

## Article

*Paradise Lost? Setting the Boundaries around Invasive Species*

# Paradise Lost? Setting the Boundaries around Invasive Species

David R. Clements and Wayne V. Corapi



Photo Courtesy Sabrina Locicero

David R. Clements

*The islands of Hawaii are extremely vulnerable to weed invasions. Should it matter to us that this “paradise on earth” is not as it was before these introductions? Do the original Hawaiian ecosystems possess greater intrinsic value than the new exotic plant communities? How do we deal with difficult issues of managing animals (e.g., wild pigs) for the good of an ecosystem? These questions provide a good test for the ethical system of James Nash which calls for individual and collectivist (ecosystem) values to work in concert. Although, from a collectivist standpoint, the pig must go, its individual rights as a sentient organism must be protected. Invasive species are finding themselves in an increasingly borderless world, and as stewards of creation, human beings need to work on setting the boundaries. Restoration of the integrity of ecosystems parallels a broader restoration of society and brings glory to God.*

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**F**or millennia, humanity has been plagued by weeds. Weeds have competed for water, nutrients, and light from other plants grown for our sustenance, interfered with our ability to move about freely, disrupted our ecosystems, and blighted our landscapes. In 1912, W. S. Blatchley defined a weed as “a plant out of place or growing where it is not wanted.”<sup>1</sup> What is a weed is determined ultimately by a value judgment,<sup>2</sup> most often a negative one. In contrast, Ralph Waldo Emerson saw the more positive side, describing a weed as a “plant whose virtues have not yet been discovered.”<sup>3</sup> Interestingly the Bible portrays weeds in somewhat ambiguous terms. In Gen. 3:17–19, God said to Adam: “Cursed is the ground because of you; in painful toil you will eat of it for the rest of your life. It will produce thorns and thistles for you, and you will eat the plants of the field. By the sweat of your face you will eat your food.”

While it might be argued that weeds therefore are bad, Augustine held that:

We should not jump to the conclusion that it was only then that these plants came forth from the earth. For it could be that, in view of the many advantages found in different kinds of seeds, these plants had a place on earth without afflicting man in any way. But since they were growing in the fields in which man was now laboring in punishment for his sin, it is reasonable to suppose that they became one of the means of punishing him. Now this interpretation does not contradict what is said in the words, “Thorns and thistles shall it bring forth to you” if we understand that earth in producing them before the fall did not do so to afflict man but rather to provide proper nourishment for certain animals, since some animals find soft dry thistles a pleasant and nourishing food.<sup>4</sup>

Thus, according to Augustine, part of the curse of Genesis 3 is not so much the introduction of new species of plants to plague us but rather the presence of a tangible symbol of our altered relationship with all of creation. While this includes our relationship

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**David R. Clements** has a Ph.D. in biology from Queen’s University and is an associate professor of biology and environmental studies at Trinity Western University, Langley, BC. He researches weed ecology in natural and agricultural systems. He has taught a Trinity Western University course on Tropical Botany on the island of Maui, Hawaii every two years since 1997. He is active in the promotion of creation care, and is President of A Rocha Canada – Christians in Conservation. He can be reached at [clements@twu.ca](mailto:clements@twu.ca).

with weeds, it does not necessarily imply that everything about weeds is bad. To ranchers in Australia, *Echium plantagineum* is referred to as Paterson's curse, after the man who allegedly introduced the plant to Australia.<sup>5</sup> However, when biological control against *E. plantagineum* was proposed in 1971, beekeepers rallied against the proposal, calling the plant by its more flattering name—Salvation Jane. One man's curse is another's salvation.<sup>6</sup>

Perhaps part of the temptation to oversimplify our understanding of weeds comes from the rapidity with which many invasive species are now spreading and invading new habitats around the world.<sup>7</sup> As David Quammen sees it, we are now moving toward a "planet of weeds."<sup>8</sup> Although the damage is caused by the weeds themselves, the transport of species by human agency is part of the large scale transformation of the planet by humans as "geographical leviathans."<sup>9</sup>

In February 1999, an executive order was signed by the US President calling for action against invasion of alien biological species in the US. In "war rooms" in the US and elsewhere, scientists and managers are developing strategies against biological invasions. Bruce Babbitt, former US Secretary of the Interior, provided the following rallying cry:

Each year noxious weeds exact an ever-heavier toll: Farmers and ranchers spend more than \$5 billion just for control. Losses to crop and rangeland productivity exceed \$7 billion. Weeds infest 100 million acres in the US, spread at 14 percent per year, and—on public lands—consume 4,600 acres of wildlife habitat per day. They diminish or cause the extinction of native plants and animals, a third of all listed species. They homogenize the diversity of creation. They ignore borders and property lines. No place is immune.

In the past it was, again, much easier for an individual, a state, a federal agency to dismiss this invasion as someone else's problem. And so the weeds—slowly, silently, almost invisibly, but steadily—spread all around us until, literally encircled, we can no longer turn our backs on it. The invasion is now our problem. Our battle. Our enemy ...<sup>10</sup>

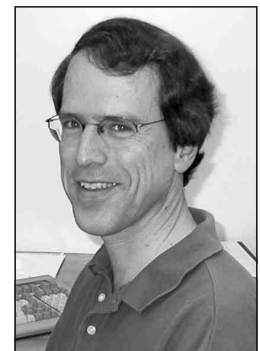
Isolation does not guarantee protection. The Hawaiian Islands have been heavily impacted by alien species. Indeed, most of the flora and fauna visitors are seeing is introduced from elsewhere. Does it matter that this "paradise on earth" is not as it was before this massive alteration of habitat, whether intentional or accidental? Do the original Hawaiian ecosystems possess greater intrinsic value than the new exotic plant communities that are now unfolding? Should attempts be made to restore the former ecosystems? How should communities deal with difficult issues of sacrificing one weed (e.g., a four-legged weed, the wild pig) for the good of an ecosystem? Ecologists have argued that natural ecosystems provide many benefits or "ecosystem services" from clean drinking water and soil to pollination and clean air. Restoration ecology, in fact, has become a multi-billion dollar business.<sup>11</sup>

Because the term "weed" and our concept of "pristine wilderness"<sup>12</sup> are both highly subjective concepts, social values and natural values must be integrated to address the above questions. In this paper, we examine Christian environmental ethics with respect to invasive species. Invasive species are finding themselves in an increasingly borderless world,<sup>13</sup> and as God's stewards of creation, part of the human task is to work on setting the boundaries that will contain them.

## Island Invasion: Stepping over the Boundaries of Paradise

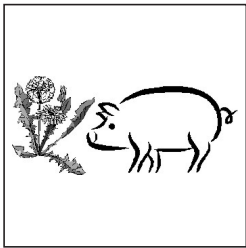
The Hawaiian Islands are the most isolated archipelago in the world.<sup>14</sup> Unique plant and animal communities have been produced there, constituted largely of species found nowhere else in the world, and thus vulnerable to the effects of invasive species. Over the apparent seventy million years of Hawaiian history,<sup>15</sup> the islands have been populated by plant and animals species only following very rare colonization events. This is due to the fact that the vast Pacific

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Wayne V. Corapi

**Wayne V. Corapi** has a Ph.D. in virology from Cornell University, a D.V.M. from Colorado State University and is board certified in veterinary microbiology (virology). He also holds a Th.M. in theology from Regent College. He is associate professor of biology at Trinity Western University and a veterinary pathologist at Central Laboratory for Veterinarians, both in Langley, BC. His research interests include viral diseases of animals and the theological justification for the promotion of animal welfare. He can be reached at [Wayne.Corapi@twu.ca](mailto:Wayne.Corapi@twu.ca).



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Ocean served as an effective boundary to “natural invasions,” prior to the arrival of the Polynesians.<sup>16</sup>

Island ecosystems are the dynamic result of the complex interaction of geology, climate, and biotic colonization forces. What might they have looked like in the years between 200 and 500 AD? As John Culliney writes:

We may imagine a bright day and blue sea, boisterous north wind-tossed spray; one or more big double-hulled canoes with ponderous sails—*Pandanus* leaves woven in huge curving triangles mounted point downward—riding ahead of the easterly swell. After weeks on the empty ocean, the travellers must have been unspeakably awed by the sight of these immense unknown islands. Surely, by such experience is a culture’s sense of destiny confirmed.<sup>17</sup>

The colonizing Polynesians introduced roughly thirty plant species.<sup>18</sup> Compared to over 1,000 native plants, this does not seem like much. Yet when the Europeans first set eyes on the leeward coasts of the islands in 1778, the landscape was dominated by pili grass (*Heteropogon contortus*). The Polynesians had propagated and encouraged pili grass using frequent fires, erasing the complex ecosystem which had existed in leeward areas. Previously a dry forest had existed there containing its own particular complement of mammals, birds, insects, and other life; four remnant stands of this forest type remain.<sup>19</sup> This transformation of the landscape also resulted in widespread climate change, disrupting the hydrologic cycle that allowed trees to grow.

The Polynesians also had brought exotic animals including the pig (*Sus scrofa*). These pigs caused damage by consuming native vegetation, thus favoring the growth of exotic weeds. Recent research has helped to unearth a picture of the large-scale changes caused by the Polynesians. Patrick Kirch and others have developed a concept of “transported landscapes” explaining how the Polynesians colonized various Pacific islands and transformed them according to their way of life and the species that they favored.<sup>20</sup> The Polynesians were not familiar with the native Hawaiian plants or animals,

or their usefulness or management. Should they, because they were non-Europeans, be absolved of blame for their conduct? Several authors think not, suggesting that transforming landscapes is a generic human tendency. It was the island chiefs who exerted much of the power in Hawaiian societies, and this was reflected in extravagant resource extraction. Kirch argues:

The term *civilization* is appropriate for the level of development realized by the prehistoric Hawaiians. To this one could add, with a naturalist’s regret, a crasser manifestation: the sheer magnitude of the transformation of land and destruction of natural ecosystems by the Hawaiians made them the equal of any of their civilized contemporaries.<sup>21</sup>

Beginning with the arrival of the Polynesians, and continuing when Captain Cook “discovered” the islands in 1778, the once virtually impervious boundaries were crossed, as colonizing peoples brought many plants and animals, and the ecosystem was subjected to repeated waves of unprecedented change. The vast majority of species introductions were either well-intentioned or unintentional, but the consequences have been severe. A single seed can quickly turn into a massive invasion. Roughly 10,000 non-native vascular plants are growing in Hawaii, with at least 1,000 now naturalized (reproducing and spreading in the Hawaiian environment), over and against a native complement of 1,131 species.<sup>22</sup> Kim Sykoryak, a former interpreter with Haleakala National Park suggests: “It would be a tragic loss if we allowed Hawaii’s to become just a little more of everywhere else we have been.”<sup>23</sup> It is not a little ironic that so many people who have come to “paradise” have sought to “improve it” by modifying the native flora and fauna.

Since the arrival of Europeans in 1778, thousands of additional plants and animals have invaded the islands and many have become “naturalized.”<sup>24</sup> Meanwhile, the native organisms have been exploited with little regard for the unique processes of the Hawaiian ecosystem.<sup>25</sup> The Europeans brought a larger, more destructive version of the wild pig. The new type of pig has genetically overwhelmed the smaller Polynesian variety.<sup>26</sup> Now all Hawaiian pigs have predominantly European characteristics, reach-

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ing up to five hundred pounds in weight. Extreme levels of habitat destruction seen in the wake of pig activities are partially due to synergistic effects of pigs dining on invasive plant and invertebrate species.<sup>27</sup> This in turn may enhance the propagation of non-native species such as strawberry guava (*Psidium cattleianum*).<sup>28</sup>

Tourism and agriculture have emerged as major sources of invasive organisms. At any given time, tourists make up around 10% of the human population on the islands.<sup>29</sup> The vulnerable island ecosystem has been continually invaded, through deliberate introductions within horticulture, agriculture, or game hunting, or as stowaways unknown to the humans who facilitate their arrival.

Westerners, like the Polynesians in Kirch's theory of transported landscapes, have brought biological components of their homelands with them. Although many of the organisms introduced to Hawaii's are the results of genuine good intentions, flagrant disregard for the value of the Hawaiian habitat is also apparent in some cases. Recently a reptile trader deliberately imported several species of reptiles and released them in the wild in order to grow and reproduce, so that children could later capture them for

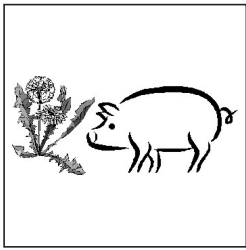
a nominal price. The habitat for this entrepreneur was just seen as a means to support a lucrative business.<sup>30</sup> Whether or not introductions are well-intentioned, it is clear that if a higher value was placed on the integrity of the affected ecosystems, greater efforts would be expended to protect Hawaii's from invasions.<sup>31</sup>

## Valuing the Integrity of Creation and the Creatures Within

The word integrity is derived from the Latin *integritas* meaning "untouched" or "entire." Thus, integrity is defined as "an unimpaired or unmarred condition; an entire correspondence with an original condition."<sup>32</sup> To integrate is to "make complete" or whole. Integrity has emerged as a normative term for describing an indicator of the health of ecosystems.<sup>33</sup> Laura Westra has developed the concept of integrity of ecosystems to include the capacity for an ecosystem to retain its specific functions as well as its components (parts and processes).<sup>34</sup> To practice ecological integrity is to integrate environment, conservation, and health.<sup>35</sup> Therefore, conserving original ecosystems should be considered a normative activity.



Kepa Ineole of the Nature Conservancy next to the sign for the Waikamoi Preserve in the Maui rainforest. Although snaring has been used at this site in the past, the relatively low population of wild pigs remaining is controlled by local hunters hired by the Nature Conservancy. *Photo courtesy Darcy Kehler.*



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James Nash ... explores the apparent dichotomy between valuing an individual and valuing the ecosystem in which it is embedded. At one pole, humanity must affirm the rights of individual lives, ... At the other pole, Nash places the need for holism, for concern about "collective connections."

Steven Bouma-Prediger further defines such actions as a series of ecological virtues.<sup>36</sup> We are to cultivate respect for the integrity of creation and receptivity to human interdependence with the rest of creation. Drawing from Gen. 1:31, Ps. 104, and Ps. 148, Bouma-Prediger reflects:

Individual creatures and the earth as a whole have an integrity as created by God and as such have more than merely instrumental value. Creatures exist to praise God and are valuable irrespective of human utility. From this theological theme comes the ethical principle of intrinsic value. Because species have intrinsic value, they have moral standing. All species, like humanity, count morally.<sup>37</sup>

But this valuing of other species does not trump all other values. We are, he says, "to preserve nonhuman species except when other moral considerations outweigh or overrule this duty." Although his emphasis here is on the integrity of individual creatures, we are also obligated to think of communities and preserve habitats "since such species cannot exist without their homes ..."<sup>38</sup> From this he derives the moral maxim: "Act so as to preserve diverse kinds of life."<sup>39</sup>

James Nash also explores the apparent dichotomy between valuing an individual and valuing the ecosystem in which it is embedded.<sup>40</sup> At one pole, humanity must affirm the rights of individual lives, not just aggregates of individual organisms. However, the entire hierarchy is connected from individual, to population, to species, to community, and to ecosystem. Although it is more important to preserve a population than an individual, a sufficient respect is required for each individual organism in order to reach the goal of preservation of populations. At the other pole, Nash places the need for holism, for concern about "collective connections." Nash says:

There is no doubt that systemic wholes, composed of diverse biotic and abiotic elements in interaction, are indispensable instruments—systemic values—for the ends of all rights-bearers.<sup>41</sup>

He points out that a relationship that is unhealthy for an individual (predator-prey relationships, for example) may be useful to the whole.

Aldo Leopold's land ethic reads: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."<sup>42</sup>

Nash warns that individualistic and more holistic rights must be seen in concert rather than in opposition. He writes:

The individualistic and collectivistic poles—a rights ethic and a land ethic—must be held in tandem, for ultimately they are not two competing ethics, but complementary sides of one ecological ethic.<sup>43</sup>

This conflict between individualistic and collectivistic ethics is apparent in the issue of the wild pig (*Sus scrofa*) in Hawaii's. The snout of the pig has been a powerful force in breaking up the integrity of the Hawaiian native ecosystem. It fits the expanded definition of a weed as "an [organism] growing where it is not wanted." The wild pig is essentially a four-legged weed.<sup>44</sup> Yet it also stands as one of the things held by some individuals to be quintessentially Hawaiian.

There are only two mammals native to Hawaii,<sup>45</sup> and thus Hawaiian ecosystems were not well-equipped to deal with pigs, which are sometimes described as "animal bulldozers." Wild pigs produce a three-fold impact on the landscape: (1) they promote invasive alien plants by disturbing the ground cover and dispersing seeds; (2) they consume seeds and seedlings of native plants; and (3) they create pools for mosquitoes to breed, spreading avian malaria (*Plasmodium relictum*) to native birds. From a distance, Maui's majestic V-shaped Iao Valley looks to be a rich, dense "natural" subtropical forest, but it is almost entirely composed of strawberry guava promoted by pigs. Parts of Maui at higher altitudes are somewhat insulated from this kind of attack, but virtually no place in these islands is immune.

Two Park Service rangers made the first systematic investigation of the Kipahulu Valley on Maui in 1945. They found that the valley was free of both pig signs and alien plants, and described the valley as an ideal example of untouched "virgin wilderness." They strongly recommended that it be protected.<sup>46</sup> Very few people ventured into the

valley over the next twenty-two years, but when a Nature Conservancy scientific expedition conducted a month-long investigation in 1967, it was discovered that incursions of wild pigs had occurred both at the upper and lower elevations of the valley, leaving only the central part of the valley relatively unaffected. By 1976, pigs were clearly moving strawberry guava into much of the valley. It was not until 1982 that managers obtained funding from Congress to begin removing pigs, and by 1989 all pigs were removed by a combination of snaring and fencing. The valley was divided into two management units. The upper unit "once again enjoys almost pure native cover,"<sup>47</sup> but the lower unit is still plagued by alien species because the pigs had been resident long enough to remove so much of the native vegetation that there was little native vegetation to regenerate and compete with alien forms.

At the same time that pigs were being snared in Kipahulu, efforts were being made to manage wild pig populations throughout Hawaii. The rights of the pig did not go unnoticed. Many hunters felt the complete eradication of pigs in particular areas was unwarranted and unfair.<sup>48</sup> In some cases, cooperation has been fostered between pro-hunting groups and game managers.<sup>49</sup> However, Michael Buck, director of the State Division of Forestry and Wildlife admits that the number of game animals will continue to be thinned, to the hunters' chagrin.<sup>50</sup>

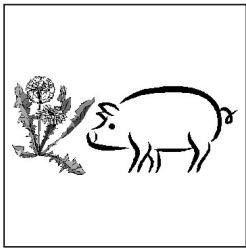
A tract distributed by People for the Ethical Treatment of Animals (PETA) in 1993 contained the following argument: "The Nature Conservancy and others should stop efforts to snare pigs, even if the last vestiges of native forests are destroyed, because Hawaii is not natural anymore, due to introduction of numerous non-native species by Polynesians and European colonists."<sup>51</sup>

Michael Soulé comments that "by claiming that Hawaii is not part of nature anymore, PETA feels justified in giving greater ethical weight to the suffering of individual mammals than to the survival of entire, endemic species."<sup>52</sup> Although Nash advocates seeing the individual and collective poles as different sides of the same ethic, it is difficult to see how the rights of the wild pig can be reconciled with those of an ecosystem largely comprised of endemic species,<sup>53</sup> with plants and birds intertwined by ecological processes that comprise an integrated, interdependent whole, only in the complete absence of the wild pig.<sup>54</sup>

How should the rights of different members or parts of creation be prioritized, whether collective or individual? In many instances, we should refuse to prioritize at all, recognizing with Nash that all is connected—the individualistic and collective aspects are inextricably linked. The spotted owl that was pitted against forestry jobs in the Pacific Northwest is really a representative of the entire



David Clements and student Tara Tosh examining a native *Sadleria* fern on west Maui. Photo courtesy Darcy Kehler.



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old growth forest. John Muir said that “when we try to pick out anything by itself, we find it hitched to everything else in the universe.”<sup>55</sup>

Holmes Rolston III makes a distinction between *intrinsic value* and *instrumental value*.<sup>56</sup> Intrinsic value is what makes an organism good, in and of itself. In Genesis 1, all of creation is called good, independent of its value to humans or other organisms.<sup>57</sup> Yet instrumental value is also evident in the creation account when seed-bearing plants and fruits are singled out as food for both humans and animals:

I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food. And to all the beasts of the earth and all the birds of the air and all the creatures that move on the ground—everything that has the breath of life in it—I give every green plant for food. And it was so (Gen. 1:29–30).

Rolston enlarges on subtle distinctions among values placed on different types of organisms, coming up with “rough” distinctions. Looking across various trophic levels, Rolston says:

Flora and insentient fauna (grass, amoebas) individually have more, yet still weak, intrinsic value [compared to nonbiotic things like rocks] as compared to their crucial instrumental value collectively in the communities in which they are incorporated.<sup>58</sup>

Thus Rolston’s ethical system requires that a sentience must be carefully accounted for in terms of intrinsic value.<sup>59</sup>

Snares used in Hawaii are wire nooses placed in areas that are likely to be frequented by pigs. The snares have one-way steel cable mechanisms allowing them to tighten once an animal is caught. They are designed to capture animals by the neck and affect an immediate kill through strangulation, but death does not always come quickly. Animals not positioned correctly in the snare die a slower, more painful death as a result of starvation, dehydration, or bleeding. The Nature Conservancy and other management agencies have argued that “snaring used in combination with fences, is by far the best method in the long run, from

standpoints of both ecosystem protection and animal suffering.”<sup>60</sup> The argument is that less killing results from snaring than hunting, and thus less cruelty.<sup>61</sup> Still, to argue that snaring is quick and painless is a denial of the obvious; even if the snare is positioned correctly, the resulting death is slower than hanging, and suffering may be exceptionally cruel in some cases. Eye-witness accounts have inspired the case against snaring:

A hunter on the island of Molakai Hawaii came upon a pregnant pig caught in a snare trap, still alive. Maggots filled her open, bleeding neck, where the wire noose had eaten through to her trachea. She was totally dehydrated ... The torn-up ground around her told of her frantic thrashing that had only tightened the noose further. She looked up at the hunter, too weak to move. He fired a merciful bullet into her, and in her death throes she aborted the babies she was carrying. She was one more victim of The Nature Conservancy’s monstrous program to annihilate the free-roaming pigs of Hawaii, pigs brought here by the Polynesians 1,500 years ago.<sup>62</sup>

This PETA report is intentionally nuanced to elicit empathy and pity, and it mistakenly incorporates the fallacy that the pigs are strictly descended from the Polynesian variety. Nevertheless, it rightfully leaves the reader with the unsettling feeling that while the current policies for reduction of the pig population in Hawaii may be effective, they are woefully inadequate.

It is clear that *all* creatures are to be under our care.<sup>63</sup> The pig is simply living out its pigness wherever it finds itself. To protect the integrity of the Hawaiian ecosystem, we should remove the pig that we ourselves placed there.<sup>64</sup> The pig has no instrumental value to organisms other than humans in this habitat, and severely impacts the instrumental and intrinsic value of the ecosystem. However, we are still obliged to respect its intrinsic value. Those involved in snaring do recognize this. Alan Holt, Deputy Director of the Nature Conservancy in Hawaii, maintains: “We only use snares when no other combination of techniques will do the job.”<sup>65</sup>

Robert Devine writes that the Nature Conservancy “is just as passionate about protect-

ing the planet's ecological well-being as PETA is about protecting animals from pain and suffering."<sup>66</sup> What is really needed is a marshaling of resources to serve both poles of the continuum of value articulated by Nash, from individual organism to ecosystem. Infrequent monitoring of snares has been defended partly by the lack of sufficient resources. A 1997 article reported:

Animal rights advocates contend that snares should be checked daily to prevent the drawn out deaths of animals only wounded by the snares. Given the acreage of the refuge's fenced areas alone, and its small staff of 13 (only four of whom are directly responsible for feral ungulate control), daily checking of snares is impractical. From the point of view of refuge staff, snares need only be checked every few weeks to ensure proper functioning.<sup>67</sup>

Passion for the well-being of creation should arouse more than a utilitarian ethic. From a biblical perspective, humans have a priestly role, and we are called to intercede on behalf of creation, seeking to restore proper relationships. This priestly role requires a sacrificial spirit that may impact our time and financial resources. While many will be inspired to offer their help to save a beached whale, the elimination of pigs to save an ecosystem may seem like a less noble and perhaps more ambiguous cause, even though it need not be.

Although in this case study we have advocated the removal of the pig as a harmful invader, the case is not so clear for other "weed" species. It would be impractical and unwise to state that *any* organism transported by humans should be removed, because in many cases removal is nearly impossible and in many cases ecosystem integrity is maintained despite the presence of invasive species.<sup>68</sup> Aside from the particular issue of the pig, there is still a question of "What is natural?" as Soulé pointed out in response to the statement by PETA. Why not have mammals in the ecosystem, especially now that it is so disrupted? Rolston suggests that the introduction of terrestrial mammals to an island chain formerly bereft of them would be consistent with a value system that sees the greatest value in the "higher animals."<sup>69</sup> As human beings we have a strong affinity with creatures most similar to us, and it is not surprising, therefore, that mammalian introductions are made. Just because "we respect the genius of life, ecosystemic integrity and beauty, and so on ... there is no reason to think that all the accidental outcomes of nature are significant or valuable."<sup>70</sup> So why not introduce the higher animals, like mongooses or wild pigs? Why not let domestic cats roam free? Rolston argues that because birds developed dispersal abilities, then the colonization of Hawaii should not be regarded as mere contingency. We would honor the adaptations of birds by letting "Hawaii be an especially remote test of oceanic mobility."<sup>71</sup> However, the Hawaiian ecosystem has become so far removed from its 70-million-year biotic history by the

intense perturbations suffered in the last several centuries, that there is some question as to whether the native ecosystems are worth saving. Yet restoration is one of the key themes of Christian earthkeeping and it needs to remain a major consideration.<sup>72</sup>

## Restoration of Hawaiian Ecosystems—for God's Glory

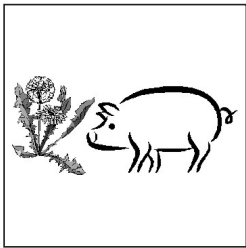
Is there any hope of returning to some "natural state?" The tract distributed by PETA bases its argument against the snaring of pigs on the claim that "Hawaii is not natural anymore."<sup>73</sup> Indeed, what is "natural" has become a serious question recently as social scientists have attempted to unearth our social constructions of nature. For William Cronon, the central paradox is that "wilderness embodies a dualistic vision in which the human is entirely outside the natural."<sup>74</sup> The difficulty with this view is that the concept of "nature" outside the influence of humans is a largely untenable and over-romanticized notion, because human influence is all-pervasive in creation. On the other hand, the basic axiom that "nothing is really natural" is overly simplistic and tends to ignore the fact that there are *relatively* pristine areas still remaining. For example, in the Waikamoi Preserve in Maui, the original set of endemic species unique to Hawaii's is more or less intact but very vulnerable, even to human trampling. It is an ecological virtue, as outlined by Bouma-Prediger, to *respect* this integrity. If we were to disregard the relative wholeness of this system, we would not be cultivating respect, but rather conceit, which is "ignorance and disdain for other creatures," and conceited individuals will "if necessary violate the integrity of the other—human or nonhuman—to serve their self-centered interests."<sup>75</sup>

After analyzing the current campaign against invasive species Jason and Roy Van Driesche wrote:

*Ua mau ke ea o ka aina i ka pono.* "The life of the land is perpetuated in righteousness." This is the Hawaii's state motto, but for the growing number of people who are fighting to protect the things that make Hawaii's unique, it means something more. This phrase implies a duty to protect the *aina*—the land—as the foundation of everything that is Hawaii's. Public awareness campaigns are fundamentally about bringing the state motto to life, for when these words move off the state seal and into the way people live, Hawaii's will have remade itself as a place once again native.<sup>76</sup>

In 1997, biologist Art Medeiros started planting trees to bring back the lost dry forest. A ten-acre enclosure was set up on a cattle ranch on the leeward side of Maui in an area known as Auwahi.<sup>77</sup> As well as excluding livestock and feral animals with the fence, the researchers killed invasive kikuyu grass with herbicides. Numerous native tree species now grow there. Perhaps the most spectacular





## Article

### *Paradise Lost? Setting the Boundaries around Invasive Species*

rescue is the successful propagation of the mahoe (*Alectryon macrococcus*). Predation of their fruits by rats had decreased the population of known trees to only a dozen, and only a single plant was left that was able to produce viable seeds. If God speaks to human beings through creation (Rom. 1:20), then "losing a species is metaphorically like tearing a page out of scripture."<sup>78</sup> In the Auwahi project, the simple act of planting trees is preventing that from happening.

The restoration of the Auwahi is bringing together various pieces of creation that were nearly lost and put in the dubious category of "remnant." The calling of those remnants back to fullness parallels Israel's own restoration and is a powerful metaphor for the creative and redemptive work of God throughout all of human history. The appropriate response, from human beings and the creation alike, can only be one of joy and thanksgiving. That kind of exuberant joy might even be projected onto the restored forest at Auwahi.

Sing for joy, O heavens,  
for the LORD has done this;  
Shout aloud, O earth beneath.  
Burst into song, you mountains,  
You forests and all your trees,  
For the LORD has redeemed Jacob,  
He displays his glory in Israel  
(Isaiah 44:23).

Should human beings be involved in restoring ecosystems and freeing them from the presence of harmful weeds and invasive species? The imagery of a future time of unparalleled joy and peace hints at the worthiness of such endeavors.

You will go out in joy and be led forth in peace ... and all the trees of the field will clap their hands. Instead of the thornbush will grow the pine tree, and instead of briars the myrtle will grow. This will be for the LORD's renown, for an everlasting sign ... (Isaiah 55:12-13).

Where landscapes have been ruined by abusive land use practices, the presence of thorn bushes and briars often provides a stark indicator of its degraded condition.<sup>79</sup> The end result of restoration, however, is a display of God's glory, whether its object is a people held in captivity or vegetation like the o'hi'a tree (*Metrosideros polymorpha*)<sup>80</sup> held captive to the onslaught of invasive species. ♦

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## Notes

<sup>1</sup>Blatchley as quoted in Robert Zimdahl, *Fundamentals of Weed Science* (San Diego, CA: Academic Press, 1999), 15.

<sup>2</sup>There are certain intrinsic biological particularities that are applied to weeds or invasive species, to aid in their classification as such. For example, H. G. Baker developed a list of weedy characteristics, such as high reproductive rate or high capacity for dispersal, but some plants may still be weeds with few or none of Baker's characteristics, so ultimately it is a matter of some aspect that is undesirable from a human standpoint (H. G. Baker, "Characteristics and Modes of Origin of Weeds," in *The Genetics of Colonizing Species*, ed. H. G. Baker and G. L. Stebbins [New York: Academic Press, 1965], 147-68).

<sup>3</sup>Zimdahl, *Fundamentals of Weed Science*, 15.

<sup>4</sup>St. Augustine, *The Literal Meaning of Genesis* 1, translated and annotated by John Hammond Taylor, S.J., 2 vols. (New York: Newman Press, 1982), 94.

<sup>5</sup>L. Briggs, "Echium; Curse or Salvation?" in *Pests and Parasites as Migrants*, ed. A. J. Gibbs and Meischke (Cambridge, UK: Cambridge University Press, 1985), 152-9.

<sup>6</sup>Biological control agents were eventually released in Australia (see [www.ento.csiro.au/redistribution/Pages/patersonscurse.html](http://www.ento.csiro.au/redistribution/Pages/patersonscurse.html)), but not without extensive consultations and an overhaul of the procedures for dealing with such issues, in recognition of potentially divergent views on weeds (Briggs "Echium; Curse or Salvation?").

<sup>7</sup>D. M. Richardson, P. Pyšek, M. Rejmánek, M. G. Barbour, F. D. Panetta, and C. J. West, "Naturalization and Invasion of Alien Plants: Concepts and Definitions," *Diversity and Distributions* 6 (2000): 93-107.

<sup>8</sup>David Quammen, *The Song of the Dodo* (New York: Scribner, 1996).

<sup>9</sup>Robert David Sack, *Homo Geographicus: A Framework for Action, Awareness, and Moral Concern* (Baltimore, MD: The Johns Hopkins University Press, 1997), 1.

<sup>10</sup>Quote from an address made to the "Science in Wildland Weed Management" Symposium, Denver, CO (April 8, 1998).

<sup>11</sup>M. Palmer, E. Bernhardt, E. Chornesky, S. Collins, A. Dobson, C. Duke, B. Gold, R. Jacobson, S. Kingsland, R. Kranz, M. Mappin, M. L. Martinez, F. Micheli, J. Morse, M. Pace, M. Pascual, S. Palumbi, O. J. Reichman, A. Simons, A. Townsend, and M. Turner, "Ecology for a Crowded Planet," *Science* 304 (28 May 2004): 1251-2.

<sup>12</sup>The theme of our social construction of concepts like "pristine wilderness" is explored in an influential recent book: William Cronon, ed., *Uncommon*

The end  
result of  
restoration ...  
is a display of  
God's glory,  
whether  
its object is  
a people held  
in captivity or  
vegetation  
like the o'hi'a  
tree ... held  
captive to the  
onslaught of  
invasive  
species.

*Ground: Toward Reinventing Nature* (New York: W. W. Norton, 1995).

<sup>13</sup>Chris Bright, *Life Out of Bounds: Bioinvasion in a Borderless World* (New York: W. W. Norton, 1998).

<sup>14</sup>Hawaii's is approximately 2,500 miles from land in any direction.

<sup>15</sup>The Hawaiian Islands provide an "almost perfect chronosequence" whereby a hotspot has existed in a particular location below the earth's crust that has produced the volcanic activity that has produced the Hawaiian Islands in a chronosequence as the tectonic plates have moved over the hotspot. The stationarity of the hotspot has been demonstrated by comparison to other island chains formed similarly such as the Marquesas and Society Islands. The Emperor Seamounts are over 70 to 80 million years old at the northwestern end of the chain, whereas the oldest existing island is Kauai estimated to be 5.1 million years old, and the youngest is Hawaii's (the big island) at less than one million years old (potassium-argon dating). The hotspot currently exists to the southeast of Hawaii's where a new island is anticipated. Information from D. Mueller-Dombois and F. R. Fosberg, *Vegetation of the Tropical Pacific Islands* (New York: Springer-Verlag, 1998).

<sup>16</sup>J. L. Culliney, *Islands in a Far Sea: Nature and Man in Hawaii* (San Francisco, CA: Sierra Club Books, 1988), 32. Scientists have analyzed the theoretical natural colonization of the Hawaiian Islands systematically, incorporating a wide range of factors including seed morphology, the anatomy and physiology of birds that must have been the major seed dispersers, prevailing winds and currents, and potential ancestors from the mainland or other islands. Dr. F. R. Fosberg hypothesized that the 1,000 or so native species could be derived from as few as 272 original plants (F. R. Fosberg, "Derivation of the Flora of the Hawaiian Islands," *Insects of Hawaii* 1 [1948]: 107-19).

Given the age of the present islands of five million years and the beginning of island formation 70 million years ago, a single new colonist would only have to become established at an interval somewhere between 5,000 and 70,000 years (Jason Van Driesche and Roy Van Driesche, *Nature Out of Place: Biological Invasions in the Global Age* [Washington, DC: Island Press, 2000], 46). Thus, the extremely unlikely combination of a seed both arriving from across the great ocean gulf and successfully surviving to reproduce on Hawaii was only required to happen 272 times. The diversity of plants beyond 272 is then assumed to have unfolded via adaptive radiation from the progenitor species.

For example, Gerald Carr and Donald Kyhos hypothesize that the twenty-eight species in the silversword alliance arose from a single seed that arrived on the islands less than ten million years ago (Gerald Carr and Donald Kyhos, "Adaptive Radiation in the Hawaiian Silversword Alliance: Compositae: Madiinae. I. Cytogenetics of Spontaneous Hybrids," *Evolution* 35 [1981]: 543-56). This well-known group of Hawaiian plants consists entirely of endemic species—i.e., species found in Hawaii but nowhere else in the world. The ancestry of these plants is linked to the California tarweeds, relatively small and unassuming plants, especially by comparison to some of the Hawaiian forms. For example, the Haleakala silversword produces a brilliant silver rosette that grows for a number of years before a tall flowering stalk up to 2.5 m high is produced. The unusual morphology and physiology of the silversword, in dramatic contrast to the ancestral tarweed, represent adaptations to the extremes of temperature, exposure to high levels of ultra violet radiation and lack of moisture in the Haleakala Crater on Maui. The rate of endemism among native flowering plants in Hawaii is over 90%, a rate virtually unmatched anywhere else in the world. All of this is to say that because of the long-standing oceanic boundaries surrounding the Hawaiian Islands, the process of natural colonization took a very long time, and involved evolutionary processes unique to the islands, producing a flora designed expressly for these islands alone.

<sup>17</sup>Culliney, *Islands in a Far Sea*, 32

<sup>18</sup>S. H. Sohmer and R. Gustafson, *Plants and Flowers of Hawaii* (Honolulu, HI: University of Hawaii Press, 1987), 16.

<sup>19</sup>D. Mueller-Dombois and F. R. Fosberg, *Vegetation of the Tropical Pacific Islands* (New York: Springer-Verlag, 1998), 486-91.

<sup>20</sup>Patrick Kirch, "Transported Landscapes," *Natural History* 91, no. 12 (1982): 22-5.

<sup>21</sup>Culliney, *Islands in a Far Sea*, 324.

<sup>22</sup>Jason Van Driesche and Roy Van Driesche, *Nature Out of Place: Biological Invasions in the Global Age* (Washington, DC: Island Press, 2000), 33.

<sup>23</sup>Kim Sykoryak, "Priorities in Paradise: The Value of Conservation Education in Hawaii," in *Conservation Biology in Hawaii*, ed. C. P. Stone and D. B. Stone (Honolulu, HI: Cooperative National Park Resources Studies Unit, University of Hawaii, 1989), 227.

<sup>24</sup>Although the term "naturalized" may have a positive ring to it, as mentioned previously, a naturalized species is one that is reproducing and spreading in the new environment. If the species has recently become naturalized, eradication or containment may well be possible, but there comes a point when this may well be impossible (e.g., the starling, *Sturnus vulgaris*, one of the most abundant birds in continental North America, was introduced from Europe).

<sup>25</sup>Ecosystem function of much of the Hawaiian islands, especially at low elevations, had already been modified from its pre-Polynesian state by the Polynesians.

<sup>26</sup>P. Q. Tomich, *Mammals in Hawaii*, 2d ed. (Honolulu, HI: Bishop Museum Press, 1986).

<sup>27</sup>L. W. Cuddihy and C. P. Stone, *Alteration of Native Hawaiian Vegetation: Effects of Humans, Their Activities and Introduction* (Honolulu, HI: Cooperative National Park Resources Studies Unit, University of Hawaii, 1990), 64-5.

<sup>28</sup>L. F. Huenneke and P. M. Vitousek, "Seedling and Clonal Recruitment of the Invasive Tree *Psidium cattleianum*: Implications for Management of Native Hawaiian Forests," *Biological Conservation* 53 (1990): 199-211.

<sup>29</sup>J. Morgan, "Tourism," in "Hawaiian Conservation Values and Practices," in *Conservation Biology in Hawaii*, ed. C. P. Stone and D. P. Stone (Honolulu, HI: Cooperative National Park Resources Studies Unit, University of Hawaii, Manoa, 1989), 146-53.

<sup>30</sup>Fern Duvall, Hawaiian State Wildlife Biologist, personal communication, May 2003.

<sup>31</sup>The evaluation of ecosystem integrity is complicated by many factors, and in terms of the Hawaiian ecosystem these factors include historical impacts of a relatively long history of invasive species impacts (i.e., since Captain Cook's time and before). However, it is clear that at least certain invading species disrupt a community on a devastating scale. One good Hawaiian example is the weed miconia (*Miconia calvescens*) which quickly became a major target for control in Hawaii because of its history, such as the fact that it came to occupy more than 70% of the forested land in Tahiti after invading there. Rita Beamish, "Hawaii on Front Line to Fight Invasive Species," *Honolulu Star-Bulletin*, Aug. 25, 2002, <http://starbulletin.com/2002/08/25/news/story9.html>.

<sup>32</sup>Philip Babcock Gove, ed., *Webster's Third New International Dictionary of the English Language Unabridged* (Springfield, MS: Merriam-Webster, 1986).

<sup>33</sup>Bryan Norton, "Improving Ecological Communication: The Role of Ecologists in Environmental Policy Formation," *Ecological Applications* 8 (1998): 350-64.

<sup>34</sup>Laura Westra, *An Environmental Proposal for Ethics: The Principle of Integrity* (Lanham, MD: Rowman Littlefield, 1994).

<sup>35</sup>David Pimentel, Laura Westra, and Reed F. Noss, *Ecological Integrity: Integrating Environment, Conservation, and Health* (Washington, DC: Island Press, 2000).

<sup>36</sup>Steven Bouma-Prediger, *For the Beauty of the Earth: A Christian Vision for Creation Care* (Grand Rapids, MI: Baker, 2001), 137-60.

<sup>37</sup>*Ibid.*, 142.

<sup>38</sup>*Ibid.*, 142.

<sup>39</sup>*Ibid.*, 142.

<sup>40</sup>James Nash, *Loving Nature: Ecological Integrity and Christian Responsibility* (Nashville, TN: Abingdon, 1991), 179-85.

<sup>41</sup>*Ibid.*, 183-4.

# Article

## Paradise Lost? Setting the Boundaries around Invasive Species

<sup>42</sup>Aldo Leopold, *A Sand County Almanac* (New York: Ballantine, 1970), 262.

<sup>43</sup>Nash, *Loving Nature*, 185.

<sup>44</sup>A pig has many similar effects on ecosystem integrity as the plant weeds it helps to spread. Mark Winston in *Nature Wars: People vs. Pests* (Cambridge, MA: Harvard University Press, 1997) likewise employs a very broad definition of “weed” including many four-legged pests such as raccoons. He writes:

We usually think of weeds as plants, but if we extend the concept to mean any potentially problematic organism that is found out of its natural place, then nature in the city is full of weeds, from dandelions to coyotes, plantain to rats, clover to geese. A deer, coyote, or dandelion in a country meadow is not a weed, but in the city these and many other organisms become problems, and we have had to maintain an extensive infrastructure of urban pest control to deal with them (p. 59).

<sup>45</sup>One is a species of bat, and another is a species of seal.

<sup>46</sup>An account of the recent history of pig impacts on the valley is found in Van Driesche and Van Driesche, *Nature Out of Place*, 11–5.

<sup>47</sup>*Ibid.*, 14.

<sup>48</sup>J. Conrow, “Saving the Aina: Landowners Want to Control Wild Animals and Hunters Want Enough Game,” *Honolulu Star-Bulletin News*, April 25, 1996.

<sup>49</sup>On the Big Island, a Natural Area Working Group has been fostering co-operation among groups including the Sierra Club and the Pig Hunters of Hawaii. Common interests include protecting public access, supporting local customs and traditional practices, improving the efficiency of state game managers, controlling logging and halting the expansion of grazing leases. Likewise, Oahu has avoided conflict by cooperating with the hunting lobby. When there is a need to reduce goats or pigs, hunters are willing to come in and help. See J. Conrow and J. Witty, “Negotiation Enters in the Land Picture: The Conservationists and Hunters Do Not Regard Each Other as Fair Game Anymore,” *Honolulu Star-Bulletin News*, April 25, 1996.

<sup>50</sup>Conrow “Saving the Aina.”

<sup>51</sup>Michael Soulé, “The Social Siege of Nature,” in *Reinventing Nature: Responses to Postmodern Destruction* (Washington, DC: Island Press, 1995), 156.

<sup>52</sup>*Ibid.*, 156.

<sup>53</sup>Endemic meaning that these species are unique to the geographic area, and presumably have co-evolved over a relatively long period.

<sup>54</sup>The question that remains unanswered, however, is whether those who support the work of PETA would be satisfied with an alternative method for the reduction of wild pigs that not only preserves the delicate ecosystems of Hawaii, whether indigenous or not, but also minimizes the degree of suffering inflicted on the pigs.

<sup>55</sup>John Muir, *My First Summer in the Sierra* (San Francisco, CA: Sierra Club, 1988), 110.

<sup>56</sup>Holmes Rolston III, *Environmental Ethics: Duties to and Values in the Natural World* (Philadelphia, PA: Temple University Press, 1988), 192–245.

<sup>57</sup>The term “biophilia” coined by biologist E. O. Wilson to recognize the “innately emotional affiliation of human being to other living organisms” is helpful (Edward O. Wilson, *Biophilia* [Cambridge: Harvard University Press, 1984], 1), but on the other hand, it may lead to an inordinate emphasis on our “preferred forms of nature” (John R. Wood, “Biophilia and the Gospel: Loving Nature or Worshipping God?” in *Living in the LambLight: Christianity and Contemporary Challenges to the Gospel*, ed. H. Boersma [Vancouver: Regent College Publishing, 2001], 153) and God’s pronouncement of goodness should extend to all forms of nature, even obscure plants in the Hawaiian rainforest that we may not know or care about prior to developing an ecological understanding of the system.

<sup>58</sup>Rolston, *Environmental Ethics*, 223.

<sup>59</sup>Robert N. Wennberg in *God, Humans and Animals: An Invitation to Enlarge Our Moral Universe* (Grand Rapids, MI: Eerdmans, 2003), argues that because of the special moral status humankind is given

within God’s creation, this calls for a “serious, even revolutionary, moral concern for animals” (p. 222).

<sup>60</sup>Excerpt from a letter to state legislators from an East Maui partnership of the Nature Conservancy, East Maui Irrigation Co., the National Park Service, and the State Department of Land and Natural Resources, August 27, 1999.

<sup>61</sup>In one unit of the Nature Reserve Area in Hakalau, the pig population was reduced by 90% in eighteen months, with 120 pigs killed in the process. In another unit, it took nine years of hunting with dogs to reduce the population by 90%. This time over 1,000 pigs had to be killed because greater survival meant greater reproduction over time. See *Environment Hawai‘i* 8, no. 4 (October 1997), <http://64.75.176.15/environment/1199snaring.htm>.

<sup>62</sup>Excerpt from *PETA News* 8, no. 2.

<sup>63</sup>For example, Gen. 2:15, gives an all encompassing injunction to care for the garden.

<sup>64</sup>Biblically, humans are given permission to kill animals (e.g., “The fear and dread of you will fall upon all the beasts of the earth and all the birds of the air, upon every creature that moves along the ground, and upon all the fish of the sea; they are given into your hands” [Gen. 9:2]), but this permission is not without restriction. The inherent power of animal sacrifices practiced in biblical times was derived from the sacredness of life, e.g., Gen. 9:4 refers to the fact that the life is in the blood of an animal.

<sup>65</sup>Quoted in Jan TenBruggencate, “Nature Conservancy Ripped Over Traps,” *The Honolulu Advertiser*, April 17, 1996.

<sup>66</sup>Robert Devine, *Alien Invasion: America’s Battle with Non-Native Animals and Plants* (Washington, DC: National Geographic Society, 1998).

<sup>67</sup>Anonymous, “Snares: Effective but Controversial” *Environment Hawai‘i* 8, no. 4 (October 1997) [www.environment-hawaii/1097snares.htm](http://www.environment-hawaii/1097snares.htm).

<sup>68</sup>In many jurisdictions, weed species are prioritized for control or monitoring based on various measures of relative impact. An example of this kind of prioritization for the Hawaiian islands can be seen at the HEAR (Hawaiian Ecosystems at Risk Project) website: [www.hear.org/wra/index.html](http://www.hear.org/wra/index.html).

<sup>69</sup>Holmes Rolston III, *Conserving Natural Values* (New York: Columbia University Press, 1994), 117.

<sup>70</sup>*Ibid.*, 117.

<sup>71</sup>*Ibid.*, 117.

<sup>72</sup>In *Caring for Creation: Responsible Stewardship of God’s Handiwork* (Grand Rapids, MI: Baker, 1998), Calvin DeWitt refers to Jesus Christ as “Creator, Integrator and Reconciler” (p. 16).

<sup>73</sup>Michael Soulé, “The Social Siege of Nature” in *Reinventing Nature: Responses to Postmodern Deconstruction* (Washington, DC: Island Press, 1995), 156.

<sup>74</sup>William Cronon, “The Trouble with Wilderness,” in *Uncommon Ground: Toward Reinventing Nature*, ed. William Cronon (New York: W. W. Norton, 1995), 80.

<sup>75</sup>Bouma-Prediger, *For the Beauty of the Earth*, 143.

<sup>76</sup>Van Driesche and Van Driesche, *Nature Out of Place*, 298.

<sup>77</sup>Arthur Medeiros, “The Pu’ole’ole Blows and ‘Awa Is Poured; Hawaiian Seedlings Return to Auwahi” *Environment Hawai‘i* 10, no. 11 (May 2000) [www.environment-hawaii.org/500auwahi.htm](http://www.environment-hawaii.org/500auwahi.htm).

<sup>78</sup>Paul Gorman, head of the National Religious Partnership, speaking on the video “Keeping the Earth” produced by the Union of Concerned Scientists and by New Wrinkle Inc., with cooperation from the National Religious Partnership (1996).

<sup>79</sup>Even though these creations are admirable in other contexts.

<sup>80</sup>The o’hi’a tree (*Metrosideros polymorpha*) is the most prominent native tree species in Hawaii, and it happens to be a member of the myrtle family.

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