
Article:
Margulies, J.D. orcid.org/0000-0003-2029-4424, Bullough, L.A., Hinsley, A. et al. (7 more authors) (2019) Illegal wildlife trade and the persistence of "plant blindness". Plants, People, Planet, 1 (3). pp. 173-182. ISSN 2572-2611

https://doi.org/10.1002/ppp3.10053

Received: 10 February 2019 | Revised: 13 May 2019 | Accepted: 14 May 2019

DOI: 10.1002/ppp3.10053

REVIEW

Plants People Planet PPP Open Access

Illegal wildlife trade and the persistence of "plant blindness"

Jared D. Margulies[1] | Leigh-Anne Bullough[2,3] | Amy Hinsley[3,4] | Daniel J. Ingram[5] | Carly Cowell[6] | Bárbara Goettsch[7] | Bente B. Klitgård[8] | Anita Lavorgna[9] | Pablo Sinovas[10] | Jacob Phelps[3,11]

[1]Department of Politics, University of Sheffield, Sheffield, UK

[2]Department of Life Sciences, Imperial College London, London, UK

[3]International Union for Conservation of Nature Species Survival Commission, Orchid Specialist Group - Global Trade Programme, Gland, Switzerland

[4]Department of Zoology, University of Oxford, Oxford, UK

[5]Centre for Biodiversity and Environment Research, University College London, London, UK

[6]Senior Science Office Policy (CITES), Royal Botanic Gardens Kew, Richmond, UK

[7]Global Species Programme, IUCN, Cambridge, UK

[8]Department for Identification & Naming, Royal Botanic Gardens Kew, Richmond, UK

[9]University of Southampton, Department of Sociology, Social Policy and Criminology, University of Southampton, Southampton

[10]UN Environment World Conservation Monitoring Centre, Cambridge, UK

[11]Lancaster Environment Centre, Lancaster University, Lancaster, UK

Correspondence
Jared D Margulies, University of Sheffield, Department of Politics, Elmfield Lodge, 132 Northumberland Road, Sheffield, S10 2TY, UK.
Email: j.margulies@sheffield.ac.uk

Funding information
H2020 European Research Council, Grant/Award Number: 694995

Societal Impact Statement

A wide variety of plant species are threatened by illegal wildlife trade (IWT), and yet plants receive scant attention in IWT policy and research, a matter of pressing global concern. This review examines how "plant blindness" manifests within policy and research on IWT, with serious and detrimental effects for biodiversity conservation. We suggest several key points: (a) perhaps with the exception of the illegal timber market, plants are overlooked in IWT policy and research; (b) there is insufficient attention from funding agencies to the presence and persistence of illegal trade in plants; and (c) these absences are at least in part resultant from plant blindness as codified in governmental laws defining the meaning of "wildlife."

Summary

This review investigates the ways in which "plant blindness," first described by Wandersee and Schussler (1999, p. 82) as "the misguided anthropocentric ranking of plants as inferior to animals," intersects with the contemporary boom in research and policy on illegal wildlife trade (IWT). We argue that plants have been largely ignored within this emerging conservation arena, with serious and detrimental effects for biodiversity conservation. With the exception of the illegal trade in timber, we show that plants are absent from much emerging scholarship, and receive scant attention by US and UK funding agencies often driving global efforts to address illegal wildlife trade, despite the high levels of threat many plants face. Our article concludes by discussing current challenges posed by plant blindness in IWT policy and research, but also suggests reasons for cautious optimism in addressing this critical issue for plant conservation.

KEYWORDS

illegal wildlife trade (IWT), Lacey Act, plant blindness, plant conservation, research bias, wildlife trafficking

1 | INTRODUCTION

This review considers the ways in which "plant blindness," first described by Wandersee and Schussler (1999, p. 82) as "the misguided anthropocentric ranking of plants as inferior to animals," intersects with increasing interest in research and policy development that centers on illegal wildlife trade (IWT). IWT has become a top priority of the global conservation and policy communities. For example, between 2015 and 2018, governments hosted high-level policy meetings in London, Vietnam, and Botswana on how to effectively combat international IWT; the US passed the Eliminate, Neutralize, and Disrupt Wildlife Trafficking (END) Act of 2016 and the 2013 Executive Order on Combating Wildlife Trafficking; the EU established the Action Plan against Wildlife Trafficking of 2016; and The World Bank announced the $131 million Global Wildlife Program, a multilateral "coordinated approach to combat wildlife crime" (The World Bank, 2018). In parallel, this article describes a surge in scholarship on IWT across a range of disciplines. These emerging platforms and debates are fundamentally (re)shaping the ways conservation priorities are set; resources are allocated, and the challenges of sustainable environmental governance are understood by policymakers, media, and the public.

Importantly, as our review will show, these efforts are largely plant blind, ignoring plants both in policy and research to date on illegal trade in wild species. Recent scholarship and policy debates are focused on the international trade of charismatic endangered animals, especially elephants, rhinoceros, tiger, and pangolin (e.g., the summary report of the Global Wildlife Program: The World Bank, 2018). By contrast, the significant global illegal trade in plants has received little attention, a latest manifestation of plant blindness within a growing policy sphere (Margulies, Hinsley, & Phelps, 2018). Yet, there is wide, long-standing literature on (legal and illegal) plant trades, including of medicinal and aromatic plant species (MAP species) and Non-Timber Forest Products (e.g., Broad, Mulliken, & Roe, 2003; Cruz-Garcia, Lagunez-Rivera, Chavez-Angeles, & Solano-Gomez, 2015; Flores-Palacios & Valencia-Diaz, 2007; Pauls & Franz, 2013; Rijal, Smith-Hall, & Helles, 2011; Tali, Khuroo, Nawchoo, & Ganie, 2019). Moreover, recent research on illegal plant trade has highlighted the importance of filling these knowledge gaps. Recent studies of trade in orchids, for instance, have shown that little is known about commercial trade in wild orchids, even though the family makes up >70% of all species listed in the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the primary governing body which sets international wildlife trade regulations (Hinsley et al., 2017; Phelps & Webb, 2015).

Plants are illegally traded for a variety of reasons, including the production of essential oils, medicines, and perfumes (Jenkins, Timoshyna, & Cornthwaite, 2018), timber (UNODC, 2016), and for ornamental collection (Goettsch et al., 2015; Hinsley et al., 2017). Plant trade makes up a part of IWT: Over 900 species of timber species are threatened by IWT and listed on CITES, including in excess of 200 species of rosewoods (mostly *Dalbergia* spp.) (CITES, 2017; Willis, 2017). Notably, between 2005 and 2014, 35% of all seizures recorded in the United Nations Office on Drugs and Crime's (UNODC) World Wildlife Seizures database were "rosewood" (although many seizures were other fragrant hardwoods marketed as rosewood), representing the highest proportion of all wildlife recorded as seized in the database (UNODC, 2016). Within the cactus (Cactaceae) family, Goettsch and colleagues (2015) note that upwards of 31% of all cactus species are threatened with extinction, and 47% of these species are impacted by collection for the horticultural trade and for ornamental purposes, much of which is illegal. Cycads are similarly considered at high risk from illegal trade as ornamental plants (Cousins & Witkowski, 2017), and are now reportedly the most endangered plant group on the planet (Brummitt et al., 2015; IUCN, 2010). As the recent TRAFFIC report on the use and trade in wild plant ingredients highlights, 60%–90% of medicinal and aromatic plants in trade are wild collected, representing an industry currently valued at 3 billion USD annually, yet traceability and documentation within this trade is often opaque (Jenkins, Timonshyna, & Cornthwaite, 2018). While the TRAFFIC report demonstrates a need for greater attention to *legal* trades in plants regulated by CITES, even less is understood about the patterns, processes, and mechanisms of *illegal* trade in plants. As a result, plants remain greatly underrepresented in IWT discussion.

This article assesses the present impacts of the privileging of animals over plants in the context of contemporary framing of policy discussion on IWT. It reviews how this imbalance emerges out of similar plant-animal dynamics in the field of conservation biology and across broader society. It then considers ways in which plant blindness has historically affected conservation policy, through a specific example of plant blindness in US wildlife trade law. This is followed by a concise review of current patterns and trends in both IWT research and US and UK government funding, highlighting the ways in which plants are widely excluded. The article concludes by discussing present challenges to overcoming plant blindness in the emerging IWT agenda.

2 | PLANT BLINDNESS AND ITS LEGACIES

The tendency to overlook the threat of IWT to plants has a clear historical context. Twenty years ago, Wandersee and Schussler (1999) coined the term "plant blindness" to refer to the cognitive condition of how plants remain in the background of many human conceptions of nature and the environment, particularly within non-indigenous societies (Hall, 2011; Van Sittert, 2003). As Heywood (2017, p. 323) aptly notes:

> It is somewhat paradoxical that the widespread enthusiasm in many cultures for gardens and gardening, parks and other urban plantings…together with the aesthetic appreciation of flowers in art, literature

> and society, and in the home as cut flowers and potted plants, is not reflected in a public appreciation of the role and importance of plants in the natural environment.

There is a growing body of research demonstrating the diversity of ways in which plants can be understood as intelligent and/or active beings within socio-ecological systems including across the fields of biology and botany (for reviews, see Cowell, 2018; Hall, 2011), geography (Fleming, 2017; Head & Atchison, 2009; Head, Atchison, & Phillips, 2015; Head, Atchison, Phillips, & Buckingham, 2014), anthropology and indigenous studies (Ellis, 2018; Hall, 2011; Kimmerer, 2013; Kohn, 2013; Rose, 2002), and philosophy (Marder, 2013, 2016; Plumwood, 1993). This interdisciplinary scholarship challenges basic assumptions that have historically kept plants painted into the backdrop of a livelier animal life. While debate continues within the plant sciences community regarding the capacity of plants to be understood as self-aware, mobile, communicative, and more than mechanistically responsive to environmental cues, research increasingly points to the myriad of ways in which plants are highly complex and adaptive beings (Hall, 2011). For instance, research has demonstrated means by which trees and other plants signal across individuals within a species in response to herbivory threats, reducing predation rates across populations (Dolch & Tscharntke, 2000; Kost & Heil, 2006). While the nascent field of "plant neurobiology" remains controversial in botany (Alpi et al., 2007), research suggesting ways plants exhibit memory (Garzón & Keijzer, 2011), can distinguish themselves from other individuals (Gruntman & Novoplansky, 2004), and display phenotypic plasticity resulting from "the complex computational capability plants can bring to bear to finely scrutinize the local environment and act upon it" (Trewavas, 2003, p. 13), all suggest ways in which plants display complex indicators of intelligence (Baluška & Mancuso, 2009; Trewavas, 2003, 2005). Despite this emerging body of research on plant intelligence, some strands of science and epistemology—how knowledge is developed and acquired—continue to devalue plant life as evolutionarily beneath that of animal life. As Heywood (2017) evidences, while zoology programs continue to flourish in universities worldwide, botany as a discipline has been in a steady decline for decades (Cowell, 2018).

Within the context of biological conservation, plant blindness remains an ongoing issue (Balding & Williams, 2016). There are significant biases related to which species garner the most research attention as well as most funding within conservation research efforts (Havens, Kramer, & Guerrant, 2013; Martín-López et al., 2009; Metrick & Weitzman, 1996). Animals, particularly charismatic megafauna, are overrepresented both in conservation research efforts, as well as in conservation funding streams compared to all other forms of life (Sitas, Baillie, & Isaac, 2009; Smith, Veríssimo, Isaac, & Jones, 2012). Plants are especially underrepresented on both accounts, demonstrating that even within the conservation science community, plant blindness is pervasive, impactful, and privileges animal life over plant life (Balding & Williams, 2016). Efforts to assess the extinction of plant taxa lags behind that of vertebrates, with only 8% (N = 28,287) of known plant species (N ≈ 310,442) assessed for the IUCN Red List compared to 68% (N = 48,101) of known vertebrate animals (N ≈ 69,903) (IUCN, 2018). And yet, three of the top five most threatened taxonomic groups comprehensively assessed for the IUCN Red List are plants—cycads, cacti, and conifers—listed in order of greatest threat (Goettsch et al., 2015). In the context of endangered species currently regulated in international trade, CITES lists a total of 5,811 registered faunal species (which includes mammals, birds, reptiles, amphibians, fish, and invertebrates), compared to 29,990 species of plants (excluding subspecies) (CITES, 2017). Plants receive proportionately far less research attention and funding in relation to the threats they face compared to animals—an imbalance also mirrored in national endangered species laws. As Havens et al. (2013) describe, at the time of their research 57% of species listed on the United States (US) Endangered Species Act were plants, yet they garnered less than 4% of the federal funding for protecting endangered species.

Balding and Williams (2016) offer the most comprehensive review of plant blindness within the field of conservation biology to date. An important finding from their synthesis of research on the phenomena of plant blindness is regarding its foundations. More specifically, they assess whether or not plant blindness is generalizable across all human societies based on biological deficiencies of human cognition, or if plant blindness is the result of particular socio-cultural histories that privilege animals hierarchically above plants. They conclude that a variety of environmental education and psychological studies demonstrate the existence of plant blindness in many societies, such as the US. However, a diversity of ethnographic and cross-cultural studies suggest plant blindness does not exist in certain cultures, especially non-Anglo/European societies such as indigenous societies of North America, Australia, and Asia (and see Hall, 2011; Kimmerer, 2013). Their synthesis concludes that the existence of human cultures in which people develop close and meaningful relations with plants "[...] points to a number of practical ways to implement plant conservation programs grounded in promotion of identification and empathy with plants and anthropomorphism of plants" (Balding & Williams, 2016, p. 1197). Namely, they suggest facilitating direct experience with plants, highlighting human and plant similarities as opposed to differences. They propose promoting empathy with plants through engaged and creative activities such as drawing and writing to promote close observation of plants, gardening to "emphasize diverse functions of plants," and collaborations between artists and scientists to "encourage active empathy with other species" (Balding & Williams, 2016, p. 1,197). In summary, while plant blindness is a global phenomenon, it is not generalizable across all human societies, nor must its existence necessarily remain a permanent feature of these societies where its presence is observed.

3 | PLANT BLINDNESS IN CONSERVATION EFFORTS: A CASE STUDY FROM THE US

The persistence of plant blindness in the conservation sciences mirrors broader societal patterns in much of the Global North that

de-privilege plants in relation to animals. This bias is exemplified by conservation efforts in the form of wildlife law in the US, which is observable in one of the most important and oldest pieces of US federal wildlife legislation: the Lacey Act of 1900 (16 U.S.C. §§ 3371–3378). Plant blindness was built into the earliest of federal wildlife protection laws in the US, and so implicitly reinforced the hierarchical privileging of animal conservation over plant conservation. Over a century passed before federal agencies revised legislation to be more inclusive of what kinds of non-human life are protected by wildlife trade law. Briefly reviewing the legal standing of plants enables a historical consideration of how limiting perspectives on the position of plants continue to bias contemporary wildlife policy, favoring the conservation of animals over the conservation of plants.

The Lacey Act was named for Iowa Congressman John Lacey, who in 1900 introduced the Act in the US House of Representatives. As Anderson (1995) explains in his review of the history and implementation of the Lacey Act, the Act "was essentially a bird preservation and restoration measure designed to enhance and protect agriculture." In other words, the original intent of the law was to assist in the conservation of birds beneficial to farmers for consuming insectivorous pests. Later amendments in 1935 and 1969 dramatically altered and expanded the purview and power of the Lacey Act, increasing penalties for those found in violation of it, whom the law applied to, the inclusion of foreign laws being grounds for violation, and utilized an expanded definition of wildlife:

> "Wildlife" means any wild mammal, wild bird, amphibian, reptile, mollusk, or crustacean, or any part, egg, or offspring thereof, or the dead body or parts thereof, but does not include migratory birds for which protection is afforded under the Migratory Bird Treaty Act. (Lacey Act 1969; 18 U.S.C. S 43)

The Lacey Act is unique among US legislation in that a person can be found in violation of the Act by violating another foreign government's wildlife laws. It was only in 1981, during a major overhaul of the Lacey Act, that a restrictive definition of plants was incorporated into the legislation's language to specifically protect certain US native species of plants that were threatened with extinction (Anderson, 1995). Until 2008, the Lacey Act considered plants and wildlife as distinctly different legal entities, with much more constrained application of the Act being applied to plants. Prior to 2008, "fish or wildlife" were defined in the Act as:

> (A)ny wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, whether or not bred, hatched, or born in captivity, and includes any part, product, egg or offspring thereof. (16 U.S.C. S 3371(a))

As Anderson (1995) notes, "this language encompasses virtually any wild animal, fish, or invertebrate, dead or alive, from any part of the world, and any part of, or product made from, such a specimen" (54). In contrast, the definition of plants under the Law is severely restricted:

> (A)ny wild member of the plant kingdom, including roots, seeds, and other parts thereof (but excluding common food crops and cultivars) which is indigenous to any State and which is either (A) listed on an appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, or (B) listed pursuant to any State law that provides for the conservation of species threatened with extinction. (16 U.S.C. S 3371(f))

This more restrictive definition of "plant" resulted in major consequences for how the Lacey Act could or could not be applied to IWT involving plants. As Anderson (1995) describes:

> Not only must the plant in question be a wild species native to the United States, it must also be specifically protected by a state law or by a CITES listing. For example, Lacey Act prohibitions apply to unlawful trade in saguaro cactus because that species is indigenous to the United States and protected by Arizona plant protection laws. However, the Act would not apply to a plant species native only to a foreign country. (55)

In practice, this meant that until 2008, while importing tiger parts or ivory became an "automatic felony violation … the Act cannot be used to prosecute the importation of an equally endangered orchid or pitcher plant species taken from a foreign rainforest" (Anderson, 1995, p. 55). In 2008, the Act's definitions of plants and wildlife were again updated (summarised in Figure 1 through a presentation of the actual track changes highlighting the old and new text).

The new language of the 2008 Amendment text incorporated a much more expansive definition of plants more akin to the Act's definition of "wildlife," bringing non-native plants under the Act's purview. The new definition also includes trees and timber, as the Amendment largely sought to reduce the importation of illegally harvested timber for consumption in the US market (Prestemon, 2015).

As summarized above, one of the US' most important wildlife laws has upheld that plants are not included in the definition of "wildlife," despite being protected through "wildlife" legislation. The impact of this separation of plant life from animal life is also observable in how other federal US agencies describe separate plant life from wildlife. The Office of Law Enforcement of the US Fish and Wildlife Service's primary mission "is to protect wildlife and plant resources" (USFWS, 2019), again drawing a distinction between the two. The US Endangered Species Act (16 U.S. Code § 1532), similarly describes "fish and wildlife" as "any member of the animal kingdom," whereas "plants" are treated separately as "any member of the plant kingdom."

In practice plants are now protected under the same overarching federal wildlife laws as animals in the US (the Endangered Species

~~(f) The terms "plant" and "plants" mean any wild member of the plant kingdom, including roots, seeds, and other parts thereof (but excluding common food crops and cultivars) which is indigenous to any State and which is either~~
~~(A) listed on an appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, or~~
~~(B) listed pursuant to any State law that provides for the conservation of species threatened with extinction.~~

(f) Plant.—
(1) IN GENERAL.—The terms "plant" and "plants" mean any wild member of the plant kingdom, including roots, seeds, parts, and products thereof, and including trees from either natural or planted forest stands.
(2) EXCLUSIONS.—The terms "plant" and "plants" exclude—
(A) common cultivars, except trees, and common food crops (including roots, seeds, parts, or products thereof);
(B) a scientific specimen of plant genetic material (including roots, seeds, germplasm, parts, or products thereof) that is to be used only for laboratory or field research; and
(C) any plant that is to remain planted or to be planted or replanted.
(3) EXCEPTIONS TO APPLICATION OF EXCLUSIONS.—The exclusions made by subparagraphs (B) and (C) of paragraph (2) do not apply if the plant is listed—
(A) in an appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (27 UST 1087; TIAS 8249);
(B) as an endangered or threatened species under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.); or
(C) pursuant to any State law that provides for the conservation of species that are indigenous to the State and are threatened with extinction.

FIGURE 1 Track changes of 2008 Amendment to Lacey Act showing the new, expanded definition of plants. Strikethrough text reflects pre-2008 amendment language, while text below reflects the Amendment's new definition of plants.
Source: Amendments to the Lacey Act from H.R.2419, Sec. 8204, https://www.aphis.usda.gov/plant_health/lacey_act/downloads/background--redlinedLaceyamndmnt--forests--may08.pdf

Act and the Lacey Act being the two most notable such laws), but plants are not, by definition in federal law, considered wildlife. The result of this separation has led to resounding effects on the priorities the US government has placed on funding protection and law enforcement for plant conservation when compared to animal conservation (Havens et al., 2013). This separation and its consequent effects are mirrored in US and international efforts to combat IWT.

4 | PLANT BLINDNESS AND ILLEGAL WILDLIFE TRADE

Despite the more recently adopted inclusive language about the threat plants face from IWT in US wildlife law, these amendments were made specifically to better tackle the illegal timber trade (H.R. 6124, SEC. 8204: Prevention of Illegal Logging Practices). International media and popular communication about the issue of IWT both by governments and conservation organizations continues to focus on rhinos, elephants, and a few other iconic animal species (e.g., Harrington, D'Cruze, & Macdonald, 2018; Interpol, 2018; Lyngdoh, Dixit, & Sinha, 2017; UK Government, 2018; UNODC, 2016). As a 2013 White House press release on President Obama's Executive Order to Combat Wildlife Trafficking states in the first sentence: "Wildlife trafficking is a multi-billion dollar illicit business that is decimating Africa's iconic animal populations. Many species—most notably elephants and rhinoceroses—now face the risk of significant decline or even extinction" (White House Office of the Press Secretary, 2013). Outside the context of the US, again the main exception to this faunal bias in IWT policy is increasing attention to the illegal timber trade (UNODC, 2016). For instance, while the London Conference on the Illegal Trade in Wildlife held in 2018 chose to include for the first time an image of an orchid alongside illustrations of an elephant, rhino, and big cat in representing the conferences theme, the only session on plants during the 2-day conference was on the illegal timber trade. EU's Timber Trade Regulations is another example where the illegal trade in timber is given targeted attention.

Biases in IWT policy focus are also reflected in IWT research. While there is growing attention in the research community to the subject of IWT, in-depth, empirical studies examining the patterns, processes, and mechanisms of illicit trade in wild species remain a relatively new area of academic research (Rosen & Smith, 2010). Within the social sciences, studies of IWT span the fields of green criminology (e.g., Lavorgna, 2014; Ngoc & Wyatt, 2013; Wyatt, 2009), geography (Collard, 2014; Massé, 2018; Moore, 2011; White, 2014; Zhu, 2017, 2018), and international politics (Duffy, 2014; Duffy, St John, Büscher, & Brockington, 2015; Elliot, 2007). Legal scholars have also engaged with IWT and the role and efficacy of legislation in combating IWT, with particular attention to transnational organized crime (Lee, 1995; Warchol, 2004; Zimmerman, 2003). With the exception of research on the illegal timber trade (e.g., Zhu, 2017, 2018), the social sciences have all but ignored illegal trade in plants. There is a larger literature on how IWT affects species conservation efforts within the field of biodiversity conservation, ranging from advances in forensics (e.g., Dormontt et al., 2015; Wasser et al., 2008), assessing the extent of illegal internet trade in wild species (e.g., Harrison, Roberts, & Hernandez-Castro, 2016; Sajeva, Augugliaro, Smith, & Oddo, 2013), demand reduction efforts (e.g., Verissimo & Wan, 2018), and spatiotemporal dimensions of IWT's impacts on species conservation (e.g., Critchlow et al., 2015). And yet, given the scale of the illegal plant trade, there are clear biases even within biodiversity conservation research favoring animals as subjects over plants.

A review of academic publications on "illegal wildlife trade" within Web of Science (conducted Jan. 2019) returned 265 articles published between 1995 and 2019, 62% of which were published between 2015 and 2019. Notably, only 26 peer-review articles addressed trade in plants. Figure 2 summarizes the breadth of species and themes currently covered within the peer-reviewed literature on the illegal trade in plants. Given the restricted nature of this literature search, the results should not be interpreted as a comprehensive review of all published studies relating to illegal trade in plants to date. Nevertheless, the results are illustrative of key patterns and notable taxonomic gaps in the contemporary spike in IWT scholarship.

In light of these notable disparities, the authors convened an expert workshop on plant blindness and IWT in October 2018, in advance of the 2018 London Conference on Illegal Wildlife Trade. The aim of the workshop was to synthesize key issues in raising awareness to the issues of plant IWT, as well as current gaps in research knowledge. The workshop was attended by an interdisciplinary group of botanists, conservation scientists, social scientists, policymakers, non-governmental organization researchers and staff, and conservation law enforcement.

A major point of discussion were the challenges of ensuring the meaningful interest in plant conservation among policymakers and non-governmental organizations (NGOs). Indeed, despite the threat of illegal trade to plants, they represent a surprisingly small part of CITES negotiation agendas (e.g., the CITES CoP 18 provisional agenda, 2019) and are weakly represented by the leading conservation organizations globally. This reflects not only broader plant blindness in society but also practical and technological difficulties that plants pose for law enforcement and customs agencies addressing IWT. Plant species identification represents a technical barrier that may be discouraging both policymakers and scholars from tackling plant trade. While tiger skins, rhino horn, and live birds may be concealed by a variety of means by wildlife smugglers, it can be incredibly challenging to accurately and quickly identify plant species and the legality of their status. This is especially challenging for customs agents, as there is evidence that illicitly traded plants are often hidden in shipments of legal plant materials, or those where permits are not required (Lavorgna, Rutherford, Vaglica, Smith, & Sajeva, 2018). Developments in DNA barcoding and other molecular techniques, already used in some cases to identify traded plants (e.g., Cowan, Chase, Kress, & Savolainen, 2006; Gathier, 2013; Staats et al., 2016) may help facilitate more accurate and timely identification of illegal plant trade. However, they are likely to present long-term challenges, especially for mega-diverse plant groups (e.g., orchids) and where capacity for such testing is low (Hinsley et al., 2017).

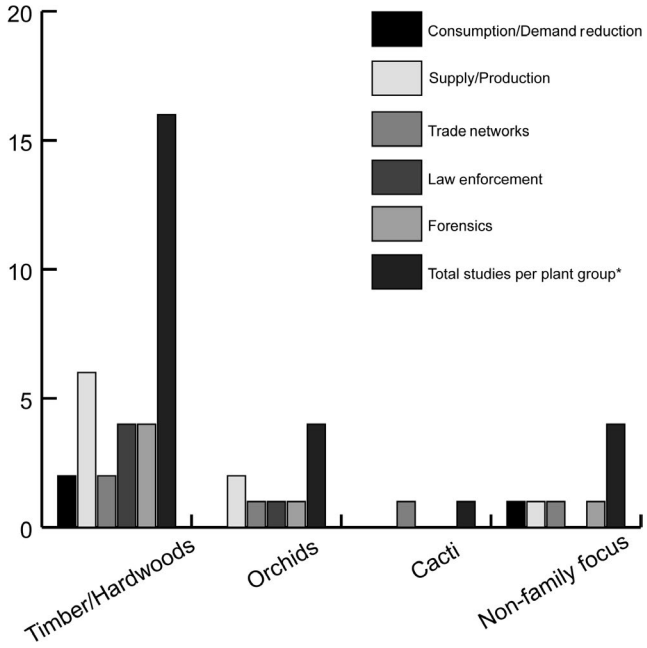

FIGURE 2 Results of peer-review literature search in Web of Science. Total number of studies per plant group may be less than the combined numbers tallied by thematic category, as several studies included multiple thematic dimensions (e.g., consumer and supply side dynamics). Literature search was based on the Boolean search query: TS=(("illegal wildlife trade" OR "IWT" OR "illegal wildlife traffick*" OR "illegal timber trade") AND (plant* OR cact* OR cycad* OR timber OR hardwood OR rosewood OR ebony OR ephiph* OR orchid*)). The Boolean search strategy was iteratively developed based on author knowledge of existing illegal wildlife trade in plants literature, and consecutive search queries utilizing a variety of keywords. Final search strategy aimed for the greatest inclusion of relevant papers (thus, illegal timber trade was included as many illegal timber trade articles do not employ "illegal wildlife trade" as a keyword or in paper titles and abstracts). Literature search was restricted to Web of Science, based on topic search. Therefore, studies which relate to or discuss illegal trade in plants but not as a primary subject (for instance, see Goettsch, 2013), were not captured in this literature search. From an initial set of 38 papers, a total of 26 papers were included in Figure 2 based on relevance after excluding papers on IWT not focused on plants (N = 2) and papers not related to IWT (N = 10)

Another key point of consensus from the workshop was that there is insufficient funding for studying illegal plant trade. For example, two leading sources of funding for research on IWT trade are the US Fish and Wildlife Service's Combating Wildlife Trafficking (CWT) Program, and the UK Government's Department for Environment, Food and Rural Affairs' Illegal Wildlife Trade Challenge Fund. The Challenge Fund has disbursed approximately £18.5 million in 5 years of funding, while the CWT program has to date disbursed $4.9 million through funding rounds in 2016 and 2017. These demonstrate strong bias in IWT funding by species group, favoring a small number of charismatic megafauna compared to plants and other less iconic species (Figure 3). Notably, plant-related projects were historically excluded from the IWT Challenge Fund, and other key funding sources (e.g., Global Environment Facility's $90 million Global Partnership to Support Wildlife Conservation and Sustainable Livelihoods) prioritize charismatic mammals, for example, elephants, rhinos, big cats, great apes, and pangolin (The World Bank, 2018). This lack of historical attention by funders may point to a cyclical problem: Not only are there fewer resources to work on plant trade but researchers and NGOs are likely to favor projects that address funders' preferences. Until funding opportunities specifically encourage and target research efforts to focus on illegal trade in plants, it may be difficult to upend these research effort disparities.[1]

The workshop considered the ways in which plant trade is often narrowly equated with valuable timber, which likely obscures the very broad impacts of IWT on plants. Within the body of published research on illegal trade in plants, the illegal timber industry has received the greatest amount of research attention to date, followed next by the illegal orchid trade (Figure 2). The focus on timber products within the funding of research concerning plant trade is

[1]Only information about successfully funded grant applications is made publicly available by the UK Challenge Fund and the USFWS CWT Program.

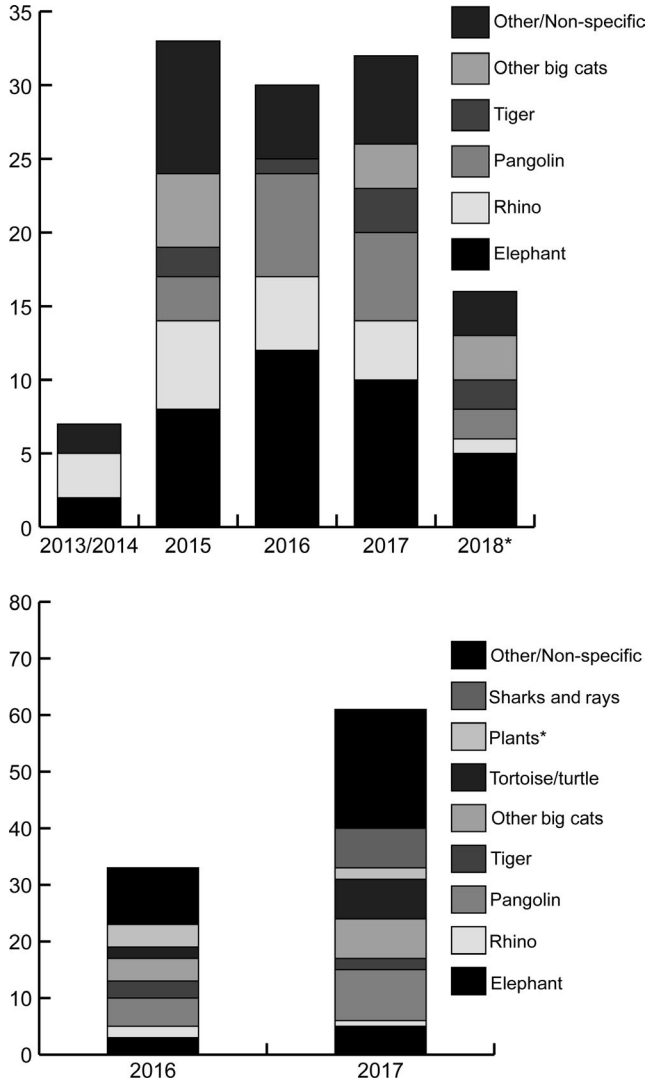

FIGURE 3 Successful UK IWT Challenge Fund grants (2013/2014-2018) delineated by species (top chart) and successful US Fish and Wildlife Service Combating Wildlife Trafficking Program grants (2016–2017) based on species (bottom chart). Shading in legend corresponds with order in columns (top to bottom). Many funded projects cover more than one species. Species tallies based on their specific mention in project summaries, so totals are greater than number of individual grants funded. *2018 was the first year projects on illegal wildlife trafficking in plants were eligible for UK Challenge Fund grants, but no plant-specific projects were funded (top chart). Plant projects funded by USFWS included five projects on hardwood timber and one project on cycads (bottom chart)

likely related both to the monetary value of the timber trade—the illegal rosewood trade alone is valued at billions of dollars per year (UNODC, 2016)—and resulting stronger links to other forms of organized crime, as well as the trade's visible impact on forest ecosystems. It is more difficult to demonstrate the impact of the removal of non-tree species, such as orchids, compared to the visible effects of illegal logging on forested ecosystems. Although the removal of non-tree species may have lasting consequences on ecosystems, the effects may be more difficult to assess or quantify.

Certain plant taxa have been illegally traded for decades, yet research on these trades is lacking. Cycads, despite being one of the most endangered groups of species on the planet also significantly threatened by illegal trade (Brummitt et al., 2015; IUCN, 2010), have received scant attention in the peer-review literature on IWT. Similarly, cacti have received little attention from the IWT research community, again despite evidence of a robust illegal trade being the primary threat to many cacti species' survival (Goettsch et al., 2015; Novoa, Le Roux, Richardson, & Wilson, 2017; Oldfield, 1997; Robbins, 2003). There are many other families and species of plants such as MAPs that are known to experience illegal trade that were not captured by this literature review, in part because much of this evidence remains in the gray literature or in non-indexed specialist journals. For instance, wild ginseng and black cohosh from the Appalachian region of the US are both known to experience intense collecting pressure for both domestic and international consumer markets (Lange, 2002; Schippmann et al., 2002). Similarly, a variety of other succulent plants face increasing pressure from illegal wild collection for international sale, including several *Dudleya* species from the California floristic province, but research to address and better understand the drivers and networks of their trade is lacking.

5 | CONCLUSION

This review on how plant blindness is manifest within the IWT arena suggests several key points: (a) plant species are abundantly overlooked in IWT policy and research, perhaps with the exception of the illegal timber market; (b) there is insufficient attention from funding agencies to the presence and persistence of illegal trade in plants; and (c) these absences are at least in part resultant from the long-term deprivileging of plant life compared to animal life as codified in governmental laws defining the purview and meaning of "wildlife."

Rather than work to raise the profile of plants within the IWT arena *as wildlife*, an alternative approach suggested in the expert workshop was to embrace distinguishing *illegal plant trade* as a separate phenomenon with distinct particularities and problems unique to plants. However, as part of ongoing efforts to combat the pervasive problem of plant blindness in societies writ large, we suggest that it is more important to consider plants *as* wildlife. Given the increasing body of research highlighting similarities, rather than differences, between animals and plants in their capacities to sense, adapt, and interpret their environments, it seems critical to connect plants with the more evocative sensibilities "wildlife" connotes in the public imagination. Highlighting plants as wildlife draws out the ways plant blindness works into accountings of wildlife as strictly animal, which we argue has resulted in a lack of attention to plants in IWT policy and research to date.

Recent changes to US legislative language on wildlife suggest, however, that there is increasing recognition of policy deficiencies related to protecting plant species under threat from illegal trade. A broader comparative analysis of legislative language would be

beneficial to determine if this trend is reflected internationally. Similarly, the inclusion of plants for the first time in 2018 into the UK Illegal Wildlife Trade Challenge Fund (though limited to cycads, cacti, and orchids) suggests that some policymakers are beginning to address the strong taxonomic biases within the IWT arena. In 2018, plants were also included, for the first time and only peripherally, in one of the global IWT conferences. Given the prominent role of both the UK and the US in shaping international wildlife trade policy and conservation finance, these changes suggest that there is reason for cautious optimism that plants may increasingly find a proportionally more equitable place at the table in conservation policy and research tackling IWT. Given these findings, it is important to consider the way in which the plant trade is taken up as a matter of pressing concern by academics, funding bodies, and the wider general public. Innovative efforts to bring to light the overlooked impacts of illegal plant trade could bolster interest, and subsequently funding, for further research. While here we highlight and discuss plant blindness in IWT, we hope that these discussions are relevant to other potential blindness in IWT research, for example, fungi or insects.

In reviewing current patterns in research efforts to date in the peer-review literature on the illegal trade of plants alongside research and project funding trends related to IWT, this article evidences persistent biases privileging a focus on the illegal trade of animals over plants by US and UK governments, as well as the lack of sufficient attention to illegal trade in plants by the scientific research community. By considering related literature on plant blindness more broadly, this article suggests that while plant blindness in the spheres of research and policy on IWT remains an ongoing concern, it is more appropriate to consider this "blindness" as symptomatic of a particular sociocultural and historical trajectory rather than a problem of inevitable permanence.

ACKNOWLEDGMENTS

We thank three anonymous reviewers and editor Dawn Sanders for their helpful and constructive comments and suggestions on earlier versions of this manuscript. We also thank Bennett Young for helpfully steering the manuscript through the revision process. Writing was supported in part by funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme grant agreement No 694995 (BIOSEC: Biodiversity and Security, Understanding Environmental Crime, Illegal Wildlife Trade and Threat Finance). The workshop, "Raising the profile of plants in IWT policy: an evidence-based agenda setting workshop" was generously hosted at the 2018 "Evidence to Action: research to address illegal wildlife trade" event in London, and we thank the conference organizers for including our workshop in the event. The usual disclaimers apply.

AUTHOR CONTRIBUTION

JDM, LAB, AH, DJI and JP wrote the manuscript. JDM, AH and JP organized plant blindness workshop which led to development of this article. CC, BG, BBK, AL and PS, contributed to plant blindness workshop, subsequent discussion, and contributed to the manuscript.

ORCID

Jared D. Margulies https://orcid.org/0000-0003-2029-4424

REFERENCES

Alpi, A., Amrhein, N., Bertl, A., Blatt, M. R., Blumwald, E., Cervone, F., … Wagner, R. (2007). Plant neurobiology: No brain, no gain? *Trends in Plant Science*, *12*, 135–136. https://doi.org/10.1016/j.tplants.2007.03.002

Anderson, R. S. (1995). The Lacey Act: America's premier weapon in the fight against unlawful wildlife trafficking. *Public Land Law Review*, *16*(27), 29–85.

Balding, M., & Williams, K. J. (2016). Plant blindness and the implications for plant conservation. *Conservation Biology*, *30*(6), 1192–1199. https://doi.org/10.1111/cobi.12738

Baluška, F., & Mancuso, S. (2009). Plant neurobiology. *Plant Signaling & Behavior*, *4*(6), 475–476. https://doi.org/10.4161/psb.4.6.8870

Broad, S., Mulliken, T., & Roe, D. (2003). The nature and extent of legal and illegal trade in wildlife. In S. Oldfield (Ed.), *The trade in wildlife: Regulation for conservation* (pp. 3–22). London: Earthscan.

Brummitt, N. A., Bachman, S. P., Griffiths-Lee, J., Lutz, M., Moat, J. F., Farjon, A., … Nic Lughadha, E. M. (2015). Green plants in the red: A baseline global assessment for the IUCN sampled red list index for plants. *PLoS ONE*, *10*, e0135152.

CITES (2017). *New CITES trade rules come into effect as 2017 starts*. Retrieved January 23, 2019, from https://cites.org/eng/new_CITES_trade_rules_come_into_effect_as_2017_starts_02012017

CITES (2019). *Provisional agenda and working documents, eighteenth meeting of the Conference of the Parties*. Retrieved May 12, 2019, from https://cites.org/eng/cop/18/doc/index.php

Collard, R. C. (2014). Putting animals back together, taking commodities apart. *Annals of the Association of American Geographers*, *104*(1), 151–165. https://doi.org/10.1080/00045608.2013.847750

Cousins, S. R., & Witkowski, E. T. F. (2017). African Cycad ecology, ethnobotany and conservation: A synthesis. *The Botanical Review*, *83*(2), 152–194. https://doi.org/10.1007/s12229-017-9183-4

Cowan, R. S., Chase, M. W., Kress, W. J., & Savolainen, V. (2006). 300,000 species to identify: Problems, progress, and prospects in DNA bar-coding of land plants. *Taxon*, *55*(3), 611–616. https://doi.org/10.2307/25065638

Cowell, C. R. (2018). Exploring the potential historic contribution and conservation value of herbarium collections in protected areas. Unpublished PhD Dissertation, University of Cape Town.

Critchlow, R., Plumptre, A. J., Driciru, M., Rwetsiba, A., Stokes, E. J., Tumwesigye, C., … Beale, C. M. (2015). Spatiotemporal trends of illegal activities from ranger collected data in a Ugandan national park. *Conservation Biology*, *29*(5), 1458–1470. https://doi.org/10.1111/cobi.12538

Cruz-Garcia, G., Lagunez-Rivera, L., Chavez-Angeles, M. G., & Solano-Gomez, R. (2015). The wild orchid trade in a Mexican local market: Diversity and economics. *Economic Botany*, *69*(4), 291–305. https://doi.org/10.1007/s12231-015-9321-z

Dolch, R., & Tscharntke, T. (2000). Defoliation of alders (*Alnus glutinosa*) affects herbivory by leaf beetles on undamaged neighbours. *Oecologia*, *125*, 504–511.

Dormontt, E. E., Boner, M., Braun, B., Breulmann, G., Degen, B., Espinoza, E., … Lowe, A. J. (2015). Forensic timber identification: It's time to integrate disciplines to combat illegal logging. *Biological Conservation*, *191*(2015), 790–798.

Duffy, R. (2014). Waging a war to save biodiversity: The rise of militarized conservation. *International Affairs*, *90*(4), 819–834. https://doi.org/10.1111/1468-2346.12142

Duffy, R., St John, F. A., Büscher, B., & Brockington, D. A. N. (2015). The militarization of anti-poaching: Undermining long term goals? *Environmental Conservation*, *42*(4), 345–348. https://doi.org/10.1017/S0376892915000119

Elliott, L. (2007). Transnational environmental crime in the Asia Pacific: An 'un(der) securitized' security problem? *The Pacific Review*, *20*(4), 499–522. https://doi.org/10.1080/09512740701671995

Ellis, W. (2018). Plant knowledge: Transfers, shaping and states in plant practices. *Anthropology Southern Africa*, *41*(2), 80–91. https://doi.org/10.1080/23323256.2018.1476165

Fleming, J. (2017). Toward vegetal political ecology: Kyrgyzstan's walnut–fruit forest and the politics of graftability. *Geoforum*, *79*, 26–35. https://doi.org/10.1016/j.geoforum.2016.12.009

Flores-Palacios, A., & Valencia-Diaz, S. (2007). Local illegal trade reveals unknown diversity and involves a high species richness of wild vascular epiphytes. *Biological Conservation*, *136*(3), 372–387. https://doi.org/10.1016/j.biocon.2006.12.017

Garzón, P. C., & Keijzer, F. (2011). Plants: Adaptive behavior, root-brains, and minimal cognition. *Adaptive Behavior*, *19*(3), 155–171. https://doi.org/10.1177/1059712311409446

Gathier, G., van derNiet, T., Peelen, T., vanVugt, R. R., Eurlings, M. C., & Gravendeel, B. (2013). Forensic identification of cites protected slimming cactus (hoodia) using DNA barcoding. *Journal of Forensic Sciences*, *58*, 1467–1471.

Goettsch, B., Hilton-Taylor, C., Cruz-Piñón, G., Duffy, J. P., Frances, A., Hernández, H. M., … Gaston, K. J. (2015). High proportion of cactus species threatened with extinction. *Nature Plants*, *1*(10), 15142. https://doi.org/10.1038/nplants.2015.142

Gruntman, M., & Novoplansky, A. (2004). Physiologically mediated self/nonself discrimination in roots. *Proceedings of the National Academy of Sciences*, *USA*, *101*, 3863–3867.

Hall, M. (2011). *Plants as persons: A philosophical botany*. New York: SUNY Press.

Harrington, L. A., D'Cruze, N., & Macdonald, D. W. (2018). Rise to fame: Events, media activity and public interest in pangolins and pangolin trade, 2005–2016. *Nature Conservation*, *30*, 107–133. https://doi.org/10.3897/natureconservation.30.28651

Harrison, J. R., Roberts, D. L., & Hernandez-Castro, J. (2016). Assessing the extent and nature of wildlife trade on the dark web. *Conservation Biology*, *30*(4), 900–904. https://doi.org/10.1111/cobi.12707

Havens, K., Kramer, A. T., & Guerrant, E. O. Jr (2013). Getting plant conservation right (or not): The case of the United States. *International Journal of Plant Sciences*, *175*(1), 3–10.

Head, L., & Atchison, J. (2009). Cultural ecology: Emerging human-plant geographies. *Progress in Human Geography*, *33*(2), 236–245. https://doi.org/10.1177/0309132508094075

Head, L., Atchison, J., & Phillips, C. (2015). The distinctive capacities of plants: Re-thinking difference via invasive species. *Transactions of the Institute of British Geographers*, *40*(3), 399–413. https://doi.org/10.1111/tran.12077

Head, L., Atchison, J., Phillips, C., & Buckingham, K. (2014). Vegetal politics: Belonging, practices and places. *Social and Cultural Geography*, *15*(8), 861–870. https://doi.org/10.1080/14649365.2014.973900

Heywood, V. H. (2017). Plant conservation in the Anthropocene–challenges and future prospects. *Plant Diversity*, *39*(6), 314–330. https://doi.org/10.1016/j.pld.2017.10.004

Hinsley, A., de Boer, H. J., Fay, M. F., Gale, S. W., Gardiner, L. M., Gunasekara, R. S., … Phelps, J. (2017). A review of the trade in orchids and its implications for conservation. *Botanical Journal of the Linnean Society*, *186*(4), 435–455.

International Union for Conservation of Nature (IUCN). (2010). IUCN Red List of Threatened Species. Cycad Facts. Retrieved January 23, 2019, from cmsdata.iucn.org/downloads/cycad_factsheet_final.pdf

International Union for Conservation of Nature (IUCN). (2018). IUCN red list of threatened species. Summary statistics. Retrieved January 26, 2019, from https://www.iucnredlist.org/resources/summary-statistics

Interpol. (2018). *Global wildlife enforcement. Strengthening law enforcement cooperation against wildlife crime*. Lyone: Author.

Jenkins, M., Timoshyna, A., & Cornthwaite, M. (2018). *Wild at home: Exploring the global harvest, trade and use of wild plant ingredients*. Retrieved January 26, 2019, from https://www.traffic.org/site/assets/files/9241/wild-at-home.pdf

Kimmerer, R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants*. Minneapolis: Milkweed Editions.

Kohn, E. (2013). *How forests think: Toward an anthropology beyond the human*. Berkeley: University of California Press.

Kost, C., & Heil, M. (2006). Herbivore-induced plant volatiles induce an indirect defence in neighbouring plants. *Journal of Ecolology*, *94*, 619–628.

Lange, D. (2002). Medicinal and aromatic plants: Trade, production, and management of botanical resources. *XXVI International Horticultural Congress: The Future for Medicinal and Aromatic Plants*, *629*, 177–197.

Lavorgna, A. (2014). Wildlife trafficking in the internet age. *Crime Science*, *3*(5), 1–12. https://doi.org/10.1186/s40163-014-0005-2

Lavorgna, A., Rutherford, C., Vaglica, V., Smith, M. J., & Sajeva, M. (2018). CITES, wild plants, and opportunities for crime. *European Journal on Criminal Policy and Research*, *24*, 269–288. https://doi.org/10.1007/s10610-017-9354-1

Lee, J. (1995). Poachers, tigers, and bears.. Oh my–Asia's illegal wildlife trade. *Northwestern Journal of International Law & Business*, *16*, 497.

Lyngdoh, S., Dixit, D., & Sinha, B. C. (2017). Print mass media coverage of wildlife in the developing world. *Current Science*, *113*(4), 564. https://doi.org/10.18520/cs/v113/i04/564-570

Marder, M. (2013). *Plant-thinking: A philosophy of vegetal life*. New York: Columbia University Press.

Marder, M. (2016). *Grafts: Writings on plants*. Minneapolis: University of Minnesota Press.

Margulies, J. D., Hinsley, A., & Phelps, J. (2018). *Illegal wildlife trade endangers plants—But few are listening*. IUCN Blog. Retrieved January 23, 2019, from https://www.iucn.org/news/species/201810/illegal-wildlife-trade-endangers-plants-few-are-listening

Martín-López, B., Montes, C., Ramírez, L., & Benayas, J. (2009). What drives policy decision-making related to species conservation? *Biological Conservation*, *142*(7), 1370–1380. https://doi.org/10.1016/j.biocon.2009.01.030

Massé, F. (2018). Anti-poaching's politics of (in) visibility: Representing nature and conservation amidst a poaching crisis. *Geoforum*, https://doi.org/10.1016/j.geoforum.2018.09.011

Metrick, A., & Weitzman, M. (1996). Patterns of behavior in endangered species preservation. *Land Economics*, *72*(1), 1–16. https://doi.org/10.2307/3147153

Moore, L. (2011). The neoliberal elephant: Exploring the impacts of the trade ban in ivory on the commodification and neoliberalisation of elephants. *Geoforum*, *42*(1), 51–60. https://doi.org/10.1016/j.geoforum.2010.09.002

Ngoc, A. C., & Wyatt, T. (2013). A green criminological exploration of illegal wildlife trade in Vietnam. *Asian Journal of Criminology*, *8*(2), 129–142. https://doi.org/10.1007/s11417-012-9154-y

Novoa, A., Le Roux, J. J., Richardson, D. M., & Wilson, J. R. (2017). Level of environmental threat posed by horticultural trade in Cactaceae. *Conservation Biology*, *31*(5), 1066–1075. https://doi.org/10.1111/cobi.12892

Office of the White House Press Secretary. (2013). Fact Sheet: U.S. efforts to combat wildlife trafficking. Retrieved January 23, 2019, from https://obamawhitehouse.archives.gov/the-press-office/2013/07/01/fact-sheet-us-efforts-combat-wildlife-trafficking

Oldfield, S. (1997). *Cactus and succulent plants—Status and conservation action plan*. Switzerland and Cambridge, UK: IUCN/SSC Cactus and Succulent Plants Specialist Group, IUCN Gland.

Pauls, T., & Franz, M. (2013). Trading in the dark–The medicinal plants production network in Uttarakhand. *Singapore Journal of Tropical Geography*, *34*(2), 229–243. https://doi.org/10.1111/sjtg.12026

Phelps, J., & Webb, E. L. (2015). "Invisible" wildlife trades: Southeast Asia's undocumented illegal trade in wild ornamental plants. *Biological Conservation*, *186*, 296–305. https://doi.org/10.1016/j.biocon.2015.03.030

Plumwood, V. (1993). *Feminism and the mastery of nature*. London: Routledge.

Prestemon, J. P. (2015). The impacts of the Lacey Act Amendment of 2008 on US hardwood lumber and hardwood plywood imports. *Forest Policy and Economics*, *50*, 31–44. https://doi.org/10.1016/j.forpol.2014.10.002

Rijal, A., Smith-Hall, C., & Helles, F. (2011). Non-timber forest product dependency in the Central Himalayan foot hills. *Environment, Development and Sustainability*, *13*(1), 121–140. https://doi.org/10.1007/s10668-010-9252-x

Robbins, C. (Ed.) (2003). *Prickly trade. Trade and Conservation of Chihuahuan Desert Cacti*. Washington, DC: Traffic North America-World Wildlife Fund.

Rose, D. B. (2002). Indigenous ecologies and an ethic of connection. In N. Low (Ed.), *Global ethics and environment* (pp. 175–187). London: Routledge.

Rosen, G. E., & Smith, K. F. (2010). Summarizing the evidence on the international trade in illegal wildlife. *EcoHealth*, *7*(1), 24–32. https://doi.org/10.1007/s10393-010-0317-y

Sajeva, M., Augugliaro, C., Smith, M. J., & Oddo, E. (2013). Regulating internet trade in CITES species. *Conservation Biology*, *27*(2), 429–430. https://doi.org/10.1111/cobi.12019

Schippmann, U., Leaman, D. J., & Cunningham, A. B. (2002). Impact of cultivation and gathering of medicinal plants on biodiversity: global trends and issues. Biodiversity and the ecosystem approach in agriculture, forestry and fisheries. Retrieved April 25, 2019, from http://www.fao.org/3/Y4586E/y4586e08.htm

Sitas, N., Baillie, J. E. M., & Isaac, N. J. B. (2009). What are we saving? Developing a standardized approach for conservation action. *Animal Conservation*, *12*(3), 231–237. https://doi.org/10.1111/j.1469-1795.2009.00244.x

Smith, R. J., Veríssimo, D., Isaac, N. J., & Jones, K. E. (2012). Identifying Cinderella species: Uncovering mammals with conservation flagship appeal. *Conservation Letters*, *5*(3), 205–212. https://doi.org/10.1111/j.1755-263X.2012.00229.x

Staats, M., Arulandhu, A. J., Gravendeel, B., Holst-Jensen, A., Scholtens, I., Peelen, T., … Kok, E. (2016). Advances in DNA metabarcoding for food and wildlife forensic species identification. *Analytical and Bioanalytical Chemistry*, *408*, 4615–4630. https://doi.org/10.1007/s00216-016-9595-8

Tali, B. A., Khuroo, A. A., Nawchoo, I. A., & Ganie, A. H. (2019). Prioritizing conservation of medicinal flora in the Himalayan biodiversity hotspot: An integrated ecological and socioeconomic approach. *Environmental Conservation*, *46*(2), 147–154. https://doi.org/10.1017/S0376892918000425

The World Bank (2018). *The global wildlife program knowledge platform 2016–2018: A global partnership on wildlife conservation and crime prevention for sustainable development*. Retrieved May 9, 2019, from http://pubdocs.worldbank.org/en/106731546908148816/43567-GWP-Annual-Report-2018.pdf

Trewavas, A. J. (2003). Aspects of plant intelligence. *Annals of Botany*, *92*, 1–20.

Trewavas, A. J. (2005). Green plants as intelligent organisms. *Trends in Plant Sciences*, *10*, 413–419. https://doi.org/10.1016/j.tplants.2005.07.005

UK Government (2018). *Press release—Government launches new plans to stamp out the illegal wildlife trade ahead of landmark UK conference*. Retrieved from https://www.gov.uk/government/news/government-launches-new-plans-to-stamp-out-the-illegal-wildlife-trade-ahead-of-landmark-uk-conference

UNODC (2016). *World wildlife crime report: Trafficking in protected species*. Retrieved January 23, 2019, from https://www.unodc.org/documents/data-and-analysis/wildlife/World_Wildlife_Crime_Report_2016_final.pdf

US Fish and Wildlife Service Office of Law Enforcement, USFWS (2019). Mission Statement. Retrieved from https://www.fws.gov/le/

Van Sittert, L. (2003). Making the Cape Floral Kingdom: The discovery and defence of indigenous flora at the Cape ca. 1890–1939. *Landscape Research*, *28*(1), 113–129. https://doi.org/10.1080/01426390306529

Verissimo, D., & Wan, A. K. Y. (2018). Characterizing efforts to reduce consumer demand for wildlife products. *Conservation Biology*. https://doi.org/10.1111/cobi.13227

Wandersee, J. H., & Schussler, E. E. (1999). Preventing plant blindness. *The American Biology Teacher*, *61*(2), 82–86. https://doi.org/10.2307/4450624

Warchol, G. L. (2004). The international illegal wildlife trafficking. *Criminal Justice Studies: A Journal of Crime, Law and Society*, *17*(1), 57–73.

Wasser, S. K., Joseph clark, W., Drori, O., Stephen kisamo, E., Mailand, C., Mutayoba, B., & Stephens, M. (2008). Combating the illegal trade in African elephant ivory with DNA forensics. *Conservation Biology*, *22*(4), 1065–1071. https://doi.org/10.1111/j.1523-1739.2008.01012.x

White, N. (2014). The "White Gold of Jihad": Violence, legitimisation and contestation in anti-poaching strategies. *Journal of Political Ecology*, *21*(1), 452–474. https://doi.org/10.2458/v21i1.21146

Willis, K. J. (Ed.) (2017). State of the World's Plants. Report. Royal Botanic Gardens, Kew, UK. Retrieved from https://stateoftheworldsplants.org/2017/

Wyatt, T. (2009). Exploring the organization of Russia Far East's illegal wildlife trade: Two case studies of the illegal fur and illegal falcon trades. *Global Crime*, *10*(1–2), 144–154. https://doi.org/10.1080/17440570902783947

Zhu, A. (2017). Rosewood occidentalism and orientalism in Madagascar. *Geoforum*, *86*, 1–12. https://doi.org/10.1016/j.geoforum.2017.08.010

Zhu, A. (2018). Hot money, cold beer: Navigating the vanilla and rosewood export economies in northeastern Madagascar. *American Ethnologist*, *45*(2), 253–267. https://doi.org/10.1111/amet.12636

Zimmerman, M. E. (2003). The black market for wildlife: Combating transnational organized crime in the illegal wildlife trade. *Vanderbilt Journal of Transnational Law*, *36*, 1657.

How to cite this article: Margulies JD, Bullough L-A, Hinsley A, et al. Illegal wildlife trade and the persistence of "plant blindness". *Plants, People, Planet*. 2019;00:1–10. https://doi.org/10.1002/ppp3.10053