust doctrine. Municipal deer management is not a
292 new phenomenon, with deer management programs continuously implemented since at least
293 1996 in some areas. In the past decade, deliberation about and efforts to manage deer have grown
294 in the suburbs of Boston (Edelblutte et al., in review).

295 Carlisle, Massachusetts is one such town that considered deer management during this time
296 period. Carlisle is a small, relatively wealthy suburban town northwest of Boston. Residents
297 describe their community as environmentally minded (“Carlisle, to maybe a greater degree than

² See Edelblutte et al. (in review) and Connors and Short Gianotti (2021) for discussion how questions about Lyme disease shapes deer management controversies

298 other towns, cares about the environment;” interview, July 23, 2021) and well-educated (“there
299 are a lot of people here who are trained in critically evaluating information and weeding out
300 misinformation”). The question of whether to allow hunting of deer on town lands has been
301 discussed in Carlisle since at least 2015 but became the subject of significant controversy after
302 the first bow hunt was implemented in 2018, with significant opposition from a group of vocal
303 residents in 2019 and 2020.

304 **b. Hunting in Carlisle is framed in terms of science and evidence**

305 Much of the debate over deer hunting in Carlisle has centered around ecological data and
306 evidence—or in the view of some stakeholders, the absence of, or uncertainties about, that
307 evidence. By its advocates, deer hunting is framed as an effective and necessary form of science-
308 based ecological management. In contrast, opponents argue that there has not been adequate
309 study to demonstrate either the need for, or effectiveness of, hunting, and they raise questions
310 about scientific uncertainty to argue that science does not support hunting. These debates include
311 three distinct, but interrelated, dimensions: the size of the deer population itself, the impact of
312 deer browsing on the forest ecosystem, and the effectiveness of hunting as a management tool.

313 First, supporters of the hunting program frequently describe deer as “overpopulated,” referring to
314 the population estimates and surveys conducted by MassWildlife: “We can safely say, we’re over
315 [the population level that] would be recommended” (interview, August 9, 2021). Opponents of
316 hunting, however, contest the data provided by MassWildlife, arguing that there is “no true
317 evidence that Carlisle has a deer overpopulation problem” (interview, July 27, 2021). Arguing
318 that MassWildlife has treated “overpopulation of deer in Carlisle as a given” based on broader
319 regional concerns, and did not adequately assess local conditions, opponents of the hunting
320 program have repeatedly called for more localized data about deer populations in Carlisle
321 specifically.

322 Second, hunting advocates emphasize the ecological threat of deer browsing on the forest
323 understory, framing hunting as an important tool to prevent negative ecological effects. They
324 argue that the impacts of deer are “becoming more and more evident” and that deer are “having
325 an adverse effect on native forest regeneration” (interview). This concern is increasingly the
326 emphasis of managers at MassWildlife, who have focused regionally on the impacts of deer
327 browse on the vegetation, rather than deer population numbers themselves, as the key metric of
328 and driver for management. MassWildlife conducted deer browse surveys in Carlisle to support
329 their conclusions that deer are having a significant impact on forest health (MassWildlife,
330 personal communication). Again, opponents of hunting call the scientific basis of this argument
331 into question, arguing that “there has not been any evidence presented that [deer are] causing
332 severe or irrevocable damage to our understory” (interview, July 27, 2021), with one individual
333 going so far as to develop their own ecological monitoring protocol for assessing deer impacts,
334 with which they counter MassWildlife’s claim to authority around data and evidence.

335 Third, hunting advocates frame the issue of hunting on town lands as a mechanism for affecting
336 the size of the deer population: in the words of one town decision-maker, the goal of the hunting
337 program was to maintain “the appropriate deer population in order to be... self-sustaining”
338 (interview, August 24, 2021). Here, opponents of the hunting program question the efficacy of
339 archery hunting for population reduction. Noting the small scale of the recent program, where the
340 number of deer killed annually on public lands was in the single digits, they suggest that
341 advocates are misrepresenting not only science but also math: “to reduce the population, you
342 have to kill more deer than are born and survive each year. So killing six deer, especially [if] we
343 have this massive overpopulation that's been presented, it's going to do zero to controlling the
344 population” (interview, July 27, 2021).

345 On all three of these points, scientific uncertainty or nonknowledge is activated as the basis for
346 arguments against hunting, with opponents frequently tacking between these three areas as they
347 describe the whole effort to justify hunting as unscientific: in their words, “science just wasn't
348 coming into it” and “we didn't have credible evidence that we actually had a problem... a lot of
349 unwarranted assumptions were being made that weren't grounded in solid evidence” (interview,
350 July 23, 2021). Many opponents of hunting have repeatedly called for more scientific study,
351 suggesting that any policy changes should wait until decision-makers can, as one interviewee put
352 it, “accumulate the scientific evidence” so that management can “be done scientifically,
353 quantitatively, and with the truth” (interview, August 26, 2021). Meanwhile, supporters of
354 hunting cite MassWildlife’s view that, although the number of deer is difficult to measure
355 precisely, the impacts are significant and any reduction to the deer population via hunting is
356 better than none. They argue that enough evidence has been accumulated to clearly justify action.

357 As one deer committee member noted, the decision-makers tasked with addressing the issue in
358 Carlisle have limited resources, are not expert scientists, and are

359 “very much relying on the information that MassWildlife have been giving us...
360 and that is obviously a point of controversy, because a lot of times people who
361 oppose hunting for various reasons have been using that as an argument against
362 going forward [with hunting], because... they'd like their own data. And of
363 course, generating the data is... very expensive” (interview, August 24, 2021)

364 From their perspective, calls for more research were intentionally being raised as a mechanism
365 for delaying and disrupting the hunting decision rather than amounting to a legitimate scientific
366 concern, describing anti-hunters’ “mantra” of “Where's the evidence? Where's the evidence?” as
367 amounting to an effort to overwhelm them with “intentionally impossible demands” (interview,
368 August 24, 2021). While some SB members continued to trust in the guidance of MassWildlife
369 experts and defend the hunting program, that trust was gradually undermined as some decision-
370 makers grew increasingly sympathetic to concerns about the lack of local data.

371 **c. Hunting in Carlisle as a question of ethics or values**

372 Both sides of the debate over deer hunting in Carlisle lean into the framing of the debate as a
373 question of science-based management and call upon data and evidence (or the lack thereof) to
374 support their views. Yet both sides simultaneously frame their *opponents'* position as being
375 driven by an underlying bias based on personal values, desires, or ethics, while downplaying the
376 role of such things in motivating their own actions and positions.

377 Supporters of hunting frequently characterize the anti-hunting perspective as being rooted in an
378 ethical stance of opposition to the killing of animals. They describe their opponents as “animal
379 lovers” or “animal rights folks” who “believe that all life is precious, and therefore any sort of
380 hunting is unethical” (interviews; August 19, 20, and 24, 2021). Indeed, some interviewees on
381 the anti-hunting side do acknowledge that their opposition to hunting is motivated by animal
382 rights or welfare considerations, saying that “I hate to see animals killed” (interview, July 23,
383 2021), but this position is rarely emphasized. In fact, one opponent of hunting rejects outright
384 being described as an “animal lover,” emphasizing that their position is rooted in science: “I’m
385 personally not opposed to deer hunting. I’m not... [someone] who think[s] it’s [an] abomination,
386 and cruel, and all that... I’d be fine with it if it was just presented as recreational hunting, and if it
387 has an effect on deer [populations], fine. But... there’s no way to prove the effectiveness, and a
388 lot of evidence that it won’t be effective [for population reduction]” (interview, August 20,
389 2021). In this way, opponents of hunting frequently turn back toward the scientific rationale for
390 hunting, and what they view as the absence of evidence to support it, rather than engage in
391 debate on ethical questions about the killing of deer or hunting in suburban public spaces.

392 Moreover, many opponents echo this characterization of the hunting program as rooted in a
393 desire to increase recreational hunting opportunities in Carlisle, characterizing the pro-hunting
394 position as the “unscientific” one. In their view, “Advocates [of hunting] basically saw the
395 resistance growing against recreational hunting, and rebranded recreational hunting as ‘save the
396 forest’ hunting... I think it’s very cynical, and I’m very... suspicious of that.” From this
397 perspective, deer hunting is being justified retroactively as scientific management, with the
398 decision made “backwards” based on “the agenda to open up town lands to hunting.” This view
399 is frequently offered in tandem with skepticism and distrust of MassWildlife, who are repeatedly
400 described as having a conflict of interest and a “hunting agenda,” since the agency’s primary
401 source of revenue comes from hunting licenses and permits. Critics of MassWildlife’s
402 management recommendations describe “a long history of propaganda” based on an “assumption
403 that hunting is a solution” to the deer issue, but note the absence of fine-scale deer density data,
404 describing MassWildlife’s survey of deer browse impacts in Carlisle as “just impossibly
405 cursory... absurd” (interview, July 23, 2021). They repeat calls for further study “by non-biased
406 scientists,” arguing that “there were no facts” and that the premise of deer causing widespread
407 ecological damage was “just this sense that was fueled a lot by Mass Fish and Wildlife”
408 (interview, July 27, 2021). One opponent of hunting describes a shift in their own thinking,
409 whereby animal rights concerns became less important to them than the question of

410 MassWildlife’s conflict of interest: “in the beginning, I came from the, ‘well, this is inhumane’
411 [perspective] and then I actually ended up doing a lot of research, and now I’m coming from a
412 much bigger, kind of like, ‘Wait a second. Yeah, we are being bamboozled here’ perspective”
413 (interview, July 27, 2021).

414 Finally, several opponents of the hunting program describe their opposition not in terms of the
415 ethics of killing animals, but as concern that interventions to “fix” ecological problems are
416 themselves often the problem: “we shouldn’t be playing God” (interview, July 12, 2021) and
417 “whenever human beings try to fix nature, they invariably blank it up... I’ll leave it to you to fill
418 in the blank” (interview, July 23, 2021). Concerns about human hubris in environmental
419 management often align with calls for better scientific evidence to support any proposed
420 intervention and resonate with actors who remain uncertain about their own views on hunting or
421 the ethics of wildlife management. In this context, distrust for decision-makers at both the local
422 and state levels, opposition to hunting for animal welfare reasons, concerns about the proper role
423 of human intervention into ecological systems and processes, and concerns about the validity of
424 scientific evidence for deer management may all be mutually reinforcing (compare Edelblutte et
425 al., in review). Moreover, growing fears of misinformation or even “propaganda” about deer
426 management, amid mutual distrust between the parties, make uncertainty about the science of
427 deer management into an increasingly powerful rhetorical and political tool.

428 **d. Hunting debate as emotional conflict**

429 In the space of a few short years, the issue of what to do about deer in Carlisle evolved from an
430 open inquiry to an acrimonious town debate that, in the words of one municipal official, “is
431 hurting the town because it sucks all of the oxygen out of more important issues.” Both sides of
432 the debate over hunting in Carlisle are quick to note how rapidly it became divisive and personal.
433 In the words of one deer committee member, the hunting program “became so hugely...
434 controversial, and frankly, divisive and nasty” (interview, August 24, 2021); others describe the
435 debates as “fractious,” “very emotional,” and “muddy and ugly,” with “contentious exchanges”
436 and “ad hominem attacks” between participants. For many participants, the emotionality of the
437 debate was seen as a barrier to having a reasonable conversation about the science behind the
438 issue: “it ends up being sort of an emotional discussion, as opposed to a factual discussion... no
439 matter how much they try to be data-based, you get drawn into emotional arguments” (interview,
440 August 20, 2021). The emotional intensity of the debate, and especially the escalation to personal
441 attacks, is described by several interviewees as preventing rational engagement between the
442 parties over the scientific issues at hand.

443 Some opponents of hunting describe the eventual decision to suspend hunting as a victory for
444 science, saying that “even some of the pro-hunting members of the Select Board... began to
445 realize that... they just didn’t have a good enough understanding of what they were doing,” and
446 some people’s views “have changed based on facts and science” (interview, July 27, 2021).
447 Select Board members, though, are a bit more equivocal about their own decision. Although

448 some do acknowledge their own uncertainty about the science, and their hope to obtain more
449 localized ecological data, as important considerations, they generally treat that uncertainty less as
450 a legitimate and serious concern than as an obstacle standing in the way of effectively resolving
451 and moving on from the issue. In the words of one SB member, “it's not worth all this angst and
452 disruption and disharmony, to be talking about things that nobody knows what they're talking
453 about... without enough information about why we're doing this, we're just talking about
454 potshots from the bushes” (interview, September 16, 2021). They tend to emphasize the personal
455 attacks and rising emotions of the debate as the foremost reason for suspending the hunt.

456 Some interviewees note that the debate became emotional precisely because the issue of deer
457 hunting is not simply scientific or rational but related to deep-seated personal beliefs. As one put
458 it, “it's like attacking someone on religion, it just gets very emotional very quickly.” Multiple
459 interviewees describe the anti-hunting group, in particular, as becoming very emotional, because
460 hunting “goes against their values” (interview, August 24, 2021), with one local resident noting
461 that there was very little room for a middle-ground position in the discussion: “if you believe that
462 the understory is being degraded, and it'll never come back, then you... feel like you want to do
463 something. And if, on the other hand, you think... killing animals is bad, then... there's no
464 common ground to be found” (interview, August 20, 2021). In this way, the emotional intensity
465 of the debate appears to have arisen at least in part because the issue of hunting is ultimately a
466 question of underlying personal ethics and values, rooted in competing notions of what it means
467 to care for the natural environment. Once again, however, even those hunting opponents who
468 acknowledge the role of their personal values turn quickly back toward an emphasis on the
469 importance of science-based management:

470 “This is not a laughing matter, killing living creatures. I mean, you if you're going
471 to kill living creatures, you better have a damn good reason for doing it... [but] if
472 I had done the homework that I've done, and it convinced me that... the deer are
473 destroying our forests, and that bow hunting would fix the problem, I would have
474 said that, in spite of the fact that I hate, I hate to see animals killed. I mean, as I
475 told you, I'm a vegetarian... [but] in spite of how I feel emotionally about killing
476 animals, if I thought there was an environmental case, a real environmental case
477 for those hunts, I would have said so.” (interview, July 23, 2021)

478 In this way, the value-laden character of the debate continues to be obscured in favor of an
479 emphasis on what constitutes objective and scientific management and the *facts* (rather than the
480 ethics) that drive it.

481 Notably, this emphasis on the absence of scientific facts is often made in tandem with references
482 to the broader social-political context around questions of fact in American society. For one
483 opponent, the justification for hunting based on deer overpopulation “feels very Trumpian...
484 they want it to be a fact, so they just speak of it as if it's a fact. And the more they repeat it, the
485 more [it] might be accepted: ‘Oh yes, the Carlisle deer overpopulation’” (interview, July 22,

486 2021). Another hunting opponent makes a similar claim with reference to MassWildlife’s efforts
487 to promote hunting, which they describe as “a lot of misinformation”: “we have to also
488 remember what era we have lived between 2016 and 2020, right? With an administration that
489 makes decisions really not based on any kind of data or scientific argument” (interview, August
490 9, 2021). Meanwhile, some supporters of the hunting program argue that it is the “philosophy
491 that we shouldn’t be killing any animals” that is fundamentally unscientific, with one comparing
492 the opposition to hunting to the anti-vaccination movement, saying “they have no science...
493 there’s no science to me” (interview, August 9, 2021).

494 **Discussion**

495 Both sides of the heated debate over hunting in Carlisle generally position themselves as
496 scientific and rational, grounding their arguments in terms of what constitutes effective, science-
497 based environmental management. As seen above, interviewees’ discussions of their positions in
498 the hunting debate strongly emphasize science and data, and rarely center underlying values,
499 ethics, or desires. Scientific evidence regarding the ecological impacts of deer is routinely
500 marshalled to support hunting, while uncertainty, and/or the absence of sufficient scientific
501 evidence, is activated as the basis for arguments against hunting. Hunting opponents have
502 emphasized the lack of definitive knowledge about deer numbers and impacts in Carlisle,
503 contributing to uncertainty in decision-making processes related to hunting. These challenges to
504 decision-making are compounded by uncertainty about the efficacy of hunting programs for
505 achieving desired outcomes on either deer populations or forest health. Through appeals to these
506 nonknowledges and uncertainties, hunting opponents have effectively altered the decision-
507 making process, leading to the program being put on hold.

508 The Carlisle deer management debates demonstrate how uncertainty in science may be deployed
509 as an obstacle to prevent action. In contrast to uses of uncertainty to hinder regulations related to
510 climate change and consumer health (Birkenholtz and Simon 2022), though, this case is not
511 necessarily about the strategic deployment of misinformation, or knowing omission, dismissal, or
512 subversion of scientific facts. Rather, this case illustrates the activation of and emphasis on
513 scientific uncertainties when other (ethical and values-based) rationales are deemed irrelevant or
514 beyond the scope of policy debates. The opponents of hunting, however, are not necessarily
515 disingenuous in their scientific concerns—for them, nonknowledge about the number and
516 impacts of deer and the efficacy of hunting as management are legitimate concerns and areas of
517 “undone science.” Yet these calls do intersect with the desire to limit hunting, which is often
518 motivated by other ethical concerns, and they have effectively served to obstruct management
519 efforts. Conversely, hunting opponents describe the information provided by MassWildlife as
520 misinformation or even “propaganda” motivated by an underlying desire to expand hunting.
521 There is little evidence, however, to suggest that the state and local actors supporting the Carlisle
522 hunt) are acting in bad faith. Even if some actors may be motivated by the goal of expanding
523 recreational hunting, they simultaneously and authentically believe hunting to be a useful tool for
524 effective management in the face of a significant ecological threat.

525 The emotions and the palpable distrust arising from Carlisle’s hunting debate underscore how
526 hunting raises questions that are not simply rational and scientific, but also about ethics and
527 values. Wildlife management—particularly lethal population control—is more than a process of
528 implementing science-based decisions and requires an interrogation of differences in values.
529 Both sides of the issue in Carlisle expressed a sincere belief that science is on their side, and
530 appealed to data and uncertainty out of genuine concern for doing things “scientifically,” not
531 merely as expedient rhetorical tools. Despite the emphasis placed on scientific data and evidence,
532 both sides of the argument still expressed concerns that the other had a secret or unspoken
533 agenda that is based on personal values, ethical positions, and/or desires. Many opponents of
534 hunting believe that the hunting advocates are primarily interested in expanding hunting, and not
535 ecological management. Meanwhile, many advocates of hunting believe that hunting opponents
536 are only concerned with animal rights and welfare, and not ecological management. Indeed,
537 these other interests are often present, but the obfuscation of these personal stakes is not
538 necessarily an indication of deceit or concealment. Rather, such considerations are repeatedly
539 sidelined through a shared emphasis on the importance of science-based decision-making. In this
540 context, the premise that decisions should be exclusively science-based and rational may cause
541 the important differences in values or ethics between stakeholders to go unspoken in public
542 discussion, and instead to be revealed in the form of acrimonious confrontations.

543 Notably, the opposing positions on hunting in Carlisle are both articulated in terms of care for
544 the natural environment. The respective views of pro- and anti-hunters represent competing
545 visions of care rooted in distinct, and often unstated, environmental ethics. On the one hand, care
546 for the individual animal calls for the prevention of suffering and death; on the other, care for the
547 forest ecosystem may require interventions that harm some animals, i.e., deer. The emphasis
548 placed on forest health as a management priority frames deer management in terms of
549 interconnected, multispecies dynamics, where deer are seen less as the central focus of
550 management than as a component and driver of broader ecosystem processes.

551 For some opponents of hunting, however, the critique of management extended beyond concern
552 for individual animals based on their intrinsic value or rights, instead emphasizing concerns
553 about human hubris in ecological management writ large. For some parties, the moral clarity of
554 not killing animals at all provides a way out of the murky ethical terrain that surrounds deadly
555 interventions that benefit some forms of life at the expense of others. For others, this position is
556 seen as elevating concern for “cute,” charismatic animals over attention to the dynamic and
557 complex ecological processes that shape forest health, animal wellbeing, and biodiversity. In
558 between, many grapple with the question of what constitutes a “real environmental case” that is
559 sufficient to justify killing deer. In this context, decision-makers are frequently asked to grapple
560 with the question of whether humans are doing too much or too little to intervene in ecological
561 dynamics (see Robbins and Moore 2013).

562 Amid such tensions surrounding ethics and care, stakeholders on both sides of the divide over
563 hunting in Carlisle turn back toward rationality and science, appealing to further scientific data

564 collection to provide a way out of the difficult decision and social conflict. In a context where
565 science-based management is accepted and even taken for granted as the only legitimate logic for
566 decision-making, questions of data and evidence often become the only accepted means for
567 engagement in debate. Even as one participant suggests that there is “no common ground” to be
568 found between the competing values in the deer debate, there is also very little opportunity for
569 discussion or debate aimed at finding such ground or placing competing values on the table for
570 discussion. Embedded in strong societal norms around scientific management, the community
571 has collectively constructed a shared notion that data and scientific knowledge are the focus of
572 the discussion. Without social norms that allow for open discussion of ethics or values,
573 participants return to scientific arguments to maintain participation in the conversations and
574 influence in decision-making.

575 In this context, any uncertainty, absence of evidence, and/or dissensus in the scientific
576 community (whether perceived or actual) can become a very effective political device, working
577 to delegitimize opponents’ arguments by undermining their claims of scientific rationality.
578 Uncertainty in the existing science becomes the key leverage point around which people tend to
579 stake their arguments. Scientific uncertainty about deer populations and impacts, as well as the
580 efficacy of hunting in their management, provides a mechanism for intervention to stop the hunt
581 that is not possible through appeals to ethics or values. Conversely, efforts to reduce uncertainty
582 and/or to increase comfort with it is an important approach to reduce oppositional efforts.
583 Uncertainty may therefore function as a proxy for ethics, with actors emphasizing arguments
584 about uncertainty because there is little space for ethical debate. In this way, the moral and
585 political dimensions of deer-related decisions are hidden behind the veil of objective, unbiased
586 scientific management.

587 As the community of Carlisle grew increasingly divided over the issue of hunting, scientific
588 uncertainty was increasingly deployed by decision-makers themselves, who used it not
589 necessarily as an argument in favor of or against hunting, but as a reason to put the entire painful
590 topic behind them and move on. Even as they did so, however, they pinned their hopes for an
591 easier (that is, less emotional) discussion to occur someday down the road on the possibility that
592 new data might be acquired that would give definitive answers to the scientific questions being
593 raised. In this way, the certainty of science was again framed as an antidote to politics, and a
594 solution that could unite the fractured community.

595 Such hopes may not be entirely misplaced, as current ongoing research aims to address at least
596 one key scientific question in the debate by measuring deer browse impacts on forest ecosystems
597 in Carlisle and surrounding communities. Such research on a very localized scale has potential,
598 at least in theory, to help bridge divides in Carlisle, since both advocates and opponents of
599 hunting repeatedly describe themselves as being open to changing their position if shown
600 sufficient scientific evidence. If this is true, documented evidence of substantial browse effects
601 could convince opponents of hunting that there really is an ecological threat from deer to be
602 mitigated, and that this is not simply a scare tactic deployed by an untrustworthy and biased pro-

603 hunting lobby. On the other hand, documented evidence of an absence of substantial effects
604 could convince advocates of hunting that ecological concerns are, in fact, overemphasized in the
605 debate. However, it is not clear what level of detail of scientific data will be sufficient to
606 convince either of the opposing parties, and moreover, the ongoing research does not address
607 other dimensions of the debate, such as the efficacy of bow hunting for reducing the deer
608 population.

609 **Conclusion**

610 What can the controversial case of deer management in Carlisle, MA teach us about the
611 entanglement of science and politics in contemporary environmental challenges? Other widely
612 discussed examples of how scientific evidence becomes deeply politicized, such as climate
613 change or consumer health, have primed many observers to think about the politics of scientific
614 uncertainty with particular expectations. For example, we might imagine nefarious actors,
615 motivated by their own profit rather than an honest interest in uncovering the facts, who will
616 latch onto and deploy scientific uncertainties as an obstacle to meaningful government action
617 that would benefit and protect the public and the environment. In such a context, scientific
618 certainty, and the quest for more and better data and evidence (despite its admittedly unending
619 nature), is framed, perhaps particularly in progressive political circles, as a solution: objective,
620 scientific truth will indeed eventually rise above the political fray. In Carlisle, however, there are
621 no such clear-cut villains, and the activation of scientific uncertainty, even if sometimes used as
622 a strategic rhetorical tool, is hardly as insidious. Although the actors are motivated by different
623 personal interests, values, and desires, they are not necessarily aligned along partisan political
624 lines, nor is anyone evidently operating in bad faith. In fact, many describe having a genuine
625 interest in reaching a consensus or compromise; they turn toward science in the hope that it will
626 provide them with one.

627 Yet scientific facts and certainty, important as they are, will only go so far to resolve Carlisle's
628 deer management conflict. That conflict ultimately comes down to a set of value-laden questions
629 about how best to "put nature and our environment first," a goal that both sides of the argument
630 would be likely to agree on, even as they might disagree over what it means. Both sides of the
631 debate over hunting in Carlisle consider their preferred actions as responsible environmental
632 stewardship, based in good science and motivated by the desire to care for the natural world and
633 its creatures. Yet they differently prioritize how to go about enacting such care, with some
634 prioritizing the welfare of individual animals, and others concerned about the overall health of
635 the forest ecosystem. Though many have called for further scientific research to address the
636 question, the collection of additional data cannot ultimately answer the underlying question of
637 whether the value of care for the forest ecosystem of Carlisle outweighs the value of protecting
638 and caring for individual deer, an ethical question beyond the purview of ecological science. In
639 this way, the emergence of new ecological science should not be expected to resolve the
640 challenge of deer management in Carlisle, but may be a generative opportunity for the

641 development of a nuanced conversation recognizing wildlife management as having complex
642 and intertwined scientific and ethical dimensions.

643 Grappling with these value-based differences requires emotional labor on the part of both parties,
644 to ease the tensions raised in the process of discussion, and to create spaces in which it is
645 possible to safely lay one's personal values and beliefs on the table for conservation. It also
646 requires making space for outright conversations about environmental ethics, such as forums for
647 discussion of deer management as a question of competing values, and divergent visions of care
648 for nature, rather than simply being about scientific data and evidence. We make no claim that
649 such spaces and labors will eliminate all conflict over Carlisle's deer management issue, or any
650 other contested environmental management debate. We do argue, however, that a deeper
651 attention to the role of personal values and ethics, and their entanglement within questions of
652 rational scientific management, may help environmental decision-makers better understand what
653 they're really dealing with. In contrast to the common paeon for rational, scientific management
654 that rises above politics, the Carlisle case study shows how managers and decision-makers must
655 grapple with the value-based and emotional dimensions of their decisions and decision-making
656 processes. Acknowledging how wildlife management debates raise competing ethics and values
657 (including ones that are rooted in care for the natural environment on both sides) may create
658 space for less acrimonious disagreement.

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660 **References:**

- 661 Adams, C. E. (2016). *Urban Wildlife Management*. CRC Press.
- 662 Baber, W. F., & Bartlett, R. V. (2005). *Deliberative Environmental Politics: Democracy and Ecological*
663 *Rationality*. MIT Press.
- 664 Baruch-Mordo, S., Breck, S. W., Wilson, K. R., & Broderick, J. (2009). A Tool Box Half Full: How
665 Social Science can Help Solve Human–Wildlife Conflict. *Human Dimensions of Wildlife*, 14(3), 219–
666 223. <https://doi.org/10.1080/10871200902839324>
- 667 Batavia, C., Nelson, M. P., & Wallach, A. D. (2020). The moral residue of conservation. *Conservation*
668 *Biology*, 34(5), 1114–1121. <https://doi.org/10.1111/cobi.13463>
- 669 Beck, T. D. I. (1998). Citizen ballot initiatives: A failure of the wildlife management profession. *Human*
670 *Dimensions of Wildlife*, 3(2), 21–28. <https://doi.org/10.1080/10871209809359122>
- 671 Biermann, C., & Anderson, R. M. (2017). Conservation, biopolitics, and the governance of life and death.
672 *Geography Compass*, 11(10), e12329. <https://doi.org/10.1111/gec3.12329>
- 673 Birkenholtz, T., & Simon, G. (2022). Introduction to themed issue: Ignorance and uncertainty in
674 environmental decision-making. *Geoforum*, 132, 154–161.
675 <https://doi.org/10.1016/j.geoforum.2021.12.003>
- 676 Bocking, S. (2004). *Nature’s Experts: Science, Politics, and the Environment*. Rutgers University Press.
- 677 Bösch, S., Kastenhofer, K., Rust, I., Soentgen, J., & Wehling, P. (2010). Scientific Nonknowledge and
678 Its Political Dynamics: The Cases of Agri-Biotechnology and Mobile Phoning. *Science, Technology, &*
679 *Human Values*, 35(6), 783–811. <https://doi.org/10.1177/0162243909357911>
- 680 Brown, J. D., & Damery, S. L. (2009). Uncertainty and Risk. In *A Companion to Environmental*
681 *Geography* (pp. 81–94). John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781444305722.ch6>
- 682 Buijs, A., & Lawrence, A. (2013). Emotional conflicts in rational forestry: Towards a research agenda for
683 understanding emotions in environmental conflicts. *Forest Policy and Economics*, 33, 104–111.
684 <https://doi.org/10.1016/j.forpol.2012.09.002>
- 685 Callicott, J. B. (1990). Whither Conservation Ethics? *Conservation Biology*, 4(1), 15–20.
- 686 Connors, J. P., & Gianotti, A. S. (2021). Becoming Killable: White-tailed deer management and the
687 production of overabundance in the Blue Hills. *Urban Geography*, 0(0), 1–23.
688 <https://doi.org/10.1080/02723638.2021.1902685>
- 689 Curtis, P. D. (2020). After Decades of Suburban Deer Research and Management in the Eastern United
690 States: Where Do We Go From Here? *Human-Wildlife Interactions* 14(1).
- 691 Decker, D. J., Shanks, R. E., Nielsen, L. A., & Parsons, G. R. (1991). Ethical and Scientific Judgements
692 in Management: Beware of Blurred Distinctions. *Wildlife Society Bulletin* 19(4), 523–527.

693 Dickman, A. J. (2010). Complexities of conflict: The importance of considering social factors for
694 effectively resolving human–wildlife conflict. *Animal Conservation*, 13(5), 458–466.
695 <https://doi.org/10.1111/j.1469-1795.2010.00368.x>Doremus 2005

696 Dryzek, J. S. (2013). *The Politics of the Earth: Environmental Discourses*. Oxford University Press.

697 Edelblutte, É., Short Gianotti, A. G., & Connors, J. P. C. (2021). Perceptions, concerns, and management
698 of white-tailed deer among municipal officials. *Human Dimensions of Wildlife*.
699 <https://doi.org/10.1080/10871209.2021.1959963>

700 Epstein, K., & Haggerty, J. (2022). Managing wild emotions: Wildlife managers as intermediaries at the
701 conflictual boundaries of access relations. *Geoforum*, 132, 103–112.
702 <https://doi.org/10.1016/j.geoforum.2022.04.004>

703 Frickel, S., Gibbon, S., Howard, J., Kempner, J., Ottinger, G., & Hess, D. J. (2010). Undone Science:
704 Charting Social Movement and Civil Society Challenges to Research Agenda Setting. *Science,
705 Technology & Human Values*, 35(4), 444–473. <https://doi.org/10.1177/0162243909345836>

706 Frickel, S., & Vincent, M. B. (2007). Hurricane Katrina, contamination, and the unintended organization
707 of ignorance. *Technology in Society*, 29(2), 181–188. <https://doi.org/10.1016/j.techsoc.2007.01.007>

708 Gambourg, C., Palmer, C., & Sandøe, P. (2012). Ethics of Wildlife Management and Conservation: What
709 should we try to protect?

710 Gaughan, C. R., & Destefano, S. (2005). Collaboration for community-based wildlife management.
711 *Urban Ecosystems*, 8(2), 191–202. <https://doi.org/10.1007/s11252-005-3265-5>

712 Gibbs, L. (2021). Animal geographies II: Killing and caring (in times of crisis). *Progress in Human
713 Geography*, 45(2), 371–381. <https://doi.org/10.1177/0309132520942295>

714 Ginn, F., Beisel, U., & Barua, M. (2014). Flourishing with Awkward Creatures: Togetherness,
715 Vulnerability, Killing. *Environmental Humanities*, 4(1), 113–123. [https://doi.org/10.1215/22011919-
716 3614953](https://doi.org/10.1215/22011919-3614953)

717 Godoy, E. S. (2020). Sympathy for Cecil: Gender, trophy hunting, and the western environmental
718 imaginary. *Journal of Political Ecology*, 27(1), Article 1. <https://doi.org/10.2458/v27i1.23526>

719 González-Hidalgo, M., & Zografos, C. (2020). Emotions, power, and environmental conflict: Expanding
720 the ‘emotional turn’ in political ecology. *Progress in Human Geography*, 44(2), 235–255.
721 <https://doi.org/10.1177/0309132518824644>

722 Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of
723 Partial Perspective. *Feminist Studies*, 14(3), 575. <https://doi.org/10.2307/3178066>

724 Heffelfinger, J. R., Geist, V., & Wishart, W. (2013). The role of hunting in North American wildlife
725 conservation. *International Journal of Environmental Studies*, 70(3), 399–413.
726 <https://doi.org/10.1080/00207233.2013.800383>

727 Hess, D. J. (2016). *Undone Science: Social Movements, Mobilized Publics, and Industrial Transitions*
728 (Reprint edition). MIT Press.

- 729 Kilpatrick, H. J., LaBonte, A. M., & Stafford, K. C. (2014). The relationship between deer density, tick
730 abundance, and human cases of Lyme disease in a residential community. *Journal of Medical*
731 *Entomology*, 51(4), 777–784. <https://doi.org/10.1603/me13232>
- 732 Kroepsch, A. C., & Clifford, K. R. (2022). On environments of not knowing: How some environmental
733 spaces and circulations are made inscrutable. *Geoforum*, 132, 171–181.
734 <https://doi.org/10.1016/j.geoforum.2021.05.009>
- 735 Kugeler, K. J., Jordan, R. A., Schulze, T. L., Griffith, K. S., & Mead, P. S. (2016). Will Culling White-
736 Tailed Deer Prevent Lyme Disease? *Zoonoses and Public Health*, 63(5), 337–345.
737 <https://doi.org/10.1111/zph.12245>
- 738 Levi, T., Kilpatrick, A. M., Mangel, M., & Wilmers, C. C. (2012). Deer, predators, and the emergence of
739 Lyme disease. *Proceedings of the National Academy of Sciences*, 109(27), 10942–10947.
740 <https://doi.org/10.1073/pnas.1204536109>
- 741 Li, T. (2014). *Land's end: Capitalist relations on an indigenous frontier*. Duke University Press.
- 742 Liboiron, M., Zahara, A., & Schoot, I. (2018). Community Peer Review: A Method to Bring Consent and
743 Self-Determination into the Sciences. <https://doi.org/10.20944/preprints201806.0104.v1>
- 744 Lutts, R. H. (1992). The Trouble with Bambi: Walt Disney's Bambi and the American Vision of Nature.
745 *Forest & Conservation History*, 36(4), 160–171. <https://doi.org/10.2307/3983677>
- 746 Manfredo, M. J., Teel, T. L., Sullivan, L., & Dietsch, A. M. (2017). Values, trust, and cultural backlash in
747 conservation governance: The case of wildlife management in the United States. *Biological Conservation*,
748 214, 303–311. <https://doi.org/10.1016/j.biocon.2017.07.032>
- 749 Manfredo, M. J., Sullivan, L., Don Carlos, A. W., Dietsch, A. M., & Teel, T. L. (2018). America's
750 Wildlife Values: The Social Context of Wildlife Management in the U.S. Colorado State University,
751 Department of Human Dimensions of Natural Resources.
- 752 Margulies, J. D., & Karanth, K. K. (2018). The production of human-wildlife conflict: A political animal
753 geography of encounter. *Geoforum*, 95, 153–164. <https://doi.org/10.1016/j.geoforum.2018.06.011>
- 754 Martin, J. V. (2021). Between Scylla and Charybdis: Environmental governance and illegibility in the
755 American West. *Geoforum*, 123, 194–204. <https://doi.org/10.1016/j.geoforum.2019.08.015>
- 756 Mazhary, H. (2021). Distancing animal death: Geographies of killing and making killable. *Geography*
757 *Compass*, 15(7), e12582. <https://doi.org/10.1111/gec3.12582>
- 758 McCance, E., Baydack, R., Walker, D., & Leask, D. (2015). Spatial and Temporal Analysis of Factors
759 Associated with Urban Deer–Vehicle Collisions. *Human–Wildlife Interactions*, 9(1).
760 <https://doi.org/10.26077/zj89-bb76>
- 761 McGoey, L. (2012). The logic of strategic ignorance. *The British Journal of Sociology*, 63(3), 533–576.
762 <https://doi.org/10.1111/j.1468-4446.2012.01424.x>
- 763 Michaels, D. (2008). *Doubt is Their Product: How Industry's Assault on Science Threatens Your Health*.
764 Oxford University Press.

765 Mitchell, T. (2002). *Rule of experts: Egypt, techno-politics, modernity*. University of California Press.

766 Morgan, K. J., & Orloff, A. S. (Eds.). (2017). *The Many Hands of the State: Theorizing Political*
767 *Authority and Social Control*. Cambridge University Press.

768 Nie, M. (2004). *State Wildlife Policy and Management: The Scope and Bias of Political Conflict*. *Public*
769 *Administration Review*, 64(2), 221–233. <https://doi.org/10.1111/j.1540-6210.2004.00363.x>

770 Oreskes, N., & Conway, E. M. (2010). *Merchants of Doubt: How a Handful of Scientists Obscured the*
771 *Truth on Issues from Tobacco Smoke to Climate Change*. Bloomsbury Publishing.

772 Parreñas, J. S. (2018). *Decolonizing Extinction: The Work of Care in Orangutan Rehabilitation*. Duke
773 University Press Books.

774 Proctor, R., & Schiebinger, L. L. (Eds.). (2008). *Agnotology: The making and unmaking of ignorance*.
775 Stanford University Press.

776 Putnam, R. D. (1977). *Elite Transformation in Advanced Industrial Societies: An Empirical Assessment*
777 *of the Theory of Technocracy*. *Comparative Political Studies*, 10(3), 383–412.
778 <https://doi.org/10.1177/001041407701000305>

779 Ramp, D., & Bekoff, M. (2015). *Compassion as a Practical and Evolved Ethic for Conservation*.
780 *BioScience*, 65(3), 323–327. <https://doi.org/10.1093/biosci/biu223>

781 Rayner, S. (2012). *Uncomfortable knowledge: The social construction of ignorance in science and*
782 *environmental policy discourses*. *Economy and Society*, 41(1), 107–125.
783 <https://doi.org/10.1080/03085147.2011.637335>

784 Robbins, P., & Moore, S. A. (2013). *Ecological anxiety disorder: Diagnosing the politics of the*
785 *Anthropocene*. *Cultural Geographies*, 20(1), 3–19.

786 Rooney, T. P., & Waller, D. M. (2003). *Direct and indirect effects of white-tailed deer in forest*
787 *ecosystems*. *Forest Ecology and Management*, 181(1), 165–176. [https://doi.org/10.1016/S0378-](https://doi.org/10.1016/S0378-1127(03)00130-0)
788 [1127\(03\)00130-0](https://doi.org/10.1016/S0378-1127(03)00130-0)

789 Scott, J. C. (1998). *Seeing like a state: How certain schemes to improve the human condition have failed*.
790 Yale University Press.

791 Senanayake, N., & King, B. (2021). *Geographies of uncertainty*. *Geoforum*, 123, 129–135.
792 <https://doi.org/10.1016/j.geoforum.2020.07.016>

793 Soulé, M. E. (1985). *What is conservation biology?* *BioScience*, 35(11), 727–734.

794 Spicer, M. W. (2010). *In Defense of Politics in Public Administration: A Value Pluralist Perspective*.
795 University Alabama Press.

796 Srinivasan, K. (2014). *Caring for the collective: Biopower and agential subjectification in wildlife*
797 *conservation*. *Environment and Planning D: Society and Space*, 32(3), 501–517.
798 <https://doi.org/10.1068/d13101p>

799 Stinchcomb, T., Ma, Z., & Nyssa, Z. (2022). Complex human-deer interactions challenge conventional
800 management approaches: The need to consider power, trust, and emotion. *Ecology and Society*, 27(1).
801 <https://doi.org/10.5751/ES-12899-270113>

802 Sullivan, L. M., Manfredi, M. J., & Teel, T. L. (2022). Technocracy in a time of changing values:
803 Wildlife conservation and the “relevancy” of governance reform. *Conservation Science and Practice*,
804 4(2), e545. <https://doi.org/10.1111/csp2.545>

805 Sultana, F. (2015). Emotional political ecology. In R. Bryant, *The International Handbook of Political*
806 *Ecology* (pp. 633–645). Edward Elgar Publishing. <https://doi.org/10.4337/9780857936172.00056>

807 Vallée, M. (2021). Fostering ignorance to maintain public support: New Zealand’s 2002–2004 urban
808 aerial pesticide spraying operation over Auckland. *Environmental Sociology*, 7(4), 382–392.
809 <https://doi.org/10.1080/23251042.2021.1884341>

810 Wagner, W. E. (1995). The Science Charade in Toxic Risk Regulation. *Columbia Law Review*, 95(7),
811 1613. <https://doi.org/10.2307/1123193>

812 Wallach, A. D., Bekoff, M., Batavia, C., Nelson, M. P., & Ramp, D. (2018). Summoning compassion to
813 address the challenges of conservation. *Conservation Biology*, 32(6), 1255–1265.
814 <https://doi.org/10.1111/cobi.13126>

815 Westerfield, G. D., Shannon, J. M., Duvuvuei, O. V., Decker, T. A., Snow, N. P., Shank, E. D., Wakeling,
816 B. F., & White, H. B. (n.d.). *Methods for Managing Human–Deer Conflicts in Urban, Suburban, and*
817 *Exurban Areas*. 106.

818 Wynne-Jones, S. (n.d.). *Rewilding: An emotional nature*. *Area*. <https://doi.org/10.1111/area.12810>

819