Human Dimensions: Vegetation Ecology

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Vegetation ecology is an important component of the human dimensions of the Ecological Society of America (ESA) because it is concerned with ecosystem services and ecosystems as potential natural hazards, which are important for the management of natural and modified landscapes. Moreover, its elements respond to the five major drivers of global change: land (and sea)-use change, climate change, invasive species, pollution, and direct exploitation (IPBES 2019). These anthropogenic changes in the structure of plant communities can change their functions and thus their services and potential threats (Clark et al. 2017). The significance of vegetation ecology to different stakeholders is often interwoven into vegetation research. Among the many stakeholders are Native Americans on tribal lands and urban minority communities. Native American cultural and economic activities are often vegetation-dependent, and urban populations benefit from the ecosystem services of plants but often lack equitable access to green space. Thus, vegetation ecology has great potential for bringing new perspectives into ecology because of its diverse stakeholders. We will discuss these groups after examining the most salient activities in vegetation ecology.

Activity in Vegetation Ecology

Classification

Classification is a core component of vegetation ecology, and its role in ESA is driven by its relevance to stakeholders (Franklin et al. 2015). Vegetation classes are identifiable, can be mapped, and meet the needs of land managers who must work on the basis of defined units. Classification is especially important for standardizing the terms and concepts that allow managers to collaborate across agencies. The need for classification led to the US National Vegetation Classification (USNVC), which is the focus of activity by ESA’s Vegetation Classification Panel (more information available online).¹ The application of the USNVC continues to grow and is the national standard for all government organizations (FGDC 2008). The USNVC has been used for all national parks (Muldavin et al. 2012), has been linked to forest inventory data (Costanza et al. 2018), and is used as the existing vegetation classification for LANDFIRE (description of LANDFIRE available online).² These baseline data are a basis for linking multiple perspectives in ecology and creating collaborations across ESA (Peet et al. 2012), and especially important for monitoring change.

Research related to global change

Of the five major drivers of global change, three are more frequently studied by vegetation ecologists: climate change, land-use change, and invasive species. Each has potential for connections of interests across ESA and with diverse stakeholders.

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Climate change: Changes in vegetation in response to climate change are a burgeoning area of research (Fig. 1). Although the research field is still growing, vegetation studies have addressed ongoing climate change for decades, including the work of paleoecologists (e.g., Webb 1992, Woodward 1992). New research in vegetation ecology investigating altered vegetation communities and resulting impacts on human life and livelihood (Anderson et al. 2020) has become a touchstone for public media presentation of the effects of climate change (e.g., Woodyat 2020). More generally, vegetation ecology is incorporated into the Intergovernmental Panel on Climate Change (IPCC) assessments of the impacts of climate change (Arneth 2015). Vegetation ecology could change the human processes affecting the climate through an indirect policy pathway and thus engage a broad range of people.

Land-use change: Vegetation ecologists have studied responses to many types of human land-use change such as agriculture, urbanization, and forestry (e.g., Bowd et al. 2018). Humans actively alter the structure and dynamics of the biota on a global scale (Ellis and Ramankutty 2008). However, land
uses have not always degraded vegetation, because long-term but limited intensity human activities can increase biodiversity at local to regional scales (e.g., Oberndorfer et al. 2020). The vegetation ecology of land-use change is central to understanding extinctions, changes in diversity, migration potential, the wildland–urban interface, and ecosystem services such as drinking water, and so engages numerous and diverse stakeholders.

Invasive species: Species that are identified as invasive (i.e., nonnative species that are likely to cause environmental, economic, and/or human health harm) are oftentimes observed in the context of existing vegetation, such as plant community diversity (e.g., Li et al. 2016; Fig. 2). Invasive species research and outreach is another research area wherein vegetation ecologists can link with others in ESA to address questions of interest to diverse stakeholders (Early et al. 2016). For example, we can use knowledge of community invasibility, traits of invasive species, and naturalization potential to predict climate change-induced range shifts (Richardson and Pyšek 2006, Estrada et al. 2016).

Fig. 2. Mapping invasive *Psidium guajava* in the Galapagos Islands where it is encroaching on native pampa habitat. Photo credit: G.P. Malanson.
Opportunities

Vegetation ecology and Native Americans

Many Native American tribes (or First Nations) now manage lands with global change in mind, integrating traditional knowledge into a variety of areas including restoration, climate change adaptation, and wildfire management (e.g., Lewis et al. 2018). Luna (2000) described efforts to use Native American knowledge of plant species in a variety of restoration projects on Native American lands, highlighting the benefits of linking vegetation ecology and cultural knowledge. Many tribal governments also recognize the importance of linking climate change for their livelihoods and heritage. The Blackfeet Climate Change Adaptation Plan outlines efforts to understand the effects of ongoing climate change on vegetation, how this is linked to Blackfeet heritage, mitigation efforts, and connections to human health and well-being (plan available online). Furthermore, collaborations exist between Native American tribes, governments, and NGOs aim to increase cultural burning and improve wildfire management outcomes (Burr 2013). For example, a memorandum of understanding between the Karuk Tribe and the Six Rivers and Klamath National Forests aims to improve wildland fire management across tribal and federal lands and ensures protection of cultural resources (Karuk Department of Natural Resources 2011).

Although the incorporation of cultural knowledge into land management on tribal lands has begun (Wynecoop et al. 2019), incorporation of native perspectives into vegetation ecology has been less apparent (but see Oberndorfer et al. 2020, Long and Steel 2020), despite potential benefits to Native communities and ecological progress. More inclusive vegetation ecology communities would provide opportunities to develop studies that incorporate traditional knowledge relevant to the effects of global change on vegetation, improve management outcomes, promote diverse and healthy ecosystems, and minimize loss of human life and property (Lake et al. 2017). Basic research in vegetation ecology by Native Americans is part of our community of science (e.g., Luna and Bahls 2017).

Vegetation ecology and urban minorities

Urban plant communities have the potential to provide a range of ecological benefits such as improving air and water quality, reducing the urban heat island effect, and preserving habitat and biodiversity (e.g., Benedict and McMahon 2012, Talal and Santelmann 2019), as well as several social, health, economic, and cultural benefits (Frumkin et al. 2017, Church 2018). However, these benefits may not be equally shared across diverse communities, and so, there is potential for urban green space design and management to balance ecological and social goals while also promoting more equitable access for minority groups (Rigolon 2016).

Urban vegetation ecologists also have the opportunity to engage diverse urban populations by communicating the benefits of urban vegetation, pursuing research that can have a positive impact on communities, and creating meaningful partnerships with a range of stakeholders. Community-based participatory research and mixed methods approaches have a unique ability to promote community engagement and change (Floyd 2014, Talal and Santelmann 2020). Altogether, these practices can help us to better support both urban biodiversity conservation and equitable access to the benefits of green spaces within cities.
Communicating vegetation ecology

There is a growing need and role for improving all science communication to the general public and among stakeholders (Kopf et al. 2019), as suggested by the new section in The Bulletin (Bulletin of the Ecological Society of America 2019). Most recently, the COVID-19 epidemic has brought science back to the forefront of policy and decisions. The many ways vegetation impacts the daily lives of diverse communities (e.g., water quality, air quality, mental health, and cultural benefits), and the research around those impacts, are ripe areas for scientific communication, and we are poised to magnify current efforts following science’s resurgence due to the pandemic.

Continuing relevance

Vegetation ecology has great potential for bringing new perspectives into ecology because of its response and relevance to the major human drivers of global change. Native American and urban minorities are the most salient groups for interaction within and among the ESA, but globally ESA members work with and for all peoples. The ESA Vegetation Section partners with the International Association for Vegetation Science in promoting international collaborations that expand the perspectives and outreach of the science (e.g., Eddy et al. 2017). The relevance of vegetation ecology in a changing climate is increasing (e.g., Kolesnikov-Jessop 2011, Pierre-Louis 2019), and it must be communicated effectively. The ESA Vegetation Section encourages these efforts to expand our perspectives and our relevance.

Notes

1 https://esa.org/vegpanel/
2 www.landfire.gov/nvc.php
3 https://blackfeetclimatechange.com

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