Inclusive Sustainability Approaches in Common-Pool Resources from the Perspective of Blackologists

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The tragedy of the commons posits that depletion of common resources harms all stakeholders. Although such a downward spiral is plausible, the potential outcomes are far more complex. In the present article, we report on this coupled feedback between resource strategies and the environment from the perspective of Blackologists. We fully embrace that our understanding and appreciation for nature are inherently shaped by our identity, culture, and lived experiences. First, we deconstruct the uses and beneficiaries of the shared resource. Then, we identify potential cascades of conflict through the lens of resource partitioning, plasticity, and mitigation strategies recognizing the inherent human dimension nested within these dynamics. We emphasize that who studies these processes can alter the framing and outcome of the tragedy through several case studies. We recommend that avoidance of environmental tragedies is possible with inclusive engagement, interdisciplinarity, and oversight at different spatial and temporal scales.

Keywords: Blackologists, conservation, interdisciplinary, coupled human natural ecosystems, tragedy of the commons, disease ecology

Historically, there is a tendency of science and scientists to extract humanity from research and ignore personal roles and identities (Kuhn 2012). This is often done under the guise of promoting unbiased research. However, there is a growing recognition that researchers embody their work and that there is no such thing as a “view from nowhere” (Nicholson 2013). Lived experiences and identities influence how the world is experienced and the questions scientists are compelled to ask and answer. Increasingly, this “personalized ecology” has become more relevant and appreciated (Gaston et al. 2018). Blackologists are not simply scholars that are Black but, rather, are scholars who deliberately leverage and intersect Blackness into advancing knowledge production. As Blackologists across environmental and related fields, our identities explicitly influence how we interact with the natural world and how we are perceived in natural spaces and must navigate in academic and research settings (Roberts and Henderson 1997, Finney 2014, Jimenez et al. 2019, Miriti 2020). Accordingly, these experiences provide a unique perspective from which to critically examine socioecological processes and the challenges and solutions that arise from them. In the present article, a group of Black interdisciplinary scientists apply that perspective to understanding and engaging with research related to the tragedy of the commons and the complex socioecological processes that drive the use and management of common-pool resources.

The concept of the tragedy of the commons, first popularized by Hardin (1968), posits that the short-term self-interests of individuals for common resources result in environmental degradation and catastrophes ranging from overfishing to the present climate change crisis. This idea has significantly influenced research surrounding human nature, natural resource use and governance, cooperation, and hazard management in a wide range of scientific fields (Axelrod and Hamilton 1981, Ostrom 2015). Although Hardin (1968) suggested that the tragedy might be inevitable, applications of the tragedy of the commons often conclude that effective mechanisms to resolve resource conflicts prevent such collapse (Feeny et al. 1990, Milinski et al. 2002, Rankin et al. 2007). Common-pool resources are considered to be renewables, including timber, forests, and fish stocks, but they also include less tangible considerations, such as climate change and antibiotics, that are difficult to spatially delineate and whose impacts permeate across scales when they are overused. Therefore, common-pool resources require regulation and management (Ostrom 2015).

A growing interest has emerged to identify and understand the major environmental challenges that intensify the tragedy of the commons and its traits, across scales that

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either exacerbate or mitigate the tragedy (Gersani et al. 2001, Cole et al. 2014, Berger et al. 2016). Furthermore, collective enterprise and cooperation represent alternatives in communities that oppose actions of selfishness (Nowak 2006). Beneath this interest lies who can versus who should interrogate this topic, how the interrogation occurs, what the justifications of the interrogation are, and where to integrate identity and experience into scrutinizing the tragedy. Our work addresses these questions through the articulation of inclusive sustainability approaches in common-pool resources from the perspective of Blackologists.

Ongoing human-induced global change alters the dynamics of common-pool resources and user interactions (Dirzo et al. 2014, Hautier et al. 2015, Sebastián-González et al. 2019). Climate change, urbanization, invasive species, pollution, disease outbreaks, land conversion, and other global-scale anthropogenic processes may create concerns surrounding the availability and quality of natural resources, exacerbating the tragedy and limiting the potential for cooperation. For example, Lake Tanganyika, a transnational lake in Eastern Africa that supports the food and protein needs, economic activities, and transportation of millions of people, is severely affected by a warming climate (O'Reilly et al. 2003, Verburg et al. 2003). Declines in biodiversity and productivity caused by climate change are associated with an increased intensity of natural resource extraction, overfishing, and ecological degradation (Johnson et al. 2017). The current COVID-19 global pandemic and potential future zoonotic outbreaks represent another important example of the links between human resource use and behavior and the tragedy of the commons. Operating at local, regional, and global scales, there is an increasing overlap of human and domestic animal populations with wildlife populations, often driven by climate change, deforestation, expanding agriculture, a lack of accessible protein sources, and human conflict (Patz et al. 2004, Wolfe et al. 2005, Allen et al. 2017 Watson et al. 2018). The degradation of common-pool resources, such as intact forests and sustainable food sources, has meaningful links to health security and future zoonotic disease spillover (Patz et al. 2004, Gibb et al. 2020). Alternative outcomes exist, however; the shared threat of global change may encourage cooperation and promote innovations to overcome the tragedy (e.g., Moss et al. 2010, Raymond et al. 2013). The complex interactions that drive human behavior surrounding resource availability are further complicated by unpredictability, unsustainability, and social inequity, creating a need to explicitly consider discussions of the tragedy and implement interdisciplinary inquiry (Al-Bakri et al. 2013, Patt 2017, Hamann et al. 2018).

Importantly and interestingly, the tragedy of the commons and the associated anthropogenic disturbances exist across scales and contexts. Common-pool resources are marked by difficulty in excluding users and potential competition among resource users (Hardin 1968, Maldonado and Moreno-Sanchez 2016). For ecologists and environmental scientists, these resources include those within protected areas, those influenced by human–environment interactions, and a range of biotic and abiotic processes (Rankin et al. 2007). The dynamics of protected area function and sustainability are influenced by local communities and their livelihoods, and ignoring their roles can have significant unintended impacts (Fiallo and Jacobson 1995, Agrawal and Redford 2009, Christie et al. 2017). The emergence of zoonoses and infectious diseases, such as COVID-19, is driven by social and ecological processes operating at local and global scales (Karesh et al. 2012, Han et al. 2016). The dynamics of food web interactions and consequent ecosystem services affect human livelihoods disproportionately across scales (Jennings and Gaither 2015). Such socioecological processes, linked by their governance and dependence on common-pool resources at different scales, provide a valuable opportunity to research the conditions under which the tragedy occurs and strategies for mitigation. In particular, overlooked feedbacks between social and ecological processes, often highlighted by our experiences as BIPOC (for *Black, Indigenous, and people of color*) scholars, may shed light on effective remediation of the tragedy. For example, explicit consideration of variation in resource users, the nature and manifestation of conflict itself, and the roles of humans as both resource users and conflict mediators provide insights into the tragedy and into the ways it can be overcome.

In this article, we present case studies on protected areas and zoonotic diseases to highlight common-pool resources and the potential for the tragedy of the commons across scales. We unpack the actors and resources with the potential for tragedy, the feedback that influences its occurrence, and potential outcomes. We focus on socioecological feedbacks and the role humans play in these complex dynamic processes. In so doing, we underscore the necessity of interdisciplinarity and inclusion to understand the tragedy of the commons, emphasizing the inherent human dimension and, therefore, the importance of identity in studying and rectifying the tragedy. We demonstrate that the diversity and broad representation of interdisciplinary scientists strengthens our collective capacity to avert the tragedy of the commons across scales. As Blackologists, we argue that the marginalization of our identities across disciplines advances the very tragedy scientific communities hope to avert.

Alternative stable states in coupled human–environmental systems

The current paradigm for understanding human–environmental interactions posits that human activities have deleterious consequences for natural ecosystems (Steffen et al. 2015). This negative relationship between humans and natural ecosystems is primarily driven by overuse and competition for resources (Dearing et al. 2010). However, recent theoretical developments suggest that human–environmental interactions represent interdependent coupled systems (Henderson et al. 2016). For example, when natural land becomes rare, resource users prioritize

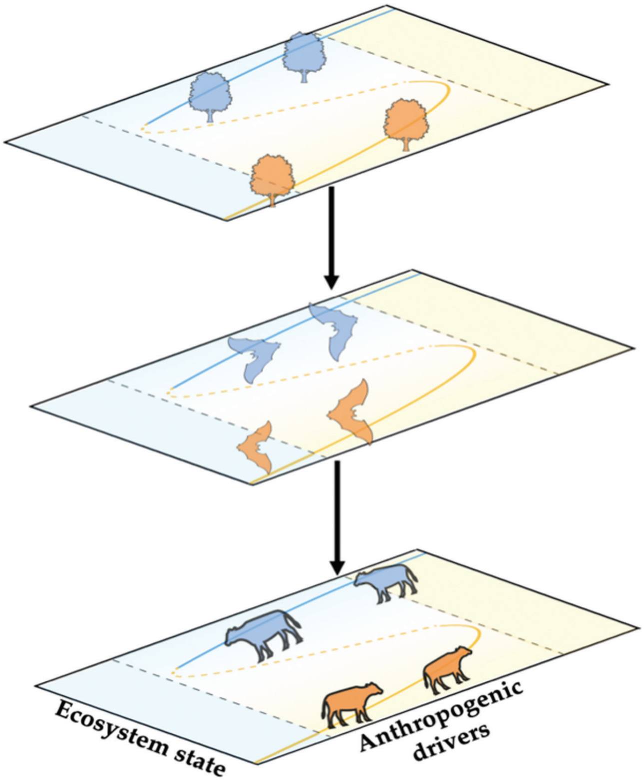

Figure 1. A conceptual diagram illustrating hysteresis between anthropogenic drivers and ecosystem state. Hysteresis is when the return trajectory to a stable state in a system (i.e., equilibrium) is different from the outgoing trajectory. The solid blue and orange lines represent stable equilibrium states and the shaded zones show the basins of attraction. The dashed line represents an unstable equilibrium and marks the boundary between the basins of attractions of the two alternative stable states.

conservation efforts, resulting in positive feedback, whereas the perception of abundant resources, such as the conversion of natural land to agriculture, devalues conservation, resulting in negative feedback.

Understanding how coupled human–environmental systems respond to changing ecological and social conditions requires the identification of key feedback loops and constraints (Scheffer 2009, Lenton 2020). Models of alternative stable states have been used to predict when a system suddenly collapses because of gradual changes in human and environmental factors (Maciejewski et al. 2019). Alternative stable-state models provide a useful framework for developing management tools to restore natural systems, particularly in situations in which the trajectories for collapse and recovery differ (Lenton 2013, Biggs et al. 2018). Alternative stable states can be intuitively understood through the representation of environments composed of stability properties at different external conditions (figure 1).

Resiliency illustrates an important component of alternative stable states because it determines the speed at which the system returns to its desired state (Scheffer 2009). Catastrophic shifts occur when the state of the system moves past a tipping point that results in irreversible change—the tragedy. When the state of the ecosystem is far away from the tipping point, the system is considered to be resilient (Strogatz 2014). Hysteresis arises when parameter changes alter the environment into multiple alternative stable states (figure 2). In the present article, we discuss particular human–environmental systems that describe common pools across spatial and temporal scales. We present a comparative analysis that factors the positive contributions of human activities by identifying design principles and practices of inclusivity that avert the tragedy of the commons.

Protected areas inciting tragedy of the commons

Conservation estates abut, intersect, and sometimes even encompass indigenous and other communities of color worldwide. Such juxtaposition implicitly features power asymmetries and incites scrutiny in these areas over who participates in knowledge production and decision-making, as well as who is included in the distribution of resultant benefits. With over 25000 designations that span 15% and 7.6% of terrestrial and marine ecosystems, respectively, protected areas remain the most pervasive global strategy implemented to conserve biodiversity and ecosystem services (UNEP-WCMC and IUCN 2019). These protected areas disproportionately occur in regions of the world with high biodiversity (e.g., tropics) and where communities of Black and Brown people are struggling for subsistence and equality. Protected areas, paradoxically, as a public good harboring common-pool resources, aim to provide assurance of natural assets with diverse benefits but through various forms of fortress conservation that can disadvantage certain populations (Brockington and Igoe 2006, Wilkie et al. 2006, Gaston et al. 2008, Watson et al. 2014). Historically built on exclusionary principles that displace people, protected areas constrain human activities, regulating the flow of benefits, restricting the scope of beneficiaries, and inducing the tragedy of the commons (Ferraro and Hanauer 2014, Oldekop et al. 2016). However, we recognize that “trapping” services within a legal infrastructure of protected areas under the misguided premise of protection creates conflict, insults traditional knowledge, and does not inherently promote sustainability of the common goods (Herse et al. 2020). Instead, the oral histories and traditions of our ancestors connect us to lands, seas, and mountains in a unique manner. It is this sense of place that can prohibit degradation because degradation of place equates to degradation of self, of culture, of history. Furthermore, displacement with prohibition arguably does not promote inclusive practices to collectively maintain and manage common-pool resources. As such, the effectiveness of protected areas to deliver conservation goals and protecting resources without large public endorsement has repeatedly been called into question. Scholars have highlighted the inadequacy of staff and budgets necessary for management, including law enforcement (Coad et al. 2019,

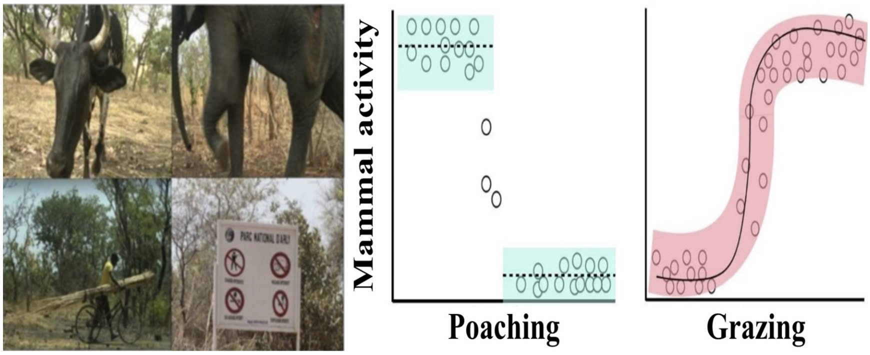

Figure 2. Tipping and socioecological regime shifts in a West African ecosystem. Mammal activity impacts due to human activities (Harris et al. 2019). Hypothetical trajectories representing the dynamics of changing ecosystems. Direct effects (e.g., poaching) leads to a tipping point resulting in reduced mammal activity. Indirect effects (livestock grazing) can also result in a tipping point resulting in redacted mammal activity.

Geldmann et al. 2019). Furthermore, Jones and colleagues (2018) reported that one-third of protected areas are under intense anthropogenic pressures, highlighting the vulnerability of small protected areas and those throughout West Africa, Europe, and Asia. However, this coupling between natural and human systems in the Anthropocene and seemingly geographic disparity creates both challenges and opportunities for place-based conservation and those from diverse backgrounds to engage in mitigating the tragedy (Dobrovolski et al. 2014, Visconti et al. 2015).

Endogenous characteristics that include synergisms among ecological, environmental, and social processes create the emergent properties of protected areas (Naughton-Treves et al. 2005, Palomo et al. 2014, Blanco et al. 2020). Tragedies emerge from mismanagement and inequitable management that benefit few while harming many. Whether deemed legal or illegal, the exploitation of common-pool resources from inside protected area boundaries across biomes elucidates the contributions of conservation to human societies, education potential, and opportunities for community involvement while simultaneously exacerbating the tragedy of the commons. Within the largest protected area complex in West Africa, Harris and colleagues (2019) documented extensive human activities, including indirect forms from domestic species that interact with wild mammal assemblages (figure 2). In an assessment of 15 Mediterranean marine protected areas, Zupan and colleagues (2018) highlighted consequences of nonconsumptive activities as threats inside boundaries and the ineffectiveness of these protected areas to curb threats in comparison to areas outside protection, particularly for those designated with partial protection. Exogenous threats operating across scales with an exaggerated human influence outside park boundaries encroach on ecosystem integrity and stability, as well as species persistence (DeFries et al. 2007, Ament and Cumming 2016, Veldhuis et al. 2019). As such, land-use planning scenarios caution (Martinuzzi et al. 2015). Ultimately, simultaneous consideration of both development and conservation agendas requires a strategic and adaptable implementation strategy to minimize the emergence of the tragedy and also requires scholars familiar with persistent struggles (Nyhus 2016, Soliku and Schraml 2018). BIPOC scholars endure systemic racism and a suite of professional barriers intended to hinder our full participation (Schell et al. 2020). Therefore, we have an empathy and relatability to indigenous communities all over the world that are challenged by simply the desire to preserve their culture and sacred ties to the environment.

In addition to broader engagement from Blackologists, we highlight two promising strategies to combat outcomes of degradation with common-pool resources. First, local people, culture, and practices should be integrated into the management of protected areas, with indigenous lands being recognized for their contributions to conservation (Corrigan et al. 2018, Garnett et al. 2018). Second, who is involved in monitoring protected areas and how they are involved requires greater scrutiny, because narrow metrics of biodiversity undervalue the social benefits derived from protected areas, and assessments based solely on outsider perspectives are not inclusive or informed. Increasing the application of tools that employ social and economic indicators with inherent considerations of governance (not just management) will promote shared benefits to avert the commons (Zafra-Calvo et al. 2017, Corrigan et al. 2018).

Infectious diseases and environmental change

Emerging infectious diseases continue to increase in frequency and coverage, with further expansion exacerbated by the Anthropocene (Hassell et al. 2017, Rogalski et al. 2017, White and Razgour 2020). Some of the most devastating infectious diseases have their origins in wildlife, including influenza, SARS (severe acute respiratory syndrome), COVID-19, and HIV/AIDS (Woolhouse et al. 2012, Aguirre et al. 2020). Zoonotic pathogens, primarily within livestock and domesticated animals, serve as a pathogen bridge between humans and wildlife (figure 3). Biodiversity conservation remains critical in minimizing human exposure and transmission (Keesing and Ostfeld 2021, Harris and Dunn 2013, Salkeld et al. 2013).

Anthropogenic environmental change affects many aspects of human health and well-being and has been associated with the recent emergence of infectious diseases. The expansion of agriculture and urbanization has drastically altered the structure and functioning of ecosystems, species diversity, and community composition (Kilpatrick and Randolph 2012, Jones et al. 2013, Hassell et al. 2017, Rohr et al. 2019). These land-use changes have

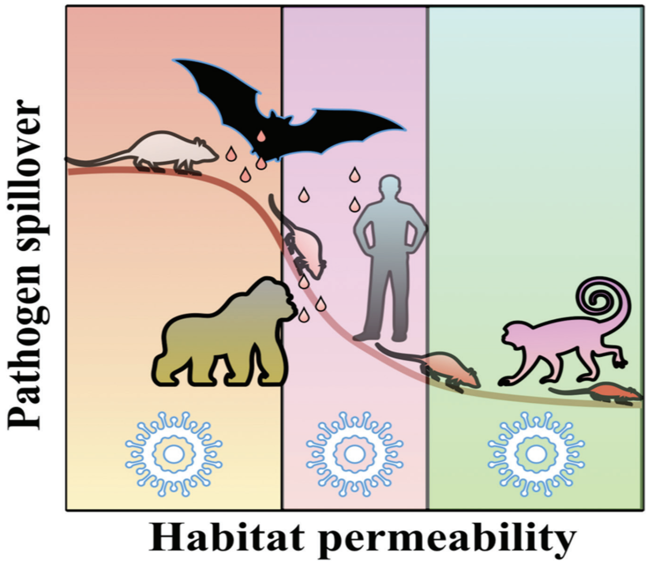

Figure 3. Pathogen spillover and anthropogenic land-use change. Human alteration of the environment increases contact rates at the animal–human interface with implications for zoonotic spillover risk.

increased contact between humans and wildlife, modulating transmission dynamics in reservoir communities and causing pathogen spillover to humans. Land-use changes have been implicated in driving zoonotic disease outbreaks. For instance, large geospatial data sets spanning 13 years from the Brazilian Amazon rainforest showed that deforestation increased malaria transmission, whereas high malaria burdens simultaneously decreased with forest clearing (MacDonald and Mordecai 2019). This contradictory finding can be explained by a bidirectional socioecological feedback loop whereby deforestation promotes malaria transmission via ecological mechanisms, but local epidemics reduce forest clearing because of poor health and, in turn, reduce economic activity (MacDonald and Mordecai 2019). Climate change is projected to exacerbate the global risk and distribution of infectious diseases (Ryan et al. 2019). The range of mosquito-borne viruses, including dengue, chikungunya, and Zika, can significantly expand and increase the potential for transmission under current climate change scenarios (Messina et al. 2015). Moreover, human and societal adaptation to climate change might shift disease patterns. For example, drought risk may encourage water storage practices that facilitate breeding sites for mosquitoes (Beebe et al. 2009). Complete mitigation of climate change to preindustrial levels will need to factor in concurrent global changes of arthropod vectors.

To avert the tragedy of the commons, we recommend that public health efforts embrace holistic approaches that incorporate socioenvironmental determinants into the study of infectious diseases by forging collaborations and partnerships with local community-based organizations serving BIPOC communities. This approach recognizes the value of the community and solicits its participation and likely results in a community response that addresses the social determinants of infectious diseases (Biehler et al. 2018). An example of the effectiveness and success of this approach is the Baltimore Mosquito Study, in which ecologists have engaged with community members. This community-based mosquito program combines ecological sampling of mosquito abundances with residents' narratives of historic race-based injustices, including monetary divestments, planning policies, and altered landscapes that facilitate suitable habitat conditions for mosquito breeding sites (Katz et al. 2020).

One major obstacle to the implementation of community-based projects is that Black scientists are less likely than their White counterparts to receive funding from national agencies, such as the National Institutes of Health (NIH; Ginther et al. 2011). One key factor that contributes to this discrepancy in funding is that Black applicants are more likely to propose approaches that include community-based interventions to address health issues in BIPOC communities that are broadly perceived as less appealing (Hoppe et al. 2019). Although reviewer bias contributes to funding disparities, we urge institutions such as the NIH and the National Science foundation to broaden their spending priorities by encouraging practical applications to addressing a myriad of environmental challenges. Some additional solutions to tackling racial funding disparities include explicitly stating that racism persists and must be expelled at research institutes, implement policies to achieve racial funding equity, diversify review panels and scoring criteria, and train grant reviewers and recipients to tackle racism (Stevens et al. 2021). As Blackologists, we call for the integration of community-based interventions in infectious disease research.

Incorporating Black identity into ecological solutions

Our work as Blackologists must be interdisciplinary and transdisciplinary to be effective. Such connectivity and inclusivity can enhance and strengthen our collective capacity to cope with and reduce the negative impacts of the tragedy of the commons at both local and broader scales. Interdisciplinary collaborations and networking provides a platform for various disciplines to aggregate their knowledge and identify research gaps and environmental priorities, which aids in creating novel and robust solutions to environmental problems. Exposure to authentic experiences and meaningful engagement among those with shared dimensions of identity could diversify the pool of future generations of ecologists, conservationists, and natural resource managers (Bela et al. 2016). Therefore, future generations (particularly those marginalized and disadvantaged because of their race) must be connected to resources including mentors, funding, professional development experiences, and collaborative networks and opportunities to promote the positive factors that broaden participation in environmentally relevant careers (Sealey et al. 2020, Miriti 2020). Diversifying the scientific workforce is an important way to build capacity and progress toward solving global environmental challenges (Choi and Rainey 2010, Pearson and Schuldt 2018).

Diverse and inclusive science is a just goal to which we should aspire. It also supports opportunities for ingenuity and innovation and is essential for productive workplaces and effective science (Batavia et al. 2020, Hofstra et al. 2020). The ways in which we apply our ecological knowledge are diverse. Many Blackologists have a personal testimonial about why they decided to further their education and pursue ecological careers, as is evident by the author list of this article. Dr. Yitbarek's interest in ecology was sparked by Eritrea's 30-year struggle for independence, in which he became aware of the devastating consequences of conflict on the environment. Dr. Bailey's path to environmental social science began with a trip for students of color to the Teton Mountain Range in Wyoming and was solidified when she realized the environmental problems her community faces in Los Angeles mirrored the challenges faced by families, communities, and ecosystems devastated by drought in southern Africa. Dr. Tyler pursued her persisting childhood love for ecology and agricultural environments in spite of the lack of representation within the academic and community fields. For MSc Strickland, it was childhood memories of being unable to swim at local beaches (e.g., Lake Michigan, Rainbow Beach) and eat the fish that were harvested because of water contaminants and pollution concerns. Living in a low-income and crime-infested neighborhood, Dr. McCary had few opportunities to enjoy recreation at local parks, a principal reason he was unaware of his interest in environmental science until later in college. Dr. Harris's transformative experience came as a teenager when participating in an excursion to the Masai-Mara in Kenya with the Philadelphia Zoo, to which she attributes her passion for place-based conservation and African biodiversity. These stories exemplify how diversity, equity exposure, and inclusion broaden the pool of talent and creativity in science, advancing the profession of ecology.

Remediating the tragedy of the commons: Overall sociopolitical considerations

The sciences are plural, political, and participatory. Inclusive sustainability approaches in common-pool resources must consider science from multiple angles (Pearson and Schuldt 2018, de la Torre-Castro 2019). On the margins, from below and lurking in the shadows of more mainstream science frameworks reside opportunities for collaboration to mitigate the tragedy of the commons. Like ecosystems, societal resilience is bred through the diversity and synergy of varying perspectives. No one science ontology, epistemology, or methodology can or should stand alone. To talk about the common-pool resources as they relate to the tragedy of the commons means to talk with the simultaneous tongues of universality and particularities where the epistemological monolith equitably gives way to pluralism.

Such is important because some of the most devastating environmental challenges where tragedy persists are being experienced, mitigated, and remedied by those most affected, in which the Black experience is inevitably encapsulated. However, tensions mount in implementing the change to promote the sustainability of common-pool resources because, for some, identity is distracting and even offensive. Overt discriminatory practices and covert "unconscious" biases alike justify the persistent saturation of authoritarianism to socioecological scholarship (Schell et al. 2020). All the while, Blackness is the hidden syntax that has incubated science into practical realities that benefit, support, and promote our power of culture. For us, Blackness is our scientific understanding of how we see ourselves, our histories, and our lived experiences in our work, albeit met with pronounced resistance. We are Black scientists, Black ecologists, Black advocates and activists who matter and unapologetically work differently. Our science is not produced and known only through microscopes, statistical projections, and empirical observations of ecological habitats; it is also ingrained in our relationships, interactions, and psyches.

The multitude of Black identities embedded in the ecological problem of solving the tragedy are strengths rather than weaknesses in a scientific matrix that thrives off of diversity. We emphasize that a necessary precursor to combatting the tragedy of the commons requires diverse science communities, social and natural alike, to converge. These communities must define what common-pool resources are amid inequitable ecosystems while respecting the nuances of unique contributions influenced by identity. Our study of protected wildlife areas and zoonotic diseases illuminate pivotal perspectives in the strategies of averting the tragedy of the commons because we are the commons. According to George Washington Carver, everything has an indispensable role in nature, and to disregard even one part of the greater whole is to do so at the peril of the entire scientific order—traditional or nontraditional (Hersey 2006). Such an ideology can serve as a valuable hypothesis as we reconsider and reframe the tragedy of the commons with the goal of equity and inclusion. Accordingly, we expect that resilient ecosystems, defined broadly and with consideration of both social and ecological needs, cannot persist while excluding any essential part of the social or political order. Similarly, such ideologies suggest that no resilient commons will thrive at the detriment of any particular group, lens, or collective ideology. Management of the commons will especially need those that can inform scientific solutions through lived experiences, local knowledge, and proximity to and impact from the problems directly. Therefore, identity—shared and unshared—embodies the root system of the commons through which the tragedies prevail and will be remedied.

#BlackEcologistsMatter!

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