

# Philosophical justifications for the extirpation of non-indigenous species: the case of the grasshopper *Schistocerca nitens* (Orthoptera) on the Island of Nihoa, Hawaii

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**Abstract** The case of *Schistocerca nitens*' establishment on the island of Nihoa presents a challenging case for conservation biologists with respect to the justification for human efforts to extirpate the insect. In justifying our actions we seek reasons that are ecologically plausible (i.e., consistent with empirical and theoretical understandings of science), ethically compelling (i.e., based on sound reasoning from well-established moral principles), and logically consistent (i.e., avoiding fallacies and contradictions). Our analysis shows that the conventional arguments for conservation programs do not meet these criteria in the case of *S. nitens*. The following reasons fail on the basis of ecological, ethical, or logical standards: the protection of biodiversity, avoidance of ecological harm, biological qualities of the invasive species (herbivory, fecundity, mobility, recency, and functional integration), anthropogenic basis of arrival, harmfulness or unnaturalness of human agency, the interference with ecological processes, or disturbance of equilibria. Rather, we suggest that an aesthetic argument provides an ecologically, ethically, and logically sound basis for conservation biologists to justify taking action against the grasshopper. The aesthetic concept of a "thick sense" of beauty gives rise to a compelling moral case for extirpation based on virtue ethics in a manner similar to the argument against tolerating roadside litter.

**Keywords** Extirpation · Invasive species · Ethics · Aesthetics · Virtue

## Introduction

Scientists often learn important lessons in the most unexpected ways, such as Alexander Fleming's accidental discovery of penicillin, Charles Darwin's serendipitous experiences on the Galapagos Islands, and Barbara McClintock's fortuitous encounters with corn. And in 1964, an unplanned incident began a series of events that have forced us to reconsider conservation biology's widely accepted practice of extirpating non-indigenous species. In that year, the Grey bird grasshopper, *S. nitens*, arrived on Sand Island off the coast of Oahu (Anonymous 1965a, b; Fig. 1). Its introduction could have been facilitated by inadvertent human activity, although we know that the insect can fly at least 300 miles over open ocean (Song et al. 2006); in 1988 the Desert locust, *Schistocerca gregaria*, crossed the Atlantic Ocean from West Africa to the Caribbean and South America (Kevan 1989; Ritchie and Pedgley 1989). The Grey bird grasshopper's remarkable capacity for flight probably accounts for its inexorable spread until finally reaching Nihoa, one of Hawaii's largest uninhabited islands.

After arriving in 1977 (Beardsley 1980), the grasshopper (which has locust-like qualities in terms of its adult swarming behavior) flourished on Nihoa's 63 ha of crumbling rock and tropical flora (Fig. 2), with as many as 400,000 individuals occupying the island in 2004 (derived from Gilmartin 2005). Conservation biologists were alarmed when *S. nitens* stripped 90% of the vegetation on the island in 2004, including denuding endemic, endangered, and locally rare plants (Gilmartin 2005). The

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**Fig. 1** *Schistocerca nitens* adult (photo P. Oboyski)



**Fig. 2** Panorama of Nihoa Island in October 2006. (Photo A. Latchininsky)

grasshopper population crashed the following year and then built back up to perhaps 20,000 individuals in 2006 (Latchininsky 2008). Because of the remoteness and difficult accessibility of Nihoa, we do not know the current status of the population. We do know, however, that the agencies (US Fish & Wildlife Service, the National Oceanic and Atmospheric Administration and the Hawaii's Department of Land and Natural Resources) administering the Papahānaumokuākea Marine National Monument to which Nihoa belongs are extremely concerned with this grasshopper.

The Nihoa population of *S. nitens* appears to be quite healthy. The notable fluctuations in numbers in 2004–2006 were typical of the “boom-and-bust” population dynamics associated with locusts and grasshoppers. The insect develops continuously and produces more than one generation per year on Nihoa. Insufficient soil moisture during the drier, spring–summer–autumn period of the island's climate, appears to be the limiting ecological factor responsible for egg desiccation. Natural enemies are

limited to Millerbirds and predatory arthropods, and they do not seem to significantly reduce of *S. nitens* populations. The Gray bird grasshopper readily feeds on most of the island's 26 plant species although grasses like *Eragrostis variabilis* appear less appetizing than other plants. Since its first appearance on Nihoa and Necker Island in 1977, the insect has colonized most of the Northwestern Hawaiian Islands: French Frigate Shoals, Laysan and Lisianski (Latchininsky 2008).

A workshop hosted by state and federal agencies in 2005 was premised on the idea that the Grey bird grasshopper did not belong on Nihoa (Gilmartin 2005). The ideal outcome was seen to be the eradication of the insect, if this could be accomplished without undue risk to the rest of the species on the island. Given that the assembled experts could not conceive of any method to accomplish this goal, the agencies were left with a watch-and-worry response along with the possibility of rescuing rare and endangered species from the island for ex situ propagation if the grasshopper populations once again irrupted. Amidst the intense discussion and debate concerning how best to eradicate, or at least suppress, the Grey bird grasshopper, the fundamental premise of conservation biology—that the insect should not be allowed to exist or flourish on Nihoa—was never explicitly raised.

What is it that we value about Nihoa such that *S. nitens* is perceived as a dire threat that should be eliminated or managed as an invasive pest? Conversely, we could frame the question as: What is it about the Grey bird grasshopper that has so agitated conservation biologists? Although grasshoppers and locusts are typically viewed as agricultural threats, in a rather unexpected way *S. nitens* has forced us not only to explore new approaches to pest management but to confront the values that lie at the core of conservation biology.

Probing deeply into the qualities of the grasshopper (and its new home) that engender such antipathy is not merely an academic exercise. Rather, we are seeking a clarity of environmental and ethical motives that is essential to credible policies and practices. If biologists are incoherent in their accounts of why *S. nitens* ought to be extirpated, then social and political support for conservation programs will likely be (and perhaps ought to be) called into question. We have what seems to be an archetypical case in conservation biology: a remote, uninhabited island being colonized by a non-indigenous species. Without being able to give ecologically plausible (i.e., consistent with empirical and theoretical understandings within science), ethically compelling (i.e., based on sound reasoning from well-established moral principles), and logically consistent (i.e., avoiding fallacies and contradictions) reasons for taking action in this seemingly clear-cut scenario, the credibility of conservationists will be eroded. If we are not

sure as to why the Grey bird grasshopper warrants eradication, then more ambiguous and complicated cases (e.g., removing feral goats from Pacific Islands or eradicating pigs from Santa Cruz Island) likely will be intractable.

We propose that two major lines of thought have the potential to capture the core rationale for extirpating the Grey bird grasshopper: the newcomer adversely alters the ecological state (static features, such as species richness) or the alien species interferes with ecological processes (dynamic qualities, such as energy flow). As will be seen, the arguments supporting these central concepts fail for a variety of reasons in the case of *S. nitens*. Given the inadequacy of the traditional explanations for conservation biology's management actions, we propose an alternative philosophical structure derived from the concept of human virtues rather than natural values.

### Conservation of ecological states

The contention that ecological states are the source of value driving conservation biology can be analyzed in terms of the island and the insect. In the former context of the island, one might argue that *S. nitens* changes Nihoa from its present condition (an ecological claim). One might also contend that the current, largely natural state of the island's biota approximates an ideal instantiation. That is to say, the geological features, climatic conditions, and geographic aspects of this island could take innumerable forms (e.g., a remote amusement park for the wealthy, a guano mine, a historical recreation of Polynesian life, or a wildlife sanctuary), but the set of conditions that comes closest to those which would obtain in the absence of humans are the most desirable. If so, then substantial changes caused by human action, even if indirect, are wrong (an ethical claim). In the latter context of the insect, one can contend that the Grey bird grasshopper has particular qualities that make its presence on Nihoa adverse to the existing conditions (an ecological claim) which represent a good or valuable state of affairs (an ethical claim).

Before entering into our analysis, we need to explicitly note that those who would base conservation biology on the protection of ecological processes (e.g., evolution, succession, competition) rather than static considerations will likely object to our characterization of policies and practices. We begin with a critique of ecological states because this framing of conservation is historically primary and remains seriously considered. For example, the Endangered Species Act is concerned with fixed entities rather than dynamic processes; within the time-frame of national politics evolutionary change is moot. With the development of ecology from static terms to notions of flux, new conceptualizations of conservation biology have

emerged. These will be analyzed in the second, major section of the paper.

### Threats to the ecological *status quo* of Nihoa

**Risks to biodiversity** Nihoa supports a unique fauna that includes 243 arthropod species (184 of these are insects) and 27 species of birds (Evenhuis and Eldredge 2004). Several of the arthropods are extremely rare, including three species of orthopterans found nowhere else on earth. Two of the bird species are also endemic to the island. The population of Nihoa Millerbird (*Acrocephalus familiaris kingi*) has ranged from as few as 31 individuals to more than 700 (Morin et al. 1997). The Nihoa Finch (*Telespiza ultima*) appears to have a more stable population, ranging from 900 to 4,000 individuals over the last 30 years (Rowland et al. 2007). Some ecologists postulate that entire assemblages of detritivorous arthropods (including crickets, earwigs, and mites) and their predators (such as spiders) depend on organic material provided by the seabirds (Conant et al. 1983).

The island also hosts 26 species of vascular plants, 12 of which are endemic to the Hawaiian Islands and three of which are found only on Nihoa: *Pritchardia remota* (there were 1,042 mature specimens of the Nihoa fan palm in 2006 [Kropidowski 2006]), *Schiedea verticillata* (a member of the carnation family), and *Amaranthus brownii* (which hasn't been seen since 1983, when there were fewer than 35 specimens [Conant 1985]).

A conservationist might contend that the Grey bird grasshopper threatens the integrity of Nihoa's biodiversity. At the very least, *S. nitens* quantitatively alters the richness and evenness of species (i.e., richness is increased and given the abundance of the grasshopper, evenness is likely decreased). In qualitative terms, *S. nitens* might be perceived as an "out of place" organism that does not belong on the island because Nihoa has, to our knowledge, never supported an acridid species. But these objections would apply to any of the resident species when they first arrived, or at least those species which were the initial representatives of their taxa. Moreover, there are dozens of other alien insect species (Evenhuis and Eldredge 2004) and given that nothing is being done about these, it is evident that merely being "out of place" is not a sufficient condition for triggering extirpation if we are also seeking logical consistency in our management practices.

We would hasten to point out, however, that one could make a distinction between what is sufficient to "motivate" us to action and what is sufficient to *prima facie* "warrant" action if we were so motivated. This distinction is important because the demands of consistency are presumably far stronger concerning the ethically warranted basis than the practically motivated basis. So, the conservationist

holding the “out of place” view could conceivably argue that we are *prima facie* warranted in extirpating all non-indigenous species from an ethical perspective, but practical considerations only motivate us in the case of the *S. nitens*. However, as we shall see, there does not appear to be a compelling practical basis for picking out the grasshopper as a species that might be readily extirpated.

In addition to the inherent desirability of consistency for rational action, it can be argued that if species, like individual animals, are moral patients (i.e., entities deserving of moral consideration without being moral agents themselves, as we do not blame or praise species or individual animals for their actions), then considerations of justice would compel us to treat equals equally and unequals unequally (Hull 1977; Goodpaster 1978; Johnson 1991; Singer 2003). As such, if we act so as to extirpate *S. nitens* and fail to act in an equivalent manner for other species that are equal in relevant ways to the grasshopper, then we have been unjust. Of course, one could question whether particular individuals, populations or species can be harmed or benefited such that they count morally so that it would be wrong to extirpate the grasshopper but to ignore other alien species. Various arguments have been made that would endorse this view, including the contention that living beings have intrinsic value (Callicott 1986; Rolston 2001; O’Neill 2003), that insect sentience is sufficient to warrant moral consideration (Lockwood 1988), that ecological wholes are morally relevant (Leopold 1968; Warren 2000; Devall and Sessions 2001), and that to be morally considerable is to have a condition that can be better or worse insofar as that entity (individual, population, or species) is concerned (Johnson 1991).

Although the harm to Nihoa’s biodiversity by *S. nitens* may not be unique, a differential response to a new species by conservation biologists might be justified if economic analysis revealed unequal costs of eradication. That is, even if the grasshopper is just another species in a long series of colonists, it may be acceptable to target a species that is no worse than its predecessors (equal benefit of eradication) if it can be eliminated with the expenditure of fewer resources (lower cost of eradication). However, the 2005 panel concluded that the grasshopper was extraordinarily difficult, if not impossible, to eliminate from the island (Gilmartin 2005), and other alien species would seemingly be much better targets for control efforts (e.g., bait stations for ants).

Moreover, in light of the mobility of *S. nitens*, eradication can be viewed as only a temporary accomplishment given that the island likely would be reinfested. In ethical terms, “ought implies can”—we cannot be morally obligated to do that which is beyond our ability. And the eradication of *S. nitens* from Nihoa is arguably impossible without eliminating the insect from all of the eastward

islands, a task that would be impossible without enormous costs to other species and competing human interests (there are many higher demands on the limited funds available for conservation).

*Likelihood of harm* Another possibility for the differential response could be that conservation biologists believe that the grasshopper has a much greater capacity to alter the abundances of indigenous species and to drive these species to extinction. After all, *S. nitens* has occasionally all but stripped Nihoa of its vegetation during outbreaks and the other 88 alien insect species known from the island (Evenhuis and Eldredge 2004) have not caused such obvious harm. So, is this concern about the state of biodiversity on Nihoa sufficient to justify the eradication of *S. nitens*?

The possibility that a new arrival will threaten existing species does not seem to be an adequate rationale. Nihoa has experienced numerous invasions in the past. When the island emerged through volcanic processes 7.2 million years ago, it was a lifeless mass of rock (Clague 1996). The initial, pioneer species were surely displaced by later arrivals such that the flora and fauna have been undergoing replacement and turnover for millennia. If an organism’s capacity to alter the *status quo* constitutes the basis for eradication, then it follows that we ought to do our best to determine what species were the initial pioneers (only these first aliens arrived without disturbing the pre-existing biodiversity) and then systematically eliminate all other species. Of course this position would require us to provide a reason for privileging earlier floristic and faunistic conditions on the island. Before tackling this issue, however, there is another question that we must consider.

Why should we favor a biological community at all? We could also argue that the geological state of the island was the original condition and that we ought to value and protect this pre-biotic state. If this is taken to be the natural or ideal condition toward which conservation efforts should aspire, then we are obligated to assure that Nihoa persists as a lifeless mass of rock. Surely plants have altered the rate of erosion and changed the island from the way it would be had these organisms not been allowed to flourish.

This line of argument gives rise to the difficulty of selecting any particular ecological state on the island to be worthy of conserving. One might object that this sort of slippery slope argument is unconvincing, that no conservation biologist actually ends up with this conclusion. Presumably we don’t arrive at bare rock as our conservation goal because we favor life over non-life for good reasons. But the concern of how we go about selecting the favored biotic community that lies somewhere between molten lava and the current set of living organisms is valid for two reasons. First, this line of argument is particularly relevant with regard to conservation biology in which we

look back in time to identify a particular objective but there is no obvious stopping point in this retrogression. Second, this concern (even if one takes it to be something of a strawman) highlights a pressing need on the part of conservationists to be clear and explicit about their motives.

*Identifying a non-arbitrary conservation goal* The Grey bird grasshopper undoubtedly constitutes a recent change to the biodiversity of Nihoa. But the same could be said about newly arrived species at any previous period of the island's history. Why should conservation biologists privilege the contemporary *status quo*? There does not seem to be a convincing basis in terms of intrinsic value for selecting the recent past as the Golden Age—the set of ecological conditions that serve as the ethical basis for conservation. Rather, we can infer that our interests—and hence, extrinsic values—are intractably a part of conservation goals (Minteer and Manning 2003; Weston 2003; Cittadino 2006). Ever since David Hume raised the problem of deriving a moral position from empirical facts (Norton and Norton 2007), philosophers have struggled with this issue (Fleming 2006). Using a statement of how something “is” as the basis for how a situation “ought” to be has been called the naturalistic fallacy. However, in terms of conservation biology, the risk is one of constructing a new twist on this old problem. That is, we may be guilty of using how an ecological situation used to be in order to assert how it should be. But we can no more derive “ought” from “is” than we can legitimately deduce “ought” from “was”—the latter perhaps should be called the conservationist fallacy. As such, there must be some additional and compelling reason, other than mere ecological history, to ground our environmental ethics.

Rather than 1976 (the year before *S. nitens* arrived on Nihoa [Beardsley 1980]), we could just as well choose the period between 1,000 and 1,700 CE—the time in which humans occupied the island. If this was our conservation standard, we'd have 25 people living on Nihoa year round and another 150 seasonal inhabitants. These native Hawaiians would hunt seabirds and fish the waters, along with constructing stone houses, water diversions, shrines, and agricultural terraces for planting sweet potato and other crops (Emory 1928). To be true to history, they might even repeat the wildfire that was accidentally started in 1885 by Princess's Lili'uokalani entourage (Clapp et al. 1977), but this time perhaps none of the Nihoa fan palms would survive the conflagration.

Is logically possible for conservationists to take a dynamic, rather than static, view of ecology and object to the presence of *S. nitens* on the basis that this insect and its consequent effects are non-natural without worrying about the species having disrupted some previous ecological state on Nihoa. That is, one could be unconcerned about the changing conditions of a natural system such that there is

no fixed Golden Age to serve as a goal and focus instead on the nature of the change (i.e., accepting natural changes and rejecting anthropogenic changes). This position will be addressed subsequently, but insofar as ecological states might serve as a basis for ethical action, conservationists implicitly favor some unspecified time prior to the arrival of *S. nitens*. However, there does not appear to be any logically consistent, ethically compelling and ecologically plausible basis for identifying any particular period. Evidently, the agencies currently managing the island would exclude the seven centuries of human occupation, given the extreme measures that are taken to protect the island from people (USFWS 2001). Perhaps two dozen living humans have set foot on Nihoa and these individuals were subjected to extraordinarily intense cleansing procedures (e.g., clothing, supplies and equipment had to be sealed and frozen for 48 h before being allowed on the island).

Why the desired ecological state of Nihoa encompasses a time-frame in which humans and grasshoppers are excluded but other colonists are included may be simply a matter of expediency. That is, we arguably know more about the state of the island in 1976 than in 1876, 1776 or any other earlier time. From an ethical perspective, such a justification is consistent with the notion that “ought implies can” (i.e., we cannot be morally required to do that which is not possible). This rationale makes conservation efforts simpler for biologists, but it is a rather weak argument in terms of ecology. It is not clear that we cannot reasonably know about earlier states of the island. Indeed, the surest conditions allowing the simplest management would be the original, lifeless version of Nihoa.

In light of the strong aversion to anthropogenic disturbances, it would seem that the Golden Age was a time in which human effects were non-existent. As such, conservationists would have to target a period prior to 1,000 CE. This is because it appears that the absence of trees (other than the fan palm) is a result of native Hawaiians having deforested the island to supply themselves with firewood and building materials (Emory 1928). But others might argue that these early people were a natural part of Nihoa and the proper ecological target is the island's state between the loss of the ancient people and the arrival of Europeans (i.e., the window of time between 1,700 and 1,822 CE). If so, then we must make sense out of what is meant by the property of being natural (or indigenous) and whether this constitutes a suitable basis for conservation—an issue that we address in the next section.

Undesirable qualities of the target, *S. nitens*

There are several features of *S. nitens* that conservation biologists might use to justify the extirpation of this species. Although some of these properties are particularly applicable

to the Grey bird grasshopper (i.e., it is herbivorous and extremely numerous), others appear to be more universal but are well exemplified by *S. nitens* (i.e., it can be characterized as an adventive visitor, a recent immigrant, and alien or non-indigenous species). We analyze each of these qualities in an effort to determine if they provide a logically consistent, ethically compelling, and ecologically plausible basis for deciding which species are to be protected (or at least tolerated) and which are to be exterminated.

**Undesirable qualities of *S. nitens*** We might justify our intolerance of *S. nitens* based on its feeding habits (Fig. 3). Conservation biologists could maintain that in ecosystems with endangered plants, newly arrived herbivores should be considered imminent threats. Moreover, the grasshopper has demonstrated its capacity to decimate Nihoa's vegetation (Fig. 4), notwithstanding the fact that the island's flora appears to have fully recovered (Latchininsky 2008). But future insect outbreaks could conceivably drive one or more of the rare plant species to extinction. So, if we consider the intrinsic value of species to be ethically compelling and the loss of endangered plants via grasshopper herbivory to be ecologically plausible, we have two of the desired elements of a justifiable rationale for extirpating the insect.

We also seek logical consistency with regard to a credible account of why *S. nitens* should be eliminated, to the extent possible, from Nihoa. However, it appears that such coherence is lacking. The island also harbors non-indigenous, herbivorous coleopterans (ant-like leaf beetles, weevils, sap beetles, bark beetles, and flea beetles), heteropterans (seed bugs and plant bugs), dipterans (leafminers), homopterans (including scales, delphacids, leafhoppers, mealybugs and aphids), lepidopterans (noctuids, leafminers, plume moths, and grass moths), orthopterans (long-horned grasshoppers) and thrips. Yet, there are no plans to



**Fig. 4** Grasshopper *S. nitens* damage to Nihoa fan palms *P. remota* combined with drought in 2004 (photo J. Culliney)

extirpate these insects to protect the plants. It is entirely possible that the chronic feeding by other alien herbivores does as much or more damage to the survival of Nihoa's plants as the grasshopper does in its boom-and-bust feeding.

Heavy feeding by *Schiedea nitens* on the rare plant, *Schiedea verticillata*, was reported during the 2002 and 2004 outbreaks. Observers described a scene of nearly complete defoliation resembling "a temperate-zone winter landscape," with leafless twigs girdled and bark chewed from woody plants (Culliney 2004), but there is no evidence that this plant, or other species on the island, was permanently damaged. Nor does it seem that *S. nitens* has diminished the prevalence of native herbivores, including endemic species of concern such as the Nihoa long-horned woodborer, click beetles, seed bugs, leafminers, and various weevils. In fact, a survey in 2006 found an abundance of *Rhyncogonus exsul* at the same time that island was supporting about 20,000 grasshoppers (Latchininsky 2008; Fig. 5).



**Fig. 3** Damage to *Sida fallax* by young nymphs of *S. nitens* (photo A. Latchininsky)



**Fig. 5** Damage to *Sesbania tomentosa* by *R. exsul* weevil (photo A. Latchininsky)

If being an herbivore is not sufficient grounds for extirpation, perhaps the criterion for extirpation is quantitative. Abundant and prolific organisms might qualify as legitimate targets. But sheer numbers alone would not seem to be an ecologically plausible justification. And even if we accept this as a reason, the conservationists have failed with respect to logical consistency. Several other non-indigenous species (including some herbivores as well as predators of endemic species) are much more prevalent than *S. nitens*. Cockroaches, ants (there are no native ants on Hawaii, and there are nine ant species on Nihoa), and aphids are certainly more numerous, and they likely comprise a greater biomass than the grasshoppers, at least in some years. If the biomass or number of scavengers, herbivores, or predators that have recently arrived on the island is the rationale for extermination efforts, then *S. nitens* should not be the primary (or only) species of concern to conservationists. However, there are no systematic efforts or plans to extirpate these other insects.

Finally, the modes of invasion by some insects may be different than that of *S. nitens*, but this does not seem to be relevant. That is, *S. nitens* (and presumably the aphids) arrived to the Hawaiian Islands with human assistance and then hopped on their own from one island to another until arriving at Nihoa. Other insects (e.g., cockroaches) were likely transported to Nihoa by humans. If anything, the latter mode of arrival would seem to provide a more compelling basis for eradication in light of there being no intermediate steps having been taken by the insect of its own accord to invade Nihoa. However, the relevant concern seems to be element of human agency in the invasion, whether or not the insect was delivered directly to an ecosystem.

*Justifiable eradication of non-indigenous species* The Grey bird grasshopper can be considered an adventive visitor, a species that comes and goes from the island. Given the paucity of annual data (there are no reports of *S. nitens* from Nihoa between 1983 and 1997), it is possible that the grasshopper has periodically disappeared from, and then recolonized, Nihoa. If so, then a conservation biologist might contend that such a species is not an integral part of the ecosystem and that it may bring with it undesirable pathogens and parasites (there are three endemic orthoptera on the island). But if this is the basis for extirpation, then we once again encounter a most troublesome inconsistency. Eight species of birds on Nihoa—which was earlier known as “Bird Island”—are visitors (Evenhuis and Eldredge 2004) including the bristle-thighed curlew, the ruddy turnstone and the Pacific golden plover. There is no effort to eliminate these animals, presumably because they have been using the island as a stopover for many years. However, this may also have been the case for nearly 40 years with *S. nitens* (and perhaps painted lady butterflies

and dragonflies, as we shall see) and may continue to be the case for centuries if no action is taken. But it seems more likely that the grasshopper has become continuously established on the island, and perhaps this is a sufficient basis for extirpation.

*Schistocerca nitens* is a relatively recent immigrant to Nihoa. It was first seen on the island in 1977, but given its mobility (Song et al. [2006] reported that individuals flew 300 miles from Baja California to Socorro Island) and its presence on Kauai since at least 1970 (which is just 150 miles from Nihoa), it is quite possible that the grasshopper was on Nihoa well before the first sighting. Conservationists could argue that new arrivals to largely intact ecosystems are justifiable targets of extermination. Based on the precautionary principle, recent immigrants might be presumed guilty of harm. But again, the federal and state agencies are inconsistent in the application of this criterion, undermining the credibility of the principle.

During the 2006 expedition, a team of scientists made the first sighting of a painted lady butterfly (*Vanessa cardui*) and only the second observation of a dragonfly (species unknown) on Nihoa (Latchininsky 2008). However, there was no policy requiring that these newest arrivals be summarily exterminated. In addition, a pintail duck, another visitor, was seen for the first time on the island. Given the damage that has been done by non-indigenous vertebrates on other tropical islands (Ely and Clapp 1973), it would seem logically consistent to have attempted to kill this bird if being a recent immigrant is the quality that motivates the extirpation of *S. nitens*. One might contend that the failure to eliminate a single bird is a rather weak argument for inconsistency, but had the scientists encountered a rat, pig, or goat (any of which could have been pregnant) it seems certain that the individual would have been summarily removed. But perhaps the basis for eliminating a non-indigenous species is better framed in other terms.

Conservation biologists have variously described species using a panoply of overlapping terms and concepts, including: alien, exotic, adventive, invasive, naturalized, indigenous, and native. Finding crisp, unambiguous boundaries between these categories is difficult. However, the key difference appears to be that of becoming a component in biotic interdependencies. Being a component of a functioning ecosystem appeals to both ecological and ethical considerations, as circumscribed by Aldo Leopold’s land ethic (1968). That is, an action is right when it fosters stability, integrity, and beauty of a biotic community. By extension, a species becomes tolerable or valued when it “fits in”—when its ecological functions (e.g., feeding) are harmonized with the rest of the community.

As such, species would not need to be native—which we take to mean having evolved in situ, as would be the case



**Fig. 6** Nihoa Millerbird *Acrocephalus familiaris kingi* on *Sesbania tomentosa* (photo A. Latchininsky)

with only a few endemics—to warrant our protection, but they must be naturalized. For example, the swordfern *Nephrolepis multiflora* is considered to be a naturalized species which probably arrived via wind dispersal (Conant 1985). Why it is considered to be naturalized or functionally indigenous is not entirely clear, although it appears that it is not overwhelming other plants but “fitting into” the community without displacing competitors. And if insects or birds use the plant for food or shelter, then one might contend that it has become integrated into the ecological state of the island.

If we adopt this version of Leopold’s ecological ethic, then does *S. nitens* pass the test? There is evidence that *S. nitens* has already become a stabilizing force in the Nihoa ecosystem (Latchininsky 2008). In the years prior to the arrival of the grasshopper, the Millerbird population was hovering below 200 individuals (Morin et al. 1997; Fig. 6). With the outbreak of the Grey bird grasshopper, the insectivorous birds flourished, with 450 reported in 2002. Their numbers dropped to fewer than 200 when the grasshopper population subsequently crashed. Although the evidence is circumstantial, one might contend that *S. nitens* is a buffer against food shortages that could threaten the rare, endemic bird. Current, albeit limited, evidence suggests that when dry conditions prevail, the grasshopper population decline lags behind that of insects less well-adapted to drought, thereby providing the Millerbird with a nutritional “bridge” in an otherwise adverse period.

There is also intriguing evidence that *S. nitens* is evolving an island race. Easily flushed from the vegetation, a typical Grey bird grasshopper normally flies a long distance from the point of disturbance. However, the grasshoppers on Nihoa are notably reluctant to take wing, and they dramatically truncate their evasive flights, landing just 3–10 m away from the point of disturbance (Latchi-

ninsky 2008; although others have not noted this tendency [M. MacDonald, pers. comm.]). The diminishment of flight is a well-known adaptation on small islands (long flights being fatal if the organism cannot readily make its way back to land). Perhaps *S. nitens* is on its way to becoming *S. nihoensis*.

Whether or not *S. nitens* is part of the ecosystem, the quality of “fitting in” has problematical elements as a standard for tolerating species. Such an approach places a conservation premium on whatever species happened to arrive first to a place. Given the random nature of wind dispersal, favoring the earliest species would privilege winged insects. One might argue that such r-selected species are more natural colonists than other kinds of animals, but then *S. nitens* would qualify in this regard. As for plants, if New Zealand spinach (a newly arrived species that is ripped up when found on Nihoa) had managed to colonize during an earlier wave of colonization, it might now warrant protection. To stretch this line of argument further, all of the endemics on Nihoa evolved from an earlier species that upon its arrival probably diminished the stability and integrity of the biotic community. Had the first orthopterans to reach the island been extirpated as being threats to the existing order, we would not have the endemic katydids or crickets that are now regarded as extremely valuable.

What is not clear is why being the first to arrive at a newly formed island is a justifiable basis for warranting protection. Even if we favor the “first species” (or “first people”) to an area, few—or perhaps, none—of the species that initially settled on Nihoa still live there. So what we’re conserving today is a set of species that represents the most recent iteration of a long series of displacements. There appears to be no compelling rationale for favoring the residents that just happened to comprise an ecologically stable biotic community when the Papahānaumokuākea Marine National Monument (or its predecessor, the Hawaiian Northwest Islands National Wildlife Refuge) was formed. Had the Grey bird grasshopper arrived before the first biological surveys of the island in 1885 (Clapp et al. 1977), the species would have been perceived as being part of the ecosystem with its periodic irruptions being no less an element of the island’s integrity than the outbreaks of locusts elsewhere in the world.

The rationales for seeking the extirpation of *S. nitens* from Nihoa based on more-or-less static qualities of the insect and the island do not appear to be ecologically plausible, ethically compelling or a logically consistent. However, organisms and ecosystems are dynamic entities, so perhaps conservation biologists can justify their intolerance of the Grey bird grasshopper in terms of processes rather than states.



## Conservation of ecological processes

There are several lines of argument pertaining to ecological dynamics that might explain why *S. nitens* is a valid target for suppression or extirpation. The rationales include: the process by which the grasshopper arrived on Nihoa, the changes in the island's ecological workings that have followed the insect's colonization, the erratic nature of the grasshopper's population dynamics, and the potential permanence of the Grey bird grasshopper (and its effects) on the island. Once again, these candidate justifications should meet the standards of being ecologically plausible, ethically compelling and logically consistent with respect to the practices of conservation biology.

### Anthropogenic introductions

The arrival of *S. nitens* on Sand Island at the entrance of Honolulu harbor in 1964 triggered eradication efforts. The presumption was that the insect had been accidentally introduced through (unintentional) human assistance (Anonymous 1965a, b). However, based on the distances the grasshopper subsequently moved between islands and the track of hurricanes from Mexico, today's entomologists cannot fully discount the possibility that the species arrived on its own (G. Nishida, pers. comm.). At least six aerial applications of malathion were used to eliminate the grasshopper, but within 5 years it had made the short, 3 km crossing to Oahu. This dispersal and the subsequent spread of *S. nitens* from island to island were most likely accomplished by the insect of its own accord. So, the justification for seeking to eradicate the grasshopper from Nihoa (and anywhere else in the Hawaiian Islands) might be derived from the anthropogenic nature of its original colonization. Setting aside the possibility that the Grey bird grasshopper arrived on its own, we must account for why a human-facilitated introduction legitimizes eradication.

The conservation biologist could appeal to the unique or higher value of natural processes. Of course, the contention that natural processes are good does not imply that anthropogenic processes are bad; we would certainly not want to argue that creating art, writing essays, or conducting science are unethical for being particularly human activities. To address this issue, we must first determine whether the conceptual divide between humans and nature is valid. A tremendous amount of intellectual capital in environmental philosophy has been focused on whether this dichotomy is real and useful (Mill 1874; Taylor 1981; Devall and Sessions 2001; Rolston 2001; Singer 2003; Fleming 2006). Even if we accept that there is a meaningful difference, we must then make the case that the metaphysical distinction has ethical relevance. So not only should the relocations of species by human agency be

essentially different than natural movements of organisms into new places, but the anthropogenic introductions must have some quality that makes them unacceptable or at least of diminished value.

In conservation biology, human changes to the environment are taken to be inherently harmful. Extending the concerns regarding ecological restoration raised by Elliot (2003) and Katz (2003), Moffett (2007) has recently made what might be the most compelling argument for the differentiation and preservation of what is natural (i.e., not of human artifact). His argument pertains to wild lands, but the implications for anthropogenic changes to the natural world are clear. In brief, he contends that wilderness (spatially expansive natural settings that are minimally altered by humans, recognizing that there are degrees of naturalness) have a kind of authenticity insofar as they have come into being in a manner that cannot be duplicated by humans. Our efforts in restoration ecology, no matter how similar to natural processes, yield a result that is at best an artful counterfeit (even a perfect copy of the *Mona Lisa* would be devalued by not having been authentically painted by the hand of Leonardo da Vinci).

From this philosophical perspective one might infer that we are obligated to minimize anthropogenic changes to natural systems, such as Nihoa (let us set aside, for the moment, the contention that the island is not wilderness insofar as non-indigenous insect species are nearly as abundant as indigenous species—and likely more prevalent in terms of population and biomass), and to act quickly and decisively to reverse human impacts. Presumably, the rapid extirpation of alien species would protect the authenticity of an ecosystem, much like a conservator's quick action to remove a vandal's paint splatter from the *Mona Lisa* would maintain the integrity of the artwork. So, if we stipulate that Nihoa is wilderness (a questionable claim in light of the current species' composition) and that Moffett's argument is ethically sound and reflects some ecologically plausible concerns with regard to alien species vis-a-vis invasion biology (Sax et al. 2005), then it follows that natural processes are particularly valuable and that we ought to do whatever is practically reasonable to erase the evidence of anthropogenic introductions from nature preserves. The question then becomes one of whether our efforts to quash the Grey bird grasshopper on Nihoa are coherent. And given the moral status of natural systems, it would seem that inconsistency would not be only irrational but unjust (i.e., failing to treat equals equally and unequals unequally).

At this point one might argue from the perspective of ecological processes that unequal treatment of species with respect to extirpation may be just. Perhaps the cumulative effects of exterminating all of the non-indigenous species might be harmful, even devastating, in that Nihoa has such

a substantial proportion of these organisms. If so, then selectively eliminating particular non-indigenous species would be ethically defensible. However, such a contention concerning the dependence of Nihoa raises the question of whether there is, in any meaningful sense, an indigenous and functional community of organisms. Even setting aside this concern, there appears to be no ecological evidence that any of the indigenous species or processes would be at dire risk from the elimination of all aliens. There might well be some adjustments in plant and animal abundances but the Nihoa ecosystem does not appear dependent on these organisms. Moreover, even if there was such concern, the available, albeit limited, evidence is that *S. nitens* might be one of the few non-indigenous species providing a benefit to a Nihoa native (i.e., the Millerbird). So even if prudential considerations were to yield unequal treatment, it is not evident that *S. nitens* should be the first non-indigenous species slated for elimination.

With further regard to consistency, let's consider what would seem to be a case of ecological (and moral) equals. The painted lady butterfly most likely arrived in Hawaii via human agency (as presumably did *S. nitens*), so the federally-funded Hawaiian Ecosystems at Risk Project considers *V. cardui* to be a non-native species (HEAR 2008). In addition, Hawaii's Office of Environmental Quality Control lists this butterfly as a pest of native plants. However, the agencies responsible for the protection of Nihoa have not sounded the alarm concerning the recent discovery of the painted lady butterfly on the island and there appears to be no plan for monitoring and eradicating the insect if (or more likely, when) it becomes established.

Another instance of functional equals (at least with respect to human effects) being treated unequally on Nihoa pertains to archeological remains which are unambiguously anthropogenic in origin. If humans and the consequences of their actions are unnatural, then traces of early Hawaiian settlement—at least some of which continue to alter the ecological processes (e.g., terraces and water courses)—should be removed along with *S. nitens*. However, the archeological sites are being protected (US NPS 2007).

More general problems also arise if we justify extirpation of alien species by appeal to their having arrived in an ecosystem—whether wilderness or otherwise—through either intentional (e.g., pigs and goats on Pacific Islands) or inadvertent (e.g., the Grey bird grasshopper on Hawaii) human assistance. By this line of argument, we ought to extirpate wolves from Yellowstone National Park. Of course, a conservation biologist might contend that such anthropogenic re-introductions are allowable in cases in which humans were the cause of the species having been lost from an area. But if we accept this caveat, we end up with seemingly absurd proposals such as Pleistocene re-wilding (Donlan et al. 2005), in which we are compelled

to move African elephants and lions to North America in an effort to compensate for the role of humans in the loss of the continent's megafauna.

One might object that we've provided a rather unsympathetic reading of conservation biology. To the extent that early humans had a role in the extinction of megafauna (most ecologists would agree that hunting was a significant factor [Martin 1967, 1984; Alroy 2001]) or alterations in the ecology of Nihoa, perhaps these effects were natural. If ancient humans behaved in natural ways, perhaps modern people have no obligation to mitigate the consequences of primitive societies. But we then need to make sense of what is (un)natural about humans. Why stone spear points were natural and firearms are not, is unclear. If the latter technology is natural then we need not worry about trying to restore the Moa to New Zealand (if such was possible), but we'd want to pursue the restoration of passenger pigeons to North America. As with the search for the Golden Age, there does not appear to be a compelling time in human history before which we were natural and after which we were capable of unnatural acts.

Returning the matter of anthropogenically introduced species, to be consistent we should extirpate brown trout, brook trout, and wild horses from the western United States. Wheat, rice, soybeans, and dozens of other non-indigenous agricultural plants also would be slated for elimination, unless their contribution to human well-being was a sufficient good to offset their deleterious effects (and this argument would probably not hold for many minor crops). These latter cases are neatly avoided by Moffett, given that the North American continent, the western region of the United States, and the farmlands of the Midwest could hardly constitute wilderness.

There is a final, rather sticky problem with regard to mitigating anthropogenic changes in ecosystems of any sort. In coming years, we will encounter the apparent necessity of extirpating species that invade new habitats in response to anthropogenic climate change, given that human agency played an indirect but essential role in their movement. With Moffett's allowance for degrees of wilderness, one might contend that the climatic refugees might make an area less natural but not unnatural. But the erosion of value would seem to be as concerning than its sudden elimination. The former process allows us to constantly renormalize our perceptions such that there may well come a time in which a scenario that would seem utterly unnatural to us would be perceived as unproblematical to future humans. Of course, one must be careful about what we *prima facie* ought to do and what we ought to do "all things considered." Perhaps if we could magically exclude climatic refugees from invading new habitats we should do so, but in light of all relevant considerations we are not ethically compelled to expend the resources needed to do

so. However, one of the things to consider in this broader context is that the economically cost-free exclusion of species that are driven into new habitats by anthropogenic climate change might well condemn these species to extinction. As such, even the “all things considered” provision does not necessarily mitigate—and may well heighten—what we took to be our *prima facie* moral duties.

#### Interference with ecological processes

We turn now to the possibility that a disruption of ongoing interactions among biotic and abiotic components of an ecosystem is sufficient grounds for eradication. There can be little doubt that the Grey bird grasshopper has, at least periodically, altered the energy and nutrient flows on Nihoa. For example, heavy feeding by *S. nitens* during outbreaks (Centre for Overseas Pest Research, COPR 1982) has surely reduced energy capture and changed the carbon flux. However, the same could likely be said of earlier insect herbivores to arrive on the island, and there has been no effort to exterminate these species. And the situation becomes even more muddled with respect to predatory insects.

Conservation biologists explicitly approve of the presence of an introduced, seven-spotted lady beetle (*Coccinella septempunctata*) because this insect may be protecting rare and endangered plants by suppressing the non-indigenous aphids on Nihoa (Evenhuis and Eldredge 2004). But if protecting indigenous species is grounds for tolerating an alien organism, then there is arguably as much or more circumstantial evidence that *S. nitens* is a benefit to Millerbirds as there is for ladybird beetles protecting indigenous flora (there appear to be no data supporting the contention that the beetle is having a positive effect on indigenous plants). Another non-indigenous predator, *Trox suberosus*, did not trigger an eradication effort even though there seems to have been no indigenous ecological processes facilitated by this insect. At least there were no known benefits until *S. nitens* arrived, and it is now possible that *T. suberosus* feeds on the grasshoppers' eggs and suppresses population growth—at least there is as much evidence of this, as there is for the benefits provided by *C. septempunctata*. If so, then we are left to wonder whether the *Trox* beetle is an ecological asset in the same sense as the ladybird beetle (i.e., controlling a non-indigenous herbivore population) or an ecological liability if the grasshopper has become a stabilizing food reserve for Millerbirds.

#### The “unnatural” nature of non-equilibria

We next turn to the erratic nature of *S. nitens*' population dynamics as a reason for targeting this species for eradication. The traditional view of ecological entities (e.g.,

populations, communities, and ecosystems) is one of equilibrium dynamics (Keller and Golley 2000; White 2006). This perception may be historically grounded in the Greek ideal of the Golden Mean from which eventually followed the Darwinian attraction to uniformitarianism and the Victorian and Protestant virtues of moderation (Stoll 2006). Twentieth century ecologists inherited the notion, accepting that a healthy, functional population should be not exhibit erratic changes in abundance, and if a disturbance does occur then the population is expected to reliably return to a steady state via dampened oscillations.

As such, the instability of *S. nitens* could be taken as evidence that the species is exhibiting unnatural population dynamics which constitutes evidence that the grasshopper is maladapted to Nihoa. However, this interpretation is not ecologically plausible in light of modern science, nor is it logically consistent. We now know that native acridid species (and other organisms) can exhibit non-equilibrium dynamics such that population outbreaks and crashes are a normal aspect of their natural history (Lockwood and Lockwood 1991, 1997). And if boom-and-bust changes were evidence that a population was not well adapted to a particular locale, then the Millerbird's fluctuations between 31 and >700 individuals over the last 30 years would indicate that this species was no better fit to life on Nihoa than is the Grey bird grasshopper.

We would further note that even if equilibrial dynamics (or any other feature contrary to the biology and ecology of *S. nitens*) was an adequate description of the natural world, we cannot conclude that this is the way the world ought to be. Deriving a moral position from empirical facts is the naturalistic fallacy. At least such a deductive move is enthymematic (i.e., missing a premise); in the case of conservation biology the argument is missing a sound reason as to why natural entities, systems, or processes ought to be preserved. Moffett's (2007) reliance on authenticity might be sufficient with further explication of why we should value that which came into being in a manner that cannot be duplicated by humans. The central concern with respect to the naturalist fallacy is that descriptive and prescriptive assertions are qualitatively different kinds of statements such that neither can be logically reduced to the other (hence the missing propositional bridge). As such, an accurate description of how much of Nihoa's plant biomass is consumed by *S. nitens* (up to 90% during an outbreak) does not necessarily lead to any ethical judgment regarding whether this is bad or whether we should intervene.

*Process without end?* The final consideration with respect to ecological processes serving as the basis for eradication of *S. nitens* pertains to the apparent permanence of the grasshopper (if we take sustained existence to be a kind of process). Perhaps conservation biologists are

incensed by this insect because its presence, and hence the changes that it imposes to the island, appear to be irreversible. The inexorable process of colonization is a threat to our presumed superiority and our standing as the most effective colonists on earth. In effect, the grasshopper is beating us at our own game.

The Grey bird grasshopper provides a stark reminder of the limitations of our scientific and technological prowess. When challenged to propose a method of extirpation with absolutely no economic constraints, the participants in the 2005 workshop failed to generate a single method for exterminating this insect while protecting the non-target organisms (Gilmartin 2005). Every method that was deemed capable of eliminating *S. nitens* was almost certain to inflict greater collateral harm to the flora and fauna than the grasshopper was causing. In effect, the process of restoring the biotic community to its pre-grasshopper condition is impossible because whatever method is used to extirpate *S. nitens* (e.g., chemical control with various insecticides and formulations, biological control with predators, parasites, or pathogens, or cultural control with traps or other devices) would likely yield ecological processes and states less—rather than more—like the those prior to the alien introduction.

But if *S. nitens* has wounded our pride and incited our ire, then why isn't the same reaction elicited by the irreversible colonizations by ants, aphids, beetles, cockroaches, flies and other insects on Nihoa? There is an important difference that sheds light on what might be the most plausible justification for eradicating *S. nitens*. The grasshopper—in terms of both the size of the individuals and the magnitude of their ecological effects—is impossible to overlook. Like a kind of environmental graffiti, *S. nitens* is impossible to ignore. One could easily boat past or walk across Nihoa without noticing the presence of the other 88 species of non-indigenous insects. But it would be quite impossible to miss from the deck of passing ship a 90% loss of vegetation during a grasshopper outbreak or to overlook during a hike the 4 cm long locust-like insects flushing from the foliage. Although such emotional and psychological reactions to *S. nitens* might not seem to constitute an ecologically plausible or ethically compelling rationale at first glance, these concerns are relevant to a philosophical theory that has not been previously applied to conservation biology. The conspicuousness of *S. nitens* and the reaction this evokes may provide a plausible rationale and defensible motive for conservation biologists to pursue the elimination, or at least the suppression, of this species.

#### Conservation of beauty and virtue

In his seminal book, *Aesthetics and the Environment: The Appreciation of Nature, Art and Architecture*, Allen

Carlson (2000) addresses a wide range of theoretical accounts for an aesthetic of natural objects. Others have previously considered the aesthetic value of species and while finding this axiology compelling in particular cases, philosophers have seemingly been dissatisfied with the anthropogenic roots—although not necessarily anthropocentric, as one can be a subjectivist without being egocentric—of this perspective (Russow 1981; Singer 2003). But those seeking an intrinsic value in species may be doomed to frustration as the search for an objective value of nature is based on the metaphysical presumption that human perceptions, interests, and needs can somehow be isolated from our knowledge of the world (Weston 2003).

A concern worth addressing, albeit too briefly, is the subjectivity of aesthetics. Although one could maintain the nihilistic or solipsistic position that beauty (as with reality, truth, knowledge, and morality) is radically relativistic such that anyone's claim is as valid as anyone else's, few—if any—philosophers would accede to such a stance (Zangwill 2007). Although there are many conceptual models for aesthetic appreciation which apply to the natural world with greater or lesser success (Carlson 2000), aestheticians are unwilling to simply throw up their hands and declare that anything goes. Rather, a normative element seems valid with respect to the judgment of taste; one can be mistaken about aesthetic claims. There is not sufficient space for us to explore the philosophy of aesthetics, but we would appeal to the commonsensical observation that it is not the case that if I think something is beautiful then it is beautiful. If such were the case for beauty (or metaphysics, epistemology, or ethics), there is simply no point in exploring, analyzing, or discussing the matters of beauty (let alone refining, cultivating, or educating people in making aesthetic judgments or in creating works of art).

Carlson's aesthetic argument represents a compelling philosophical account with regard to its descriptive power (i.e., it seems to account for how we value species) and its prescriptive features (i.e., it provides a morally defensible consideration, if not the entire rationale, in our valuing of species). The most relevant analysis with respect to justifying the extirpation of *S. nitens* from Nihoa (and eliminating non-indigenous species in general) is his "eyesore" argument. We contend that this aesthetic basis for human action is ecologically plausible, ethically compelling, and logically consistent.

The eyesore argument makes an explicit appeal to aesthetic values, rather than ecological or ethical considerations (except insofar as there is an implicit and seemingly non-controversial claim that we ought not to destroy what is beautiful or we at least ought to prefer or privilege that which conserves beauty all other things being equal). However, we'll argue that these latter aspects are

entirely consistent with the aesthetic position and that differential treatment of *S. nitens* and other alien species on Nihoa is coherent in light of aesthetic value. Carlson's argument shifts the issue from being centered on nature (and whatever ecological and ethical factors might underpin the eradication of non-indigenous species) to an anthropocentric foundation which appears to be far less likely to overreach or generate problems of consistency.

Carlson develops his argument from two premises. He maintains that we should prefer aesthetically pleasing environments over displeasing ones and that human-generated junk, trash, and debris is not aesthetically pleasing. Although he does not allude to non-indigenous species, the extrapolation from physical litter (e.g., empty bottles, candy wrappers, and styrofoam cups) to biological litter (e.g., non-indigenous species, invasive weeds, and anthropogenically introduced organisms) is entirely consistent with his line of argument.

#### Preference for aesthetically pleasing environments

The most obvious reason for preferring beauty is that it satisfies a justifiable interest, one that is consistent with human virtue. That is, we might contend that we ought to prefer aesthetically pleasing environments because beauty is both valuable (in an axiological sense) and good (in a moral sense). As such, during a fire in the Louvre it would be wrong to choose to save a soiled napkin in preference to the Mona Lisa. The beauty of the painting is sufficient to justify our choice of rescuing it.

Carlson notes that in the context of environmental aesthetics, however, there is the further temptation to posit a correlation between something being natural and its being beautiful. This association might be defensible for pristine natural places and objects, but problems arise when considering altered sites and things that are not completely natural. Carlson focuses on roadsides and why litter is undesirable, but the same considerations would hold for Nihoa (which is not pristine given that almost 50% of the insect species on the island are non-indigenous) and *S. nitens* (which might be thought of as biological litter in this context). The most serious problem is that artists and craftsmen are demonstrably capable of making some objects more aesthetically pleasing by making them less natural. The cabinetmaker or the sculptor is capable of altering wood and stone in ways that make the resulting objects more beautiful than the raw materials. Of course this contention depends on the origin and nature of the wood or stone, but surely beautification is possible in at least some circumstances (e.g., carving from scrap lumber scavenged from a dump or the sculpting from stones found in the slag heap of a mine site).

Recall also the earlier concerns with regard to the contention that natural states or processes have greater value than those of human creation. This position was found to be weak, although Moffett proposed a possible defense with respect to wilderness (which he took to be large, complex systems with nominal human disturbance). In effect, these places are the sorts of pristine locations in which Carlson finds the possibility of a correlation between the natural and the beautiful. If we appeal to naturalness as the justification for preferring a site or object, then we've shifted to a new argument. That is, we'd be contending that we ought to clean up our mess—be it physical trash or biological litter—not because it is ugly but because it is not natural. So, let us set aside the notion that natural things are beautiful (recognizing that if this is true, then perhaps the case for extirpating *S. nitens* is stronger) and address the central aesthetic premise of the eyesore argument.

#### (Biological) trash is not aesthetically pleasing

The rationale for removing roadside litter hinges on successfully arguing that trash is ugly, a position that Carlson shows to have important ethical ramifications. Likewise, to make a case that the extirpation of *S. nitens* from Nihoa can be justified in aesthetic (and eventually moral) terms, we must understand what makes something aesthetically pleasing and why the grasshopper fails in this regard. Hospers (1946) makes a powerful and vital distinction between two senses of beauty: thin and thick. The thin sense of beauty pertains to our sensual enjoyment of a place or object by virtue of its physical appearance. A thick sense of beauty involves an engagement with the qualities and values that the appearance conveys to the viewer. This form of beauty is “expressive” insofar as it evokes an experience beyond the sensory phenomenon. Such a distinction is similar to Leopold's (1968) differentiation of the pretty from the beautiful in the context of environmental aesthetics.

Carlson uses the example of an old house. With a thin sense of beauty, the observer sees and appreciates the elaborate woodwork, stained glass windows, elegant architectural lines, etc. But a thick sense of beauty evokes a sense of profound craftsmanship, attention to detail, concern for quality, and more genteel times. The house's aesthetic qualities become linked to human values and elements of a virtuous life. Likewise, a thin sense of beauty regarding Nihoa would involve an appreciation of the island's soaring cliffs, luxuriant vegetation, and graceful birds. A thick sense of beauty might involve a sense of the rich interdependencies among the organisms, the fortitude of species living in such a difficult location, and the capacity of life to convert bare rock into a vibrant biotic community.

With respect to the thick sense of aesthetics pertaining to the Grey bird grasshopper, it is important to note that the insect is much like a locust in its natural history. Although the species does not aggregate in nymphal bands, the adults form swarms and may undergo morphological changes consistent with phase variation and certainly exhibit the long-distance flights of locusts (Song et al. 2006). Indeed, *S. nitens* has been called a locust by various authors (e.g., Heitler and Burrows 1977; Mizisin and Ready 1986; Harrison 1989; Song et al. 2006), a term that produces a strong, adverse response in Judeo-Christian cultures (Lockwood 2004). The literary thread that weaves from the Biblical story of the plagues of Egypt (Exodus 10:1–20) through Laura Ingalls Wilder’s account of locusts in *On the Banks of Plum Creek* may be useful in an effort to describe why we react negatively to the presence of *S. nitens*.

Of course, it is possible that people could come to view insects (including locusts) as a valuable and tasty food source, in which case the thick sense of beauty via this association could be positive. Indeed, one could posit almost any sort of cultural linkage to an element of nature. Our effort, however, is to provide a plausible account for contemporary conservation biologists’ response to *S. nitens* in light of the actual, not merely the possible, associations between humans and acridids that have developed in western societies.

From the concept of a thick sense of beauty, Carlson contends that litter is unsightly not because of any intrinsic property of trash such as its physical appearance but because of what the litter implies about us. It is offensive because its presence means that humans are litter-makers. That is, the expressive qualities of a hamburger container alongside the road include the implication that we are the sort of people who endorse “waste, disregard, carelessness, and exploitation.” Likewise, *S. nitens* is aesthetically displeasing not because of any aspect of the insect (in fact, one might contend that the grasshopper is quite beautiful in some regards) but because its presence on Nihoa expresses our being an arrogant people who care only about ourselves, lack sensitivity to the needs of others, and leave our mark by changing the world however we please. A society that does not clean up its biological trash would be the sort of people one might expect to dam the Grand Canyon, pave Old Faithful, shoot the last condor for sport, serve dolphin for dinner, and crush the weak and vulnerable among our own ranks.

Along with this, one might contend that our concern is, at least in part, driven by a sense of guilt. As such, we pick up trash or extirpate species to undo or correct an earlier wrong and thereby relieve our sense of shame. Such a possibility would point toward a metaethical theory of psychological egoism (Sober 2000) or at least a kind of emotivism (Gensler 1998). Given that Carlson is already

committed to a form of aesthetic subjectivism, it would not seem to be a serious problem if ethical discernment is also based on one’s mental experiences. We would note, however, that such a possibility does not commit us to a degenerate kind of moral relativism.

Carlson also makes the more controversial argument that if we find a place or object aesthetically offensive in a thick sense, then it will be much more difficult to appreciate it in a thin sense. For example, until World War II it seems that people in various cultures found the swastika to be aesthetically pleasing. Its clean lines, sense of movement, and balanced form were appealing. However, with the adoption of this object as a symbol of the Nazis, it took on a thick sense, evoking the horrors of war and genocide. So a psychological contamination of this sort can preclude one’s ability to find something pleasing in a purely sensual manner. In a parallel manner, it seems plausible that conservation biologists’ knowledge of the presence of *S. nitens* on Nihoa—and the thick sense in which the island has come to represent the capacity humans to spoil even remote places of no economic value—means that a thin appreciation of this place is no longer possible. For those who are aware of *S. nitens* (and the grasshopper and its effects are difficult to ignore), Nihoa is a less beautiful place.

From the aesthetic to the moral, ecological and rational

Trash is a statement of who we are. In effect, litter expresses the values and attitudes of those who are responsible for litter. By accepting the presence of garbage in public places, we tacitly condone (even approve of) values and attitudes consistent with waste, disregard, carelessness, and exploitation. And it is here that Carlson makes the turn from aesthetics to ethics.

The human qualities implicit in roadside trash are not morally acceptable to us. We do not approve of behaviors that are wasteful, careless, and exploitative. Likewise, we see little or no virtue in arrogant people who care only about themselves, lack sensitivity to the needs of others, and change the environment however they please—all of which are apparently endorsed by our tolerance for the presence of biological litter (e.g., *S. nitens* on Nihoa). Rather than a utilitarian or deontological (rights/duties based) ethic, conservation biology may be rooted in virtue ethics (Hursthouse 1999; Swanton 2003). As such, it is our moral character rather than our intentions or the consequences of our actions that is to be judged as praiseworthy or blameworthy. To be ethical is to be the sort of person who has learned how to make rational decisions in light of the richness of circumstances and in so doing leads a life that is worthy of imitation and admiration. And littering—whether physical or biological—would not be consistent

with a person who is living a good life. As such, efforts to eliminate *S. nitens* from Nihoa (i.e., to clean up our mess) would be ethically virtuous.

The virtuous person must be, at least for the Greeks, rational as this is an essential and distinguishing quality of being human. So, is the extirpation of the Grey bird grasshopper logically consistent with the other actions (and inactions) of conservation biologists? One can argue that *S. nitens* is aesthetically offensive, particularly in the thick sense of ugliness, in a way that the other non-indigenous species on the island lack. Moreover, a species that could not readily be seen during a hike or a species whose ecological effects could not be seen from a passing ship would not have the same potential for being considered biological litter. A minimum condition of being ugly in the thin sense would be to be visible, and the other alien insects (and most of the non-indigenous plants) are simply not apparent. As such, singling out *S. nitens* for extirpation—a sort of biological litter control campaign—is a logical policy from an aesthetic perspective.

Finally, conservation biologists are often limited in terms of the resources that can be committed to pursuing the protection of a species, habitat, community, or ecosystem. As such, the concept of “triage” is commonly applied as an approach to addressing the multifarious challenges of selecting which species to add or subtract from a locale. Although *S. nitens* is clearly not the easiest or least expensive alien to extirpate from Nihoa, nor is there good evidence that it is the most damaging non-native species on the island, we might frame the decision to target this species for extermination as a form of aesthetic triage. That is, the *S. nitens* could be understood as the organism with the greatest capacity to offend our thick sense of beauty.

All that remains of our original criteria for a justification of conservation biologists’ efforts to eliminate *S. nitens* is ecological plausibility. Our earlier dismissal of naturalness as a foundation of beauty would seem to undermine any appeal to the ecological effects of the grasshopper. By making the move to aesthetics, the justification becomes about us and our virtues rather than about the object or place of concern. However, recall that a thick sense of aesthetics depends on the capacity of something to evoke associated values. The reason that we find *S. nitens* aesthetically offensive is precisely because of what the insect represents in ecological terms. If it did not in any way alter the existing relationships and processes or if it actually enhanced these in some unambiguous way (its effects on the Millerbird being countered in an aesthetic sense by its rather more evident capacity for denuding the vegetation) we would be much less inclined to be put off by its presence. In this regard, its being a locust—a property that seemed culturally interesting but otherwise irrelevant earlier—becomes

germane. A locust is an invasive, dominating, pestiferous, overwhelming creature. Borrowing Carlson’s description of what is implied by litter, we even perceive that these insects represent a sort of biological endorsement of waste, disregard, carelessness, and exploitation.

In summary, the eyesore argument of environmental aesthetics of Carlson seems to have the greatest potential for providing a justification for conservation biologists’ efforts to extirpate *S. nitens* from Nihoa. And perhaps this argument represents the strongest philosophical foundation for our general approach to tolerating or trying to eliminate non-indigenous species. The interpretation of such organisms as biological litter understood in terms of a thick sense aesthetics provides an ethically compelling, ecologically plausible, and logically consistent explanation for our actions.

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