

The Ecological Citizen

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CONFRONTING HUMAN SUPREMACY IN DEFENCE OF THE EARTH



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**Cover photo**

A protestor at an Extinction Rebellion gathering at Blackfriars Bridge, London, UK, in November 2018.

Julia Hawkins

The Ecological Citizen

An ecocentric, peer-reviewed,
free-to-access journal

ISSN 2515-1967

Aims

- 1 Advancing ecological knowledge
- 2 Championing Earth-centred action
- 3 Inspiring ecocentric citizenship
- 4 Promoting ecocentrism in political debates
- 5 Nurturing an ecocentric lexicon

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“Unless the new forms of community extend beyond the traditional humanistic bounds to include the community of Nature, the game is up.”

Stan Rowe

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The biodiversity crisis must be placed front and centre

The world's increasing awakening to the climate crisis, and a rising climate movement in its wake, are encouraging shifts. At the same time, it is discouraging and even maddening that anthropogenic climate change (hereafter just climate change) is typically framed as *the* major ecological and social emergency. This all-too-prevalent diagnosis is both obfuscating and invalid. It is obfuscating because when the horror-fascination with climate change monopolizes attention, it often dims awareness of the extinction crisis that is accelerating on multiple fronts – extinction of species and subspecies, extinction of wild populations and numbers of individuals, extinction of genetic variation, and mass extinction (see Ceballos *et al.* [2017]). What's more, when attention is directed toward the extinction crisis, the cognition-engulfing spectre of climate change encourages the perception that climatic upheaval is to blame. This is simply false: “the enemies of old” – *agriculture and killing* – are the major direct causes of the biodiversity crisis (Maxwell *et al.*, 2016).

Climate change is exacerbating that crisis specifically because of its synergistic conjunction with the habitat destruction, the habitat fragmentation and the wildlife killing that have already sapped biological diversity. Rapid climate change is pelting wild species and wild places that are *already* severely compromised by other blows – blows that continue to be operative and continue to be overriding. In other words, life might have been able to handle a certain degree of climate change were it not for both its beleaguered condition and, in the case of terrestrial organisms, the impermeability of the landscape (due to industrial agriculture, infrastructures, and

other human obstacle courses). It needs to be added, however, that if anthropogenic emissions continue to climb unabated, triggering positive feedbacks that catapult Earth into a ‘hothouse state’, then all bets are off for most complex life (Steffen *et al.*, 2018; McKibben, 2019).

Even so, we should not let our critical faculties be foiled by continuing to frame a really big symptom – climate change – as the major problem we face. Climatic upheaval is a side effect of the actual problem of human expansionism within the ecosphere: ceaseless growth on the consumptive, demographic and technological-infrastructure fronts. Such growth is allowed to continue by a shared tacit gestalt that human planetary ascendancy is somehow ordained and that humans hold the authority of ‘eminent domain’ over the Earth. Should climate change be addressed with resolve in the near future, by means of technological and behavioural shifts, then a dangerous symptom will become manageable, leaving the establishment of human empire undisputed. In this historical moment, wherein the awakening of a collective awareness of humanity's overreach is at our fingertips, we must not miss the opportunity to look hard and look long at nature's occupation and its irreversible impoverishment of life as we know it. This haemorrhaging of biological abundance and diversity is not just occurring but accelerating – and it would be even if the by-product of burning fossil fuels did not happen to amplify the greenhouse effect on planet Earth.

All told, the coming years are arguably the most significant in human history, with nothing less than the fate of the Earth and humanity at stake. The destruction of

Joe Gray and Eileen Crist

About the authors

Joe and Eileen are co-editors of this special issue on the biodiversity crisis.

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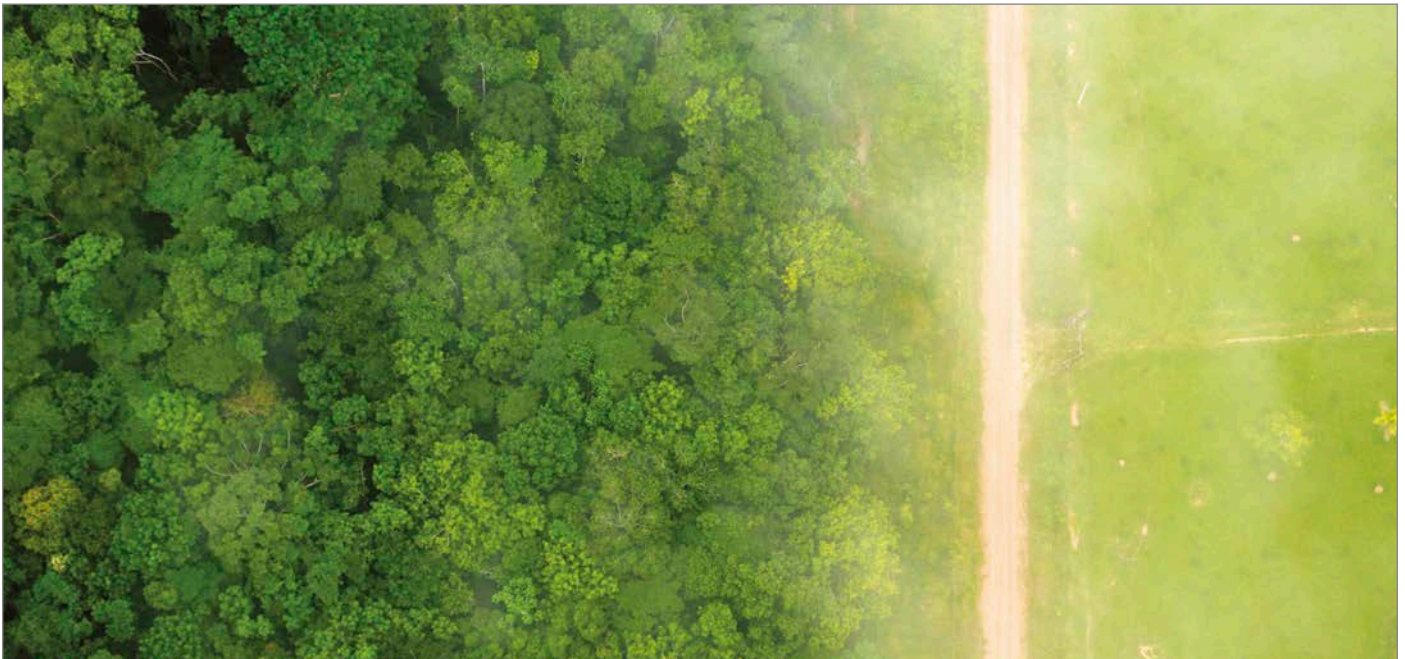
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Agriculture; anthropocentrism; biodiversity; climate change; sixth mass extinction



A bird's-eye view of the stark contrast between forest and agricultural land near Rio Branco in Brazil (photo: Kate Evans/CIFOR [CC BY 2.0; <https://creativecommons.org/licenses/by-nc-nd/2.0/>]).

“The battle for the Earth’s future will be one, first and foremost, of political will, mass mobilization, and the emergence of a new human consciousness and identity.”

life’s variety, complexity, and abundances – the biodiversity crisis – is on course to be a tragedy of scale that ushers in a depauperate and desolate era. Much of the manifold beauty of the current radiation of life with which we share Earth is being rapidly erased. This is an unfolding ecocide that remains an enormous (albeit invisible) injustice to the non-human world and bodes a bleak future for human life and self-understanding. That humanity has yet to comprehend the ethical and existential gravity of the biodiversity crisis reveals the blindsiding bankruptcy of human supremacy – and of the mostly unquestioned ‘right’ of human dominance within, and domination over, the natural world. There is an ever-more-urgent need to awaken society and policy-makers to life’s devastation, to the ongoing inequity toward the more-than-human world and to the imperative to end biodiversity collapse in our time.

This special issue of *The Ecological Citizen* explores many of the major facets of the biodiversity crisis – from the effects of sensory pollution to the decline of insects and the extinction of large-scale migrations, and from the freshwater biodiversity crisis and plundering of the oceans to the perils of infrastructure development. Climate change is but one

of many crucial topics covered. We thank each of the authors for contributing their viewpoints and areas of expertise to the issue. In bringing this collection of writings together, we have strived to present a global picture wherever possible and give space to many voices. What has been especially heartening about stewarding the issue to publication is seeing authors not just dwell on problems but offer solutions to the crisis, some of which are already beginning to unfold. It is clear that we know what the problems are, in the main, and have practical solutions available. The battle for the Earth’s future will be one, first and foremost, of political will, mass mobilization, and the emergence of a new human consciousness and identity. ■

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The silence of the humpback whale

Humpback whale populations are declining in many parts of the world, entailing the loss of both their ecological functions and their magnificent music. This is not just an environmental crisis, but a moral catastrophe. The fate of the whales is a tragic loss for humans, who take pleasure in seeing them and hearing their songs. Far more significant on a moral scale, the whales' fate is unjust, a violation of our duty to protect innocent beings from undeserved suffering, in violation of their rights. It is profane, a violation of our duty of reverence. And it is cruel, a violation of our duty of compassion. How much of Earth's legacy of beautiful lives are we willing to trade away, in order to maintain an unmerited and unsustainable way of life?

I remember *Songs of the Humpback Whale*. This was the sensational 1970 recording of humpback whalesong that brought whales into the hearts of people around the world. As the whales courted in Hawaiian bays, their plaints were almost operatic in their drama, their lust, the lyricism of their songs. Friends gave us the LP when our daughter was born, so we could rock her to sleep to the whispers and whoops of the whales. As graduate students just moved to town with a new baby, we had nothing in the house but a mattress on the floor, a record player, and a load of firewood for the stove. The forest smell of the damp oak, the music of the whales, the warm, gently breathing weight of a new baby on my chest – this was what the world was created to be, I believed, nothing less or more. The baby slept soundly, dreaming maybe of rising and falling on a gentle swell, lulled by the music of the great whales.

Thirty years later, we moved to a cabin on the edge of a cove in south-east Alaska. That first day, the sun finally dropped below the mountains, leaving a pink glaze on the water. We slept to the wash of waves in the rockwrack. But not for long. A sudden call jolted us awake – a long, drawn-out squeal. *Did you hear that? What in god's name? A wolf howling?* – it might have been, but there were no wolves on the island and the sound was chestier than

wolves. An elephant trumpeting? – that's what it sounded like, but no mastodons had stomped these beaches for 10,000 years. Nothing we had ever heard matched the magnitude of that bleating. A ruckus of thunks and splashings sounded from the inlet, and then the night returned to its gentle swash. In the morning, we saw a distant pod of humpbacks, spouting clouds of sunlight.

That, we learned, was the feeding call of the humpback whale.

Although they are probably the very same whales that sing in Hawaii, the humpbacks of south-east Alaska add a different call to their repertoire when they migrate back to northern feeding grounds. All violin music in the Hawaiian bays, on the feeding grounds in Alaska, whales trumpet. The cacophony is part of their feeding ritual, unique to the south-east. A member of a pod circles deep, blowing bubbles the size of beach balls. The bubbles form a sort of cylinder, encircling a school of herring. Other whales swim below, herding the herring into a tight ball. A whale sounds the signal – that magnificent screech – and, jaws agape, all the whales drive powerfully upward through the panicked fish. They go so fast, they breach the surface, sailing half a body's length into the sky. Water streams from the baleen curtains that hold the herring in their maws. Gulls scream as

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Animal ethics; ecological ethics; intrinsic value; rights of nature; water

“No one knows what will happen next to the humpback whale populations, but the trends – the rising temperatures of the water, the falling populations of feed-fish and zooplankton – draw a jagged falling line on graphs.”

whales fall back onto the water with all the grace of a school bus falling off a cliff.

When we are out fishing, we usually hear exhaling whales before we see the cloud of breath. One returning whale in our inlet rasped heavily every time he inhaled or exhaled. People could identify him from miles across the water. ‘Growler’, they called him. Other whales exhaled in long breaths that sounded exactly like someone was dragging an ice chest across the deck of a boat. But the most beautifully breathing whales were the silent ones in fog on the far side of the inlet. When they exhaled, a cloud of silver glitter formed over their curled backs and silently disappeared. One morning in Freshwater Bay, we glimpsed a whale that was sleeping, a big lump floating so close to the surface that we were glad not to have hit it. The whale’s great bulk rose with the inhalation, sank on the exhale, quietly, slowly, snoring on the swell.

This is the music of the humpback whales in Alaska.

The humpback whale population in south-east Alaska had been abundant and growing at about five per cent per year (Neilson et al, 2018). Until five years ago. By now, the numbers are down nearly 60%. Lots of things happened in that time. A perfect storm of ocean events shifted prey availability and quality – global warming, powerful El Niño conditions, an unprecedented “blob” of warm water in the Gulf of Alaska, harmful algal blooms. A concurrent mass die-off of seabirds signalled widespread prey shortages. Whales in south-east Alaska were visibly thin, and even the zooplankton were skinny, measuring lower levels of lipids. Glacier Bay and adjacent waters in Icy Strait usually nurture about ten new humpback calves every summer. Last year, there was one calf, and it disappeared. Most likely it died and, too thin to float, sank to the bottom of the bay. Imagine the music of a dead calf, the scurrying crabs and clicking shrimp, the swish of hagfish, the rasp of shark skin against the small flayed body.

No one knows if the whales have shifted feeding grounds, following dwindling bait fish, or if they have died. If that many

whales have died, one would expect a plague of dead whales washing up on beaches, but there were none. That might make sense; an emaciated whale may sink quickly, and then the pressures of the deep sea may hold the carcass on the sea-bottom, a banquet for the hungry ocean. Another plausible scenario is that whales, unable to store enough fat on the feeding grounds, set off for Hawaii nonetheless – and don’t make it. Whale numbers are down in Hawaii as well as up north. No one knows what will happen next to the humpback whale populations, but the trends – the rising temperatures of the water, the falling populations of feed-fish and zooplankton – draw a jagged falling line on graphs.

What exactly would be the nature of the wrong, if we were to let whale-song slip away, or worse, propel it into oblivion? There are a number of words to use, human beings being prodigious inventors of varieties of wrong-doing. If Inuit people have forty words for ‘snow’, as I am told, how many words does the western world have for ‘wrong’? I can think of five big ones. Tragedy. Injustice. Profanity. Cruelty. Disrespect.

1. Tragedy

When I look out my window now, the inlet is flat as silver-plate, dinged here and there by a merganser or loon. I watch for whale-spouts; although I can see five miles across the inlet and even farther in both directions, I do not find them. That is a true loss. Seeing whales makes me glad. So much larger than I am (a floating school bus), so mysterious in their underwater travels (the great migrations), so ponderously clever in their lifeways (the underwater nursing calves), so beautiful in their shining dives (the waterfalls from lifting flukes), so oddly wonderful (the stalked eyeballs that allow them to see into their own mouths), so full of life (the triumphant roar) – they lift me out of myself and invite me into something far greater than my paltry concerns, into the infinitude of evolution and the great mysteries of beautiful life. Simply to be in view of that is a joy, and when once I had the chance to move in close to a whale and

breathe in the whale's exhalation, I was overjoyed (until I learned about the bacteria in the exhaled breath).

I'm not alone. In our inlet, tourists on the tour-boat *Island Song* line the rails in bright raincoats, holding long-lensed cameras. They cheer when a whale spouts, a rejoicing we can hear a mile across the water. The scene makes me think of photos of sailors returning to port after the war – that eager, that glad, that crowded at the ship's rail. This is a mystery in itself, why humans are drawn so strongly to the great mammals, as strongly as they might be drawn to home after a war – but it seems to be so.

This joy is part of the instrumental value of whales, their worth as means to human ends. It is a value, but utterly egocentric and insulting, when you think about it, to imagine that the value of the whales is primarily their value to us. Imagine the long evolutionary journey of whales, dragging themselves onto the muddy shore, stalking the swamps on dog-like legs, swinging elongated heads, and then finally splashing back into salty water, their feet sucking mud, their mouthparts maybe mumbling like crabs, the air electric with thunderstorms maybe and erupting volcanoes. Imagine the slow movement of their nostrils to the top of their backs and the transformation of a tail into those splendid flukes, black tulips of the sea. Imagine the evolution of that hulking grace. And where did the baleen come from, and over how many million years, the feathery filters stuck with krill? And the songs: how many generations taught how many generations to sing songs so compelling that they outsold the Monkees? To what end? That I would smile at night to hear them howl? That's all?

Let us grant the terrible sadness we would feel if the whales disappeared. Let us grant the tragic unfolding of human folly. But let's reason past our own selfish interests. Apart from these, what exactly is wrong with letting whales slip into oblivion?

2. Injustice

With the whales and all of Earth's beings, we share the kinship of common

substance, the kinship of common origins, the kinship of interdependence, and – perhaps disastrously – the kinship of a common fate. There are no natural hierarchies of deserving in this planet-wide family. If we and whales have evolved as interdependent and equally remarkable parts of a morally worthy whole, then we acknowledge also the *moral* unity of all life. So, a planetary argument by analogy unfolds: Just as humans ascribe intrinsic value to themselves, value beyond their usefulness to others, so the rest of creation too has intrinsic value. Just as humans grant legal and moral consideration to their own interests, so the interests of all others are worthy of consideration. And just as humans grant themselves rights that protect their most necessary interests, so the rest of creation too has the right to protection of their essential interests.

Industrial-age humans have been slow to realize that all members of the Earth community have rights. Steeped in self-glorifying narratives of human superiority over the rest of the natural world, intoxicated by seemingly limitless power to turn nature to human uses, blinkered by short-term self-interest, humans have chosen to reserve rights for themselves. However, the narrative of human exceptionalism is increasingly challenged by a notable convergence of religious, indigenous, ecological and evolutionary insights. We understand now that not only human beings, but other living beings, species, ecological communities, landscape formations and waters, have interconnected *interests*. Humans are morally obliged to recognize and to weigh these interests in decisions that impact nature. That is to say, other-than-human members of the Earth community also have *rights*, and those *rights* count.

Accordingly, the Universal Declaration of the Rights of Mother Earth and other legal and moral documents around the world encode nature's rights as a "common standard of achievement." The rights include, among many others, the right to life and to exist; the right to regenerate its biocapacity and to continue its vital cycles

“Steeped in self-glorifying narratives of human superiority over the rest of the natural world, intoxicated by seemingly limitless power to turn nature to human uses, blinkered by short-term self-interest, humans have chosen to reserve rights for themselves.”

“Damage to the whales – whether by overfishing their food species, acidifying the very water they swim in, degrading the zooplankton they feed on, warming the water (the list is long) – violates their rights.”

and processes free from human disruptions; the right to be free from contamination, pollution, and toxic or radioactive waste; and the right to maintain its identity and integrity as a distinct, self-regulating, and interrelated being.

Damage to the whales – whether by overfishing their food species, acidifying the very water they swim in, degrading the zooplankton they feed on, warming the water (the list is long) – violates their rights. And it is a particularly pernicious violation, because the whales are the very definition of innocent, having done nothing to deserve this cruelty.

3. Profanity

Let me tell you about one day a dozen years ago – a special day, but not a unique day. The whales had been feeding in the inlet, but they were resting now on the glaze of the sea, and our boat rested some distance away. There were many whales. They all sucked bright day into their lungs, blew it out with the sound of a rockslide. Then there was silence except for the whispers of murrelets and the flicks of the fins of wounded fish. Already, the sea had melted the rough water, skinning it with silver. Gulls swayed on the swell, and even the sacrilegious gulls were silent.

A whale folded its back, slowly unfolded, and levered its flukes into the air. The tail stood like a black jib, streaming water, then sank as the whale dove to a seam below the reach of the sun. Water slipped into the space the whale had pressed on the sea. One by one, other whales raised their flukes and dove. The gulls, still silent, waited. They knew that in their own time, the whales would begin the hunt again. The water rose and fell in meditative breath.

I don't want to say that moment felt like a spiritual experience, because I don't want to default to human comparisons, but it felt somehow sanctified. That moment, and those whales, were irreplaceable, essential, beautiful and fearsome, astonishing, beyond human understanding, generative, wonderful. If this is the language of the sacred, then let us use those words. This is the sanctity that we must protect, the

endlessly creative world that we must save, the lyric voices that we must hear, the wonder that we must preserve.

Every extinction, every suffering, every destruction, is a profanity, a failure of reverence. It is a violence we cannot even begin to measure because we have only the sorriest understanding of the world's multitude of lives. The world is a mystery of infinite and intrinsic value.

4. Cruelty

None of us can directly experience the pain or sorrow felt by another creature. We infer it from cries and pleas, and from analogy to what we ourselves would feel. The sorrow of a mother whale, faithfully nursing her calf through the watery nights, but too starved herself to provide the nutrients to keep the little one alive – what agony is this? It might be less than you or I would feel, but it might as likely be more, the breaking of a great whale's heart. One might argue that a whale doesn't have the mental capacity – the consciousness or self-awareness – to grieve. One might argue that she doesn't remember pain – a merciful amnesia. But these would be arguments from ignorance; we just don't know. But we can imagine.

If there are any limits to permissible human behaviour, then surely cruelty to innocent creatures is beyond the pale. Pain inflicted as an unseen and unintended consequence of activities aimed at other, maybe admirable, goals; pain inflicted as a foreseen but discounted consequence of other activities; pain inflicted knowingly and intentionally as part of a business plan to drive up corporate profits – here is an escalating scale of shameful behaviour. As we think about the extinction crisis, as we count down the numbers, as we calculate the rate of ecosystem collapse, it is essential to remember that the crisis shimmers with suffering. That makes it not just an environmental crisis, but a moral catastrophe.

5. Disrespect

A great whale is a wondrous thing. It is *astonishing*, from the Latin, *tonus*, to be struck, as if by lightning – radical

amazement, to see such a creature, so tuned to the flashing fish and the dark sea. It is beautiful, the glistening blue-black back decorated with barnacles, studded with scars from cookie-cutter sharks, a mammoth animal, but graceful as flowing water. It is knowing, as elders are knowing, having seen the world's cruelty and promise. It is magnificent beyond human measure, slowly folding and unfolding through time. It is roaring grand. It is eager for on-going life. It is a trembling consciousness, a manifestation of the mind of the universe.

It is worthy – that's the word. It is excellent. And so it must continue. And the thought that we humans might trade the humpback whale, for what? The profligate burning of oil and gas? Profits from a reckless herring fishery? A failure to imagine a sustainable way to live on Earth? Greed, pure and simple? That is moral monstrosity on a cosmic scale. It's time for a new global conversation about the true worth of the world's great diversity of lives – not in the pinched terms of human financial or emotional interests, but in terms of the 'great journey of the universe' toward an abundance of ongoing life.

* * * * *

Last year, under gathering clouds, I knelt beside a tide-pool. Maybe you have done the same. Blue mussels paved the rocks, cutting my hand when I turned a stone. The bottom of the stone was slathered

with life – tiny starfish, algae like orange paint, crust-of-bread sponges, porcelain crabs disguised as pebbles, decorator crabs disguised as seaweed, fish disguised as rays of light. The moving tide was noisy, the harsh inhale and groan. Scratching claws and bubbling jaws, a constant *plop plop* as seawater dripped off globules and tentacles and who knows what. Behind me, I could hear my grandsons calling to each other, "Guys! Come. Look and see." And then, out in the inlet, a humpback whale began to roar.

Never have I heard as complete a repudiation of the idea that human beings are the only wondrous beings, that we are in charge, that we are the point of the whole thing. Each being is worthy. Each fractal layer is necessary, all the lives the theme, all the lives the variations. The planet is still crammed with lives of urgent striving, crawling over each other, burrowing into every crack, floating on the seas. The fate of these lives is not a matter of indifference or of economic expediency. These lives are the irreplaceable consequence of planetary creativity over four billion years. As consequences of the same creativity, we human beings have obligations to honour the Earth's beings and the processes that created them, to celebrate and protect them until the end of time. ■

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“As consequences of the same creativity, we human beings have obligations to honour the Earth's beings and the processes that created them, to celebrate and protect them until the end of time.”

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The green world

In many ways, plants are fundamentally different from other kingdoms in the domain of life. Through photosynthesis, with its absorption of carbon dioxide and release of oxygen, plants serve as the lungs of planet Earth. As organisms capable of synthesizing their own food from inorganic substances, they are the basis for food webs upon our blue-green planet. From this wondrous arising, the miracle of life moves forth. Diverse forests, grasslands, deserts, tundra, wetlands, and waterways blanket the Earth, providing refuge for untold realms of biodiversity from molecules to species to bioregions and biomes. Vascular plant numbers total over 400,000 taxa, with 20% threatened with extinction. Along with the twin spectres of climate chaos and species extinctions, vast numbers of individual plants and animals are being extirpated beyond our ability to comprehend the losses. The green world is being razed by agricultural expansion and deforestation, as well as from wildfires, industrial agriculture, and indiscriminate use of biocides. Along with immediate steps to reduce human numbers and its attendant consumption, the best conservation science tells us setting aside half the Earth for the preservation of wild nature is crucial if humanity and the more-than-human world is to make it through this plight of our own making.

Canto LXXXI

*Pull down thy vanity, it is not man
Made courage, or made order, or made grace,
Pull down thy vanity, I say pull down.
Learn of the green world what can be thy place.*
Ezra Pound

All of life is a miracle of existence, with each organism having its own unique qualities and attributes, Darwin's "endless forms most beautiful and most wonderful." Yet no being exists independently. Ecology and evolution provide ample evidence of species interconnecting to form mutualistic relationships and communities. This interdependence can be viewed as webs of connectivity, or as an ecological pyramid emphasizing trophic levels, serving as a metaphor for the flow of energy through ecosystems.

Fundamental to such an ecological view lies the world of plants, the green of the leaf, and the marvel of photosynthesis. "When a particle of light strikes a molecule of chlorophyll, an electron is jolted out of the molecule and raised to a higher energy level.

Within a fraction of a second, it returns to its previous energy state. All life on this planet is dependent upon the energy momentarily gained by the electron. Photosynthesis is the vital link between the physical and biological world [...] 'What drives life is a little current, kept up by the sunshine,' (Nobel laureate Albert Szent-Györgyi)" (Raven and Curtis, 1981).

Through respiration, animals breathe in oxygen to release the energy from the food we eat and exhale carbon dioxide as a waste product; plants absorb immense quantities of carbon dioxide through photosynthesis, and release oxygen as a waste product. There is more than just metaphor at play in the perception that the green world serves as the lungs of planet Earth (Jabr, 2019).

What of the green world here in the early decades of the 21st century? From the Arctic tundra and the realm of circumboreal conifer forests, to the tropics with their vast rainforests, mangroves and other habitats of prolific diversity, the vegetation of the Earth, like so much else, is under assault from expanding human economies and the crush of our numbers.

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Vegetation, as the collective assemblage of plants in the landscape, is distinct from the *flora* of an area. The latter, in its most elemental sense, is a list of the plant species occurring there. The basic unit of a flora is the species; the basic unit of vegetation is the community or association. Implicit in the term plant community are such attributes as soil type, moisture regime, microclimate, slope, aspect, elevation, temperature and disturbance history. In other words, an integrator of factors defining qualities of habitat.

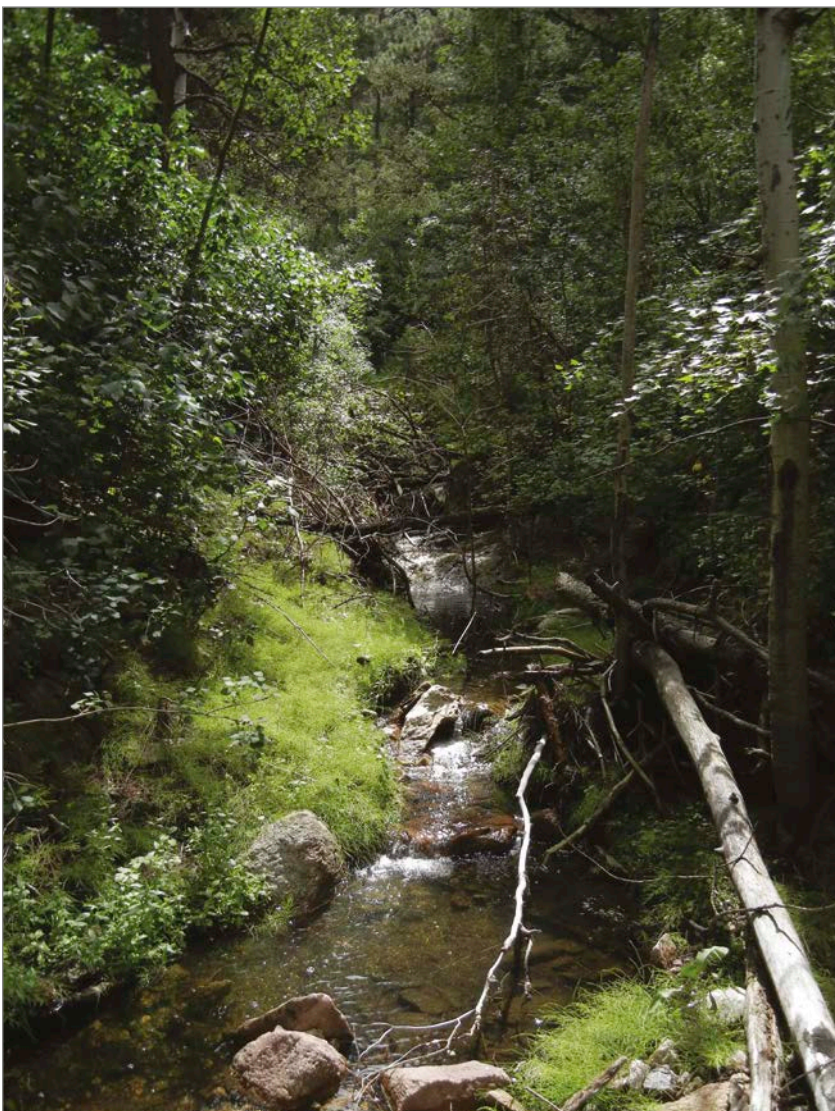
The species diversity of the world's flowering plants is being extirpated to the extent that fully one in five (20%) of the estimated 390,000 vascular plants are threatened with extinction (RBG Kew, 2016). Another study, released from Kew as this

paper goes to press, found that 571 species had been extirpated since the beginning of the Industrial Revolution, with the caveat that the true number is likely to be much higher (Humphreys *et al.*, 2019). Researchers said the extinction rate was 500 times greater now than before 1750, and this number is also likely to be an underestimate (Carrington, 2019).

Extinctions in plant species are difficult to assess compared to most animals. Extinction is an absolute term, meaning no individuals remain alive (RBG Kew, 2016). Proving an absence is a fool's errand in field biology, no matter the level of searching; this is true for animals as well as for plants. For plants however, there can be long extinction lag times influenced by numerous factors. Species–area curves describe the relationship between the area of a habitat and the number of species found within that area. These are not as effective in predicting populations of stationary plants as compared to mobile animals owing to the influence of features such as spatial scales and patch structure. More intrinsic factors affecting lag times include long-lived seed banks in the soil, the longevity of woody plants, particularly in the tropics, and the numerous ways plants can reproduce themselves through asexual means or self-fertilization (Cronk, 2016).

One botanist's account of tropical species loss is as follows (Tripp, 2016):

Ruellia speciosa is, true to its epithet, a beautiful species. And one of my favorites. I could probably write a short story about this one, about watching for hours the hummingbirds fawn over it in a deep fissure on top of a mountain overlooking Ciudad Oaxaca [...] about its wonderfully pungent odor [...] about the population mutants that produce the strangest internal floral accessory structures. Well, best just to read all about it in the taxonomic revision of *Ruellia*. I owe a great deal of gratitude to Salvador Acosta for leading me to this population in 2005, which represents the only time I've seen this species alive in the field. I have searched and searched for many other populations, based on localities from





historical herbarium records, but all such attempts were unsuccessful.

Update as of January 2016: I returned to the above locality some 10 years after I first visited it. The population has now been extirpated from housing development. Not all stories have a happy ending.

* * * * *

There is an old saying in conservation about “saving the last of the least, and the best of the rest.” The ‘least’ are those species on the precipice of extinction and being lost forever. The ‘rest’ are those populations and habitats with a chance of being saved. They provide a source of diversity to build upon in the hope of restoring a small park, a large county, or a vast reach of native prairie, forested uplands or alpine mountains where genuine rewilding can proceed.

As readers of this journal are keenly aware, one of the most pressing ecological concerns of the 21st century is the extinction and extirpation of species across the planet. Normally staid scientists and journals are speaking of ‘ecocide’, ‘biological annihilation’ and ‘ecological Armageddon’, as plant and

animal numbers are extirpated beyond our ability to comprehend the full scope of the losses (Ceballos *et al.*, 2017; Hallmann *et al.*, 2017). Here, the emphasis is not on species extinction, an attendant horror to extirpation, but rather the decimation of individual beings on such a scale as to be truly horrific in its implications for the fabric of life on Earth: in short, the loss of wild nature’s abundance and the cumulative impacts this has on food webs, biogeochemical cycles and energy paths linked to that abundance. One scientist involved in some of the referenced studies listed the top three threats to biodiversity as “habitat loss, habitat loss, and habitat loss.”

Before addressing some of the major threats to the green world and the biota it sustains, let us concede that without an immediate start to lowering human numbers and their attendant consumption, there is little hope of building a sustainable and just society, let alone restoring a world with room for wildness to play an unbounded role. The late Al Bartlett, a physics professor at the University of Colorado, gave what would prove to become a celebrated talk on exponential growth. It was titled *Arithmetic, Population and Energy*:

“Before addressing some of the major threats to the green world and the biota it sustains, let us concede that without an immediate start to lowering human numbers and their attendant consumption, there is little hope of building a sustainable and just society, let alone restoring a world with room for wildness to play an unbounded role.”

Sustainability 101, and was presented over 1700 times. He would often end his presentation with a simple question. “Can you think of any problem in any area of human endeavor on any scale, whose long-term solution is in any way aided, assisted, or advanced by further increases in population, locally, nationally, or globally?” (Bartlett, 2013). In looking at some of the most troubling threats to the green world, the answer is clearly no.

A 2016 analysis in the journal *Nature* lists two of the greatest threats to species diversity as: one, agricultural expansion, which includes food, fibre, fuel and livestock production; and, two, over-exploitation, which includes deforestation, hunting and fishing (Maxwell *et al.*, 2016). The authors are aware that assigning categories to threats may be more of a distraction than an exercise in clarification, pointing out that more than 80% of the species included in their analysis are affected by a combination of agriculture and over-exploitation. They suggest that a better understanding of how threats act “additively, synergistically or antagonistically” is needed to more effectively evaluate the conservation costs of human impacts (Maxwell *et al.*, 2016). Once

again, we come back to interdependence, but this time with the awareness that the complexity it engenders can determine the dynamics of ecological ruin as much as it can beget ecological integrity and beauty.

Another study reports that 27% of the total loss of forests worldwide between 2001 and 2015 was due to industrial-scale farming and ranching (Curtis *et al.*, 2018). Most of this permanent land use change (deforestation) occurred in the tropics. Large swathes of Amazonia have been converted to cattle ranches and soybean farms, while South-East Asian forests have been converted to palm oil plantations. The remaining areas maintained the same land use over 15 years; in those areas, loss was attributed to forestry (26%), shifting agriculture (24%) and wildfire (23%). These latter effects may represent an erosion of the integrity of habitats, but not a permanent loss of wild nature. This analysis was driven, in part, to assess the effectiveness of corporate commitments to zero deforestation in their supply chain by 2020. The conclusion was that the rate of commodity-driven deforestation has not declined (Curtis *et al.*, 2018).

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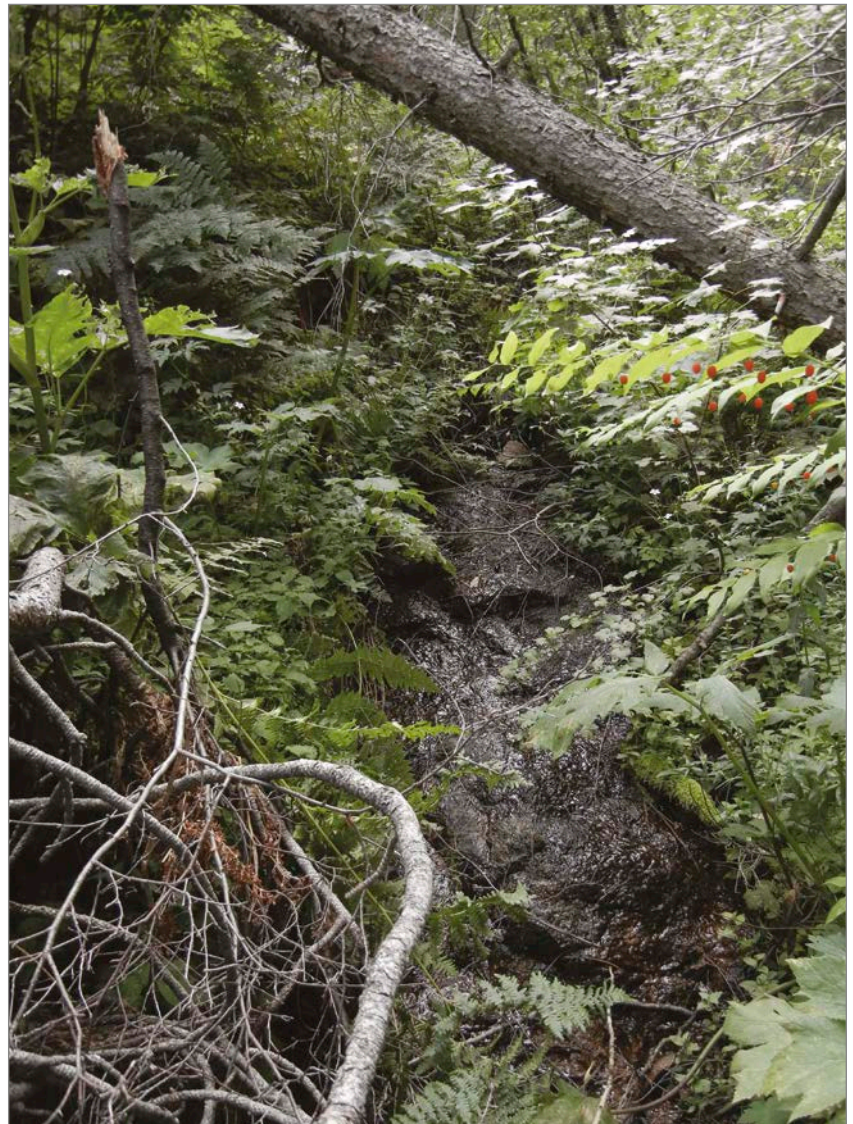


Moist tropical deforestation is perhaps the greatest concern in the 21st century for terrestrial habitat and species loss, but its contemporary prevalence should not obscure the historical despoilment of vast tracts of the Earth's surface. Reliable figures are disturbingly difficult to pin down, but it appears that over 50% of the planet's land area has been converted to human-dominated use. Recent reports go as high as 75% (IPBES, 2019). According to Hoekstra *et al.* (2005: 24): "Habitat loss has been most extensive in tropical dry forests (69% converted in SE Asia); temperate broadleaf and mixed forests, temperate grasslands and savannahs (>50% lost in North America); and the majority of Mediterranean forests, woodlands and scrub." From these areas major civilizations emerged – Eastern/rice, New World/corn and Western/wheat – and were largely defined by the impacts of agriculture and the spread of metropolitan centres. The loss of species across these biologically rich, continental-scaled biomes is a disquieting reproach to our human tenure on planet Earth.

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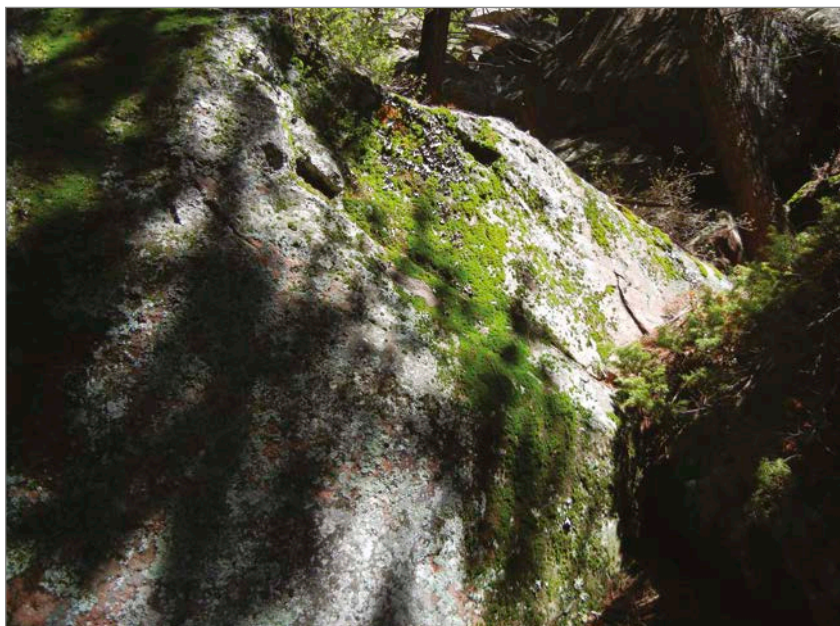
Even in the absence of climate disruption, the green Earth would be in a world of hurt. While anthropogenic climate upheaval exacerbates virtually all ecological impacts, there are some effects more directly linked to the new climate regime. As a resident of western North America, and more precisely the Southern Rockies bioregion, I have witnessed a host of fires far outside the range of natural variability over the past 40 years. According to a Colorado State University assessment, "wildfires in Colorado destroyed less than 100,000 acres per decade over the 1960s and the 1970s. For the 1980s and 1990s, the total was over 200,000 acres per decade. For the 2000s, the total [has been over] 1,000,000 acres" (Wikipedia, 2019).

We appear to be moving into a 'state-shift' where low-elevation forested sites consisting of ponderosa pine and Douglas fir are crossing climatic thresholds involving, for example, soil moisture and maximum surface temperatures. High fire



severity and low seed availability further compromise post-fire regeneration. Davis *et al.* (2019: 1) have noted: "At dry sites across our study region, seasonal to annual climate conditions over the past 20 years have crossed these thresholds, such that conditions have become increasingly unsuitable for regeneration".

While such studies concentrate on low-elevation sites, there are other reports focusing on forests at higher altitudes and latitudes (Harvey, 2016). These emphasize a significant decrease in regeneration in the 21st century, pointing to moisture deficits and, to a lesser degree, distance to seed source. The vegetation these sites will support in the future range from reduction in forest density and extent, to compensatory increases from lower-montane and upper-



treeline species. Further scientific research may be needed, but savvy naturalists and the intimacy of those who have lived for generations in a particular place also have a role to play in this work (Noss *et al.*, 2012; Turner, 2014).

In recent years, phenology, the study of the seasonal timing of life's processes, has experienced a revival in the light of climate woes. Concerns over plant-pollinator dynamics have been among the most studied systems in looking at disruptions of ecological interactions (Memmot *et al.*, 2007). An interesting side to the story involves Henry David Thoreau and his efforts to map the seasonal patterns of Concord's natural history. Richard Primack and his colleagues have looked at this in some detail, providing those of us with a life-long affection for the sage of Concord with another story to tell of ol' Henry traipsing for miles to find the earliest blooms of the season (Primack and Miller-Rushing, 2012).

Here in the Southern Rockies of Colorado, at the Rocky Mountain Biological Laboratory (RMBL), David Inouye and his students have pursued phenological studies to previously unheard levels of detail after 40 years of work. Tucked away in their Elk Mountain redoubt, they have built a dataset of some 2 million individual flowers from 121 species, establishing that since the 1970s the wild-flower season has extended an average

of 35 days at the RMBL site (Langlois, 2014). Their studies bring to mind the old caveat about nature not being more complicated than we think, but more complicated than we *can* think; nature rarely if ever proceeds in a straight line. Cardona *et al.* (2014: 4916) have commented: "A diversity of species-level phenological shifts contributes to altered co-flowering patterns within the community, a redistribution of floral abundance across the season, and an expansion of the flowering season. These results demonstrate the substantial reshaping of ecological communities that can be attributed to shifts in phenology."

* * * * *

Documenting state shifts from forests to shrub-lands in the wake of wildfires, the reshaping of communities as a result of phenological shifts attributable to climate change, or the decline of insect populations due to expanding agriculture impacts all point to the loss, if not extinction, of ecological interactions. In some cases these can be ascribed to out-of-kilter food-web interactions (Sanders *et al.*, 2018), in others to the direct or secondary mortality resulting from insecticides and herbicides (Gassmann *et al.*, 2014; Hladik *et al.*, 2018).

In the case of disruptions from pesticides, often associated with genetically modified crops, we see the serious impact of industrial agriculture with its practice of fence-row to fence-row cultivation. While concern over health impacts from consuming GMO foods may be warranted, the ecological effects of producing these foods upon soils, watershed and biota are seldom given the attention they deserve. Along with a humane and ecologically just reduction in global population, an urgent transformation away from industrial agriculture is imperative if the richness and variety of life on our blue-green planet is to make it through the 21st century. Sustainable agriculture systems rooted in ecological practices mimicking natural processes must be embraced and, over time, put into place worldwide. Such an agroecology would not only produce healthier food, it would support wildlife,

restore the quality of soils and water, and sequester carbon from the atmosphere (Union of Concerned Scientists, 2019).

Nevertheless, even more is called for if the aspirations of this journal and the readers who come to it are to be realized. *The Ecological Citizen's* mission statement declares its commitment to "address the central issue of our time: to halt and reverse our current ecocidal course and create an ecological civilization." Organizations such as the Wildlands Network, Nature Needs Half and Half Earth are spearheading these visions, providing support for myriad grassroots groups doing the hard work on the ground (Foreman, 2004; Wilson, 2016; <https://natureneedshalf.org>).

As audacious as proposals to secure half the planet as biodiversity preserves may once have sounded, the best conservation science tells us this is what is necessary

if the twin spectres of the sixth mass extinction and climate chaos are to be averted. This is also the enduring message from the traditions of indigenous people around the planet, as well as the coyote wisdom of a gifted 16-year-old girl from Sweden and the rebellion of young activists she has spawned (Turner, 2014; Dodd *et al.*, 2019).

In researching this paper I was charmed to discover that, as early as 1972, Eugene Odum, the author of my first ecology textbook, published research concluding: "It would be prudent for planners everywhere to strive to preserve 50% of the total environment as natural environment" (Odum and Odum, 1972). Twenty years later, Reed Noss, another of my ecological mentors, came to the same conclusion, publishing his findings in *Wild Earth*. Then, a further 20 years on he co-authored a seminal paper on the topic



“We need to
revivify our
covenant with
the natural
world.”

in *Conservation Biology* (Noss, 1992; Noss *et al.*, 2012).

Most recently, in ‘A Global Deal for Nature [GDN]: Guiding principles, milestones, and targets’, Eric Dinerstein and his colleagues (2019: 1) map out “a time-bound, science-driven plan to save the diversity and abundance of life on Earth. Pairing the GDN and the Paris Climate Agreement [to] avoid catastrophic climate change, conserve species, and secure essential ecosystem services.” With the help of social media, millions of people around the planet were alerted to the GDN’s release and downloaded the plan. Even as I write these words, the UN Report on Biodiversity and Ecosystem Services has been released by IPBES (2019). The dire findings reported in this document only amplify the need for urgent action.

* * * * *

As a denizen of western North America, I have been blessed with the endowment of public lands, lands serving as a geography of hope for our democracy. I cut my conservation teeth on visions of the Great Plains restored to a buffalo commons and of the Rocky Mountains serving as a continental corridor for large mammals. More recently, in conjunction with a floristic survey of a natural area in Boulder County, Colorado, I assessed the county as a whole to determine the extent of protected lands in the region. It turns out over 60% of these lands are under some form of protection as city or county open space, state parks, US Forests Service lands, statutory wilderness areas or national park. This is in a county of 740 square miles (1920 km²) with a population of 325,000 people.

I am fortunate to live in a place where those who came before us had the foresight to recognize the beauty of these lands and worked to set aside relatively large parcels for their natural values. In recent years, we seem to have lost that spirit, forgetting we each need to lighten our steps if their ecological integrity is to survive. We need to revivify our covenant with the natural world, to embrace an ethic of membership and stewardship, and, in the words of Barry Lopez, rediscover that spot “between the extremes of nature

and civilization where it is possible to live without regret” (Lopez, 1989: 178).

I would like to suggest to my neighbours – and are we not all neighbours? – that we begin to view these lands as a commons. Not the commons of tragedy on which individuals pursue their singular ends, but rather a multispecies commons of sharing and cooperation. A bestowal upon which the citizenry as a whole has come to an agreement as to what is best for the plant and animal communities that flourish here, and for those of us who are fortunate enough to share it with this more-than-human-world. This can become the context in which we restore, and begin to make reparation, with these lands and with each other.

In the end, we need the solace and calm of wild nature to be whole. To be held by the gaze of a wild animal, to be nourished by a quiet trail. And beauty, beauty most of all, is essential. ■

* * * * *

For the Children

*The rising hills, the slopes,
of statistics
lie before us.
The steep climb
of everything, going up,
up, as we all
go down.*

*In the next century
or the one beyond that,
they say,
are valleys, pastures,
we can meet there in peace
if we make it.*

*To climb these coming crests
one word to you, to
you and your children:*

*stay together,
learn the flowers,
go light*

Gary Snyder (1974)

* * * * *

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“In the end, we need the solace and calm of wild nature to be whole. To be held by the gaze of a wild animal, to be nourished by a quiet trail. And beauty, beauty most of all, is essential.”



Minstrel bug nymphs in an organic garden in the Cévennes, France

Addressing global insect meltdown

Insect diversity is enormous, with possibly 5–8 million extant species. Most of these remain undiscovered, with only just over a 1 million species described (Adler and Foottit, 2017). Many more await discovery, while many previously unknown species are being revealed through genetic studies. This huge insect variety means countless ecological interactions, from herbivory and pollination to predation and parasitism. Importantly, insects are a vital component of terrestrial food webs, meaning essential food items for many birds, small mammals, lizards and amphibians, as well as for each other.

As insects are small and often hidden among plants, in crevices, or below ground, we do not easily relate to them. It is mostly the large, benign and charismatic species, such as butterflies, dragonflies and grasshoppers, to which we relate. In short, while we value the few, we underappreciate the many. Yet it is this ‘many’ that not only grace the planet, but also support a vast number of life functions that we rarely see, and so do not value. This unseen majority is apparent in swifts, martins and swallows wheeling for hours, catching insect food on the wing. At any one time, there are trillions of insects circulating in the air, known as ‘bioflows’, creating an intrinsically important dynamic ecological tapestry, where essential nutrients for ecosystems are continually circulated (Hu *et al.*, 2016).

Current concern is not just about the decline in insect species (Sánchez-Bayo and Wyckhuys, 2019), but also their abundances (Hallmann *et al.*, 2017), through fragmentation and attrition of insect populations globally (Samways, 2019). Put simply, insects are not as abundant or diverse as in the recent past. Insect decline was already recognized in

the 1870s (Swinton, 1880), and has become concerning since the 1950s, but today it is alarming. This could be the start of the largest global meltdown of insects – species and individuals – since the Cretaceous, 66 million years ago.

Perceptions

Many of the scientific and management tools are in place to halt, and in some locations reverse, this precipitous insect decline (Samways, 2015). The fundamental issue facing us is to improve our overall appreciation and valuation of insects, and then have the will to stop the decline (Simaika and Samways, 2018). While human-induced climate change has its deniers, global insect meltdown is shrouded in ignorance more than denial. It is now crucial that more people become aware of what is happening to insects, which, besides having intrinsic value in terms of their vast diversity and evolutionary legacy, are also essential for life as we know it, as well as for our survival (Losey and Vaughan, 2006). A third of our food crops, especially those of high nutritional value, require insect pollinators. Moreover, most flowering plants depend on insect pollinators. The global decline in insect pollinators has indeed been a shock, stimulating much needed action for recovery for all insects (Habel *et al.*, 2019). There is a growing realization that not only humans, but also much of the fabric of terrestrial life, depends on the ‘services’ of insects.

Reasons for insect decline

The reasons for human-driven insect decline are many and diverse. Loss of natural habitat, attrition of remaining habitat fragments, and agricultural intensification are the greatest threats to insects in most

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“A move away from agricultural intensification to ecological intensification (where all natural ecological integrity and ecosystem function and resilience is maintained) is now crucial.”

parts of the world (Gerlach *et al.*, 2012). Natural forests, wetlands and grasslands have been converted to plantations, grazing lands and croplands, making these areas often depauperate in insects. This large-scale onslaught on environmental conditions has resulted in collateral damage to insects. There has been little appreciation that these small animals rejuvenate and till the soil, enable the survival of flowering plants, support innumerable fauna that are higher in the food chain, and, through some of them being predatory or parasitic, are an effective alternative to the use of generally harmful pesticides. Their homes in the form of indigenous microhabitats are being taken away in a matter of just a few years.

In addition, the use of heavy machinery, nitrogenous fertilizers, pesticides and overly intense grazing, as well as pollution, has further impacted insects. Many of these compounded impacts are adversely synergistic, each producing increasingly antagonistic impacts alongside the others. Additionally, climate change has emerged as an extra impact, producing, in concert with landscape fragmentation, a ‘deadly anthropogenic cocktail’ (Travis, 2003).

Increasing human demands and incursions are also adding pressure on freshwater ecologies, whether through over-abstraction of water, or pollution of rivers, lakes, and other water bodies with pesticides, nitrogenous compounds and heavy metals (Darwall *et al.*, 2012). In and around towns and cities, there are two other impacts adversely affecting insects: artificial lighting, which disorients and affects the survival of night-flying insects such as moths (Longcore *et al.*, 2015), and roadkill from increased traffic density and speed (Martin *et al.*, 2018). Except in rare cases, these impacts are proving to be extremely challenging to address.

How to help insects

Firstly, we need to assess how insect species and their populations are faring. While such assessments require scientific validation, citizen science is now playing a vitally important role by providing more eyes and hands to record changes in insect

populations. In some areas, this extra help is physically improving conditions for insects through habitat restoration. Citizen science for young learners is also a great opportunity, not least because they are receptive to actions that improve their own future (Saunders *et al.*, 2018).

A move away from agricultural intensification to *ecological* intensification (where all natural ecological integrity and ecosystem function and resilience is maintained) is now crucial (Garibaldi *et al.*, 2019). This approach views insect and other diversity of life forms as requiring space. Yet this is not any space, but rather quality space in terms of allowing for a greater proportion of natural or semi-wild habitat relative to areas of production. Providing abundant protected areas of natural habitat, contiguous with cultivated lands, thus plays a major role in this approach. Also important are networks of conservation corridors (Figure 1; Samways and Pryke, 2016). At the smaller spatial scale, improvements for insect life can be fostered by planting insect-friendly strips of vegetation between crop rows (Figure 2). This practice is associated with the approach known as ‘integrated pest management’, where there is maximal use of natural enemies for injurious insects and thus less reliance on pesticides. Natural or semi-natural vegetation can also provide refuges and nectar resources for these natural enemies, as well as for pollinators (Winter *et al.*, 2018). This shift to a more sensitive ecological approach also necessitates a shift in human perception and values, to take on board a sustainable future for biodiversity and agriculture, beyond immediate commercial profitability.

In an urban environment, greenspace in the form of urban parks and eco-friendly gardens is playing a major role in insect protection (Guenat *et al.*, 2019). However, the issue of artificial lighting of urban areas is still a great challenge. There are some technical ways to reduce the impacts of light pollution, such as moving away from white to a softer light (Somers-Yeats *et al.*, 2013) and reducing roadkill



Figure 1. Large, remnant, high-quality conservation corridors, such as this one among plantation blocks, play a major role in conserving insects in a changing world.

through improvement in the structure and naturalness of roadside vegetation (Skórka *et al.*, 2013) and implementation of insect flight deflectors for their protection (Skórka *et al.*, 2015). However, globally there is limited motivation for implementing such actions, given so many other social perspectives and priorities among urban planners.

River protection ideally must consider the whole catchment, and must also include conservation of the riparian corridor, as many aquatic insects require both good water conditions and a healthy river margin (Dalzochio *et al.*, 2018). Ponds are also playing a major role in insect conservation, especially when they are well-vegetated, unpolluted, and functionally well connected (Hill *et al.*, 2018).

The future

Global climate change will be less severe on insect populations when

options are available for insects to move across the landscape, as they did before industrialization and widespread habitat fragmentation. This means that we must always consider ways to improve functional connectivity across the landscape, especially for maintaining high levels of intact populations and their dynamics across the landscape. Inevitably, we will see distinct insect winners and losers in this rapidly changing world, depending on the traits of species on the one hand, and the extent and degree of the challenges that they face on the other. While we are losing species and populations, some insect species are already genetically adapting to the new conditions. What is now required is raising awareness about the plight of insects and their importance to the natural functioning of the planet, and providing them with as many opportunities for survival as possible. ■



Figure 2. At a small spatial scale, inter-rows between crop lines (here vines) provide essential stepping stone habitats for insects across the landscape.

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Restoring the living ocean: The time is now

The first part of this two-part essay looks at the destruction that industrial fishing has unleashed on the global ocean. Human beings have forgotten the living abundance that the seas once harboured. A conglomerate of anthropocentric concepts, mega machines, international fishing fleets and consumerist oblivion has laid waste to that abundance, and brought extinction, death and suffering to marine beings. The subject matter of part two is deep-sea mining, which is under preparation for commercial launching. Like industrial fishing, it must be stopped. What is at stake at this historic moment is not only the fate of the living ocean, but who we are and who we choose to be as humanity on this planet.

Part 1: Sweet delight and endless night

The global ocean is imperilled. What remains of marine life abundance, a tiny fraction of what once was, continues to be afflicted by industrial fishing, anthropogenic starvations and diseases, rapid climate change and acidification, and all manner of pollution such as sewage, garbage, oil spills, and fertilizer and pesticide runoff (Danson, 2011). Persistent organic pollutants have infiltrated the ocean so that the bodies of some top predators meet the definition of toxic waste (Whitty, 2011: 118). And what to say of the spectre of gigantic amounts of plastic, decomposing but not biodegrading, killing millions of marine animals every year, and entering the worldwide food web? (Law and Thompson, 2014; Mooney, 2014).

Of the multiple threats to the ocean, industrial fishing has caused and continues to cause the greatest devastation. In the odd 150 years of its history, and especially since 1950, industrial fishing by an international cadre has perpetrated an egregious assault on fish – indeed, on all marine life and habitats. Along with industrial agriculture, industrial fishing constitutes Exhibit A of the human-supremacist mode of operation: both exercise *biome-scale* appropriation and extraction, with blithe matter-of-factness,

as if massively destroying ecosystems were the most normal thing ever devised. The global fishing industry operates more vessels than there are numbers of fish left to be caught, while the incalculable numbers of slaughtered bystanders are labelled ‘by-catch’ as if they are killed by mistake.

This onslaught on virtually the entire ocean rests on its presumed rightful conversion into an all-you-can-eat buffet for global consumers, cushioned with nomenclature like fisheries, fish stock, seafood and by-catch to moor the normality of that buffet in the human mind. Industrial fishing additionally depends on rezoning the ocean’s places as either nation-owned (economic exclusive zones) or humanity’s commonwealth (the high seas [also known as ‘the Area’]), thus institutionalizing human ownership of the ocean – and further befuddling the human mind. Industrial fishing also relies on a plunder-enabling international regime of ‘maximum sustainable yields’, flags of convenience, government subsidies, developing nations (corrupt and non-corrupt) selling fishing rights to developed nations (unscrupulous and not), and lax-to-non-existent law enforcement against illegal fishing practices by both authorized and poaching vessels.

What suffers is not only the living ocean whose very existence in the cosmos is as close to the miraculous as human beings can experience. What suffers is the human –

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“Ignorance about both the ecological history and current state of the ocean is rampant.”

human identity – degraded to user, usurper and petty criminal in the community of life.

Ignorance about both the ecological history and current state of the ocean is rampant. The seas have become destitute of “their once great abundance of whales, walruses, sea cows, seals, dolphins, sea turtles, sharks, rays, and large fish” (Jackson, 2005: 29). The immense shoals of small fish – known as prey or forage fish because they feed a diverse and large cast of predators – are also in precipitous decline. It strains the imagination to countenance the destruction of marine life that has occurred: to learn from archaeological data, eyewitness and first-hand accounts (e.g. fishing or whaling logbooks), and historical marine ecology about the cornucopia of marine life, most especially prior to when industrial fishing commenced on a global scale (Schrope, 2006; Roberts, 2007). Marine biologist Callum Roberts writes that “before 20th century industrial fishing took off, European seas seethed with life” (2007: 128); these were seas that had *already* been long assailed by fishing – we might try to imagine what that life-seething was like in places more untouched. On a global scale today, in the words of marine researchers Ransom Myers and Boris Worm, “everywhere you go, in every ocean basin, hotspots of life are only relics of what was once there” (Myers and Worm, 2005).

Without willingness to open to the understanding of what has been lost, humanity will remain incapable of aspiring to the restoration of life-filled seas. Instead, people will settle for the large-scale replacement of wild fish with factory-farmed fish, while seas suffer bulldozed continental shelves and seamounts, massive defaunation and extinctions, offshore and deep-sea mining, jellyfish population explosions, and the disappearance of coral reefs and coastal wetlands. Humanity is in danger of capitulating to the human takeover of the ocean that is leading to its ontological reduction into a ‘protein’ factory, a desalinizing solution to the freshwater crisis, a fossil-fuel and mineral extraction domain, and a global transit zone for container ships, nuclear-armed

submarines and cables. A ‘serviceable’ big body of water, in other words.

Abundance

Which is exactly what the ocean is not. Everything about the ocean – including its delicious scent, which is also fading (Upton, 2013) – flows from its polyphony of life. The ocean is a life-creating and life-proliferating crucible, the place where life itself likely emerged, and whose deep past lingers in our intimate fluids of sweat, blood, and tears (Helmreich, 2010). Until recently, the seas teemed with beings from the microscopic phytoplankton and zooplankton (the bottom of the food web, now threatened) to billions of prey fish, billions of carnivorous big fish, and millions of whales whose carcasses and dung returned to marine life – including to the abyssal biota – food to feed them. As true of the ocean as it is of the land, “the world is the sphere of superabundance. Heaven and Earth contrive to drip sweet dew. Contrary to the command of man, it drips evenly over all species” (Cafard, 2017: 70).

Abundance fed abundance and bred abundance, and fish often graced with long lives grew to be really big. (Fish typically continue to grow as they become older. Bigger fish lay more eggs, so bigness is a vital source of marine abundance.) In *The Unnatural History of the Seas*,¹ Callum Roberts reports that 30-foot great white sharks were compared to whales and 20-foot sharks (rare these days) were common when, for example, the Europeans arrived at the islands, shores and seas of the New World (Roberts, 2007). Erstwhile numbers and sizes of all fish are legendary – not only the cod who fed people for centuries, but also the tuna, marlin, sturgeon, salmon and swordfish to name some others. Cod could reach three feet, and their extravagant numbers were compared with grains of sand; imagine the numbers of the fish they fed on. The average swordfish today has dropped to less than half the size it was 100 years ago (Danson, 2011: 104), meaning that swordfish live under the perpetual shadow of being hunted so their odds of living long are slim.

Indeed marine animals do not get to live as long, eat as heartily and grow as big as they did when the seas overflowed with life, and feeding was not a competition or a struggle with scarcity, but an extravaganza of more-than-plenty to go around. Coastal seas were bursting with enormous diversity and numbers of beings, and wildlife spectacles could be witnessed from shore (Roberts, 2007). What beauty there was to bruise the eyes when the Caribbean was graced with coral reefs, forested with sea meadows, and dwelled in by innumerable groupers, reef sharks, moray eels, rays, parrotfish, seals, sea turtles, and rainbows of all sorts and sizes of tropical fish (Figure 1). Only ten per cent of the original coral-reef Caribbean habitat remains today. Imagining the Mediterranean in the early Holocene is nearly impossible, for it is a sea that has been subject to human exploitation for millennia. To grope in the mind's eye

towards former and not that distant Edens of the seas is not some nostalgic pastime: It is about nurturing a yearning towards who *we need to become* to restore and inhabit that rich lifeworld again.

The food web of the ocean belied the classic pyramid structure of profusion of microorganisms, followed by prolific plant life and small critters, topped by lesser numbers of mid-sized predators, and finally capped by few large predators at the web's apex. Rather than being triangular, the ocean's food web displayed abundance at every trophic tier (Jackson, 2005). The plankton and krill; prey fish like herring, sand eels, sardines, menhaden and anchovetas; the larger fish such as mackerel, cod, haddock, pollock and sturgeon; the even bigger ones, like sharks, swordfish and tuna; the sea turtles and the seabirds; the mammals, such as seals, manatees, dolphins, porpoises and whales;



Figure 1. A sea turtle photographed off Curaçao in the Caribbean Sea in 2012 (photo: Laszlo Ilyes [CC BY 2.0; <https://creativecommons.org/licenses/by/2.0/>]).

and the habitat-building oysters, mussels, sponges, clams and reefs. Numbers of species, population masses, extravagant sizes and marine wildlife spectacles were as unbounded as the seas are wide and deep.

An intimate and rich conversation primordially bonds marine and terrestrial life. Clouds forming over the seas with the help of oceanic microorganisms bring rain to the land, and rain loosens nutrients from rocks that flow back to the sea via rivers. The ocean's bounty was also brought inland by anadromous fish (Waldman, 2010; Jackson *et al.*, 2011). Rivers of fish might be pursued inland by their predators, like porpoises swimming up Britain's Thames and sharks into North America's James River. The salmon, shad, whitefish, sturgeon and others brought nutrients to the terrestrial animals, trees and soil. Eels went the other way, bringing gifts of the land to the seas. Thus is the natural world knit into a higher-order pattern of intelligence through life's strivings, sensory pleasures, evolved interfaces, whole-weaving multiplicities and mutual feasts.

Stories of fish-filled seas and rivers, and of fecund ecotones where ocean and land meet, teach us that our life-science ideas about 'cooperation versus competition' and 'mutualism versus struggle for survival', while exhibiting some limited erudition, do not hold a candle to life's phenomena themselves, which are creative, fecund, myriad and relational, including relations between different species of mind. For millennia, Western civilization endeavoured to keep itself in the dark about non-human minds, for they have represented a cardinal threat to human arrogance. When we awaken (as is dawning today) to the pervasiveness of forms of awareness on this planet, we surface into awe. When we awaken, we see ourselves *seen* from non-human standpoints – and recognize that we have always been seen. We acknowledge that we do not want to be seen as tyrant-zombies to be feared and avoided, but rather as mindful, curious beings who might even evoke awe in them. Awe is not epiphenomenal sentimentality. It is a state of grounded being that reflects

the awesomeness of the living world; it is the real ground to build human life and inhabitation.

Experiencing the numinous quality of non-human awareness is blissful. That some might dismiss such a statement as romantic does not undo the fact that a clear human being encountering the numinous quality of non-human awareness feels bliss – subtle or elating, commonplace or sublime. Indigenous peoples, who were conscious of the nexus of perceiving-the-numinous and experiencing-bliss, participated in the living world's creativity, abundance, multiplicity and reciprocity. Along with bears, eagles and trees, they also welcomed and ate the migrating fish. And the fish always returned, in numbers that "stretched capacity to believe," surging onward, seeming to reverse the river's flow, spawning prodigiously, more than enough to sustain the forest and its beings, more than enough to recreate their own abundance (Roberts, 2007: 49; Vickers and McClenachan, 2011: 128).

Wetiko

More than enough to keep the First People in gratitude (House, 1999). Not so for members of a culture raised on a credo of *Homo sapiens'* superlative stature. As Native American writer Jack Forbes expounds about the Wetiko psychosis, supremacist individuals and societies destroy in order to devour the life of those considered beneath them, whether non-human or human (Forbes, 2008). The belief of being exceptional – ensouled, rational, self-aware, technological or what-have-you – makes it easy to turn others into *just* trees, just fish, just rivers, just meat, or, until not too long ago, just savages.

The fish runs of Europe were wrecked by fishing, dams and industry in the medieval period, all but silencing one of the planet's sea-land conversations (Roberts, 2007). Europeans turned to their fish-abounding coasts, and, after overfishing them, continued fishing further and further afield. Eventually, they came to the New World for its fish – and for its whales, walruses, seals, seabirds, sea turtles and

“For millennia, Western civilization endeavoured to keep itself in the dark about non-human minds, for they have represented a cardinal threat to human arrogance.”



Figure 2. Plastic pollution on a beach in Ghana in 2018 (photo: Muntaka Chasant [CC BY-SA 4.0; <https://creativecommons.org/licenses/by-sa/4.0/>]).

sea otters. Thus, ‘civilized’ rapaciousness towards the natural world kept rehearsing itself, except that the destruction of the New World was more horrific because of its speed, scale and brutality. By the early modern period, Wetiko markets targeting oblivious consumers were devouring the marine life of the New World as flesh, eggs, oils, pelts, fur and feather commodities (Mowat, 1996).

Over the course of centuries and accelerating in the 18th through the 20th, the whale people – called “fisheries” – were serially decimated, population after population, place after place, and species after species. Wherever seafarers found unexploited whale pods, the numbers were staggering. The whales came to see those seafarers, crowding around the ship vessels; they were slaughtered in response. Yet those whalers were not murderers – they were brainwashed by a sociocultural setup of human supremacy, and thus stripped of the desire (*the human birthright*) to see, be seen by and communicate with non-humans. To learn this missive from history – of the internal connection between the devastation of the non-human realm and the pitiable contraction

of the human spirit – is key to redeeming that history through the liberation of all Earthlings from the physical cruelty and mental decay of supremacist creeds.

By the end of the 19th century, whaling was a global business. Today, even with a moratorium, the vast majority of whales are gone. Where once they sought us, now many humans seek to be near them. We must restore a world in which they thrive again and we can mutually meet. Every life meeting is a meeting of minds, and in the meeting of minds lies one of the greatest joys of being alive. Therefore, still-whaling nations must stand down today. The whales are experiencing suffering enough – what with anthropogenic starvations and disease, ship collisions, entanglements in fishing gear, noise pollution and the scourge of plastic waste (Figure 2). One hundred thousand small whales, dolphins, and porpoises are deliberately slaughtered every year, by an international cast of offenders, for meat, bait or body parts (Altherr and Hodgins, 2018). Whales are washing up emaciated and with their stomachs full of plastic and garbage. In one example, a sperm whale beached in 2012 was found to have in their stomach

“From an exuberance of life the ocean has become unsafe for its residents, yet the public seems buffered from that knowledge, society keeps up the pretense of seafood as ‘health food’ and the mainstream observes silence about the plight of the sea’s beings.”

30 square metres of tarpaulin, 4.5 metres of long hose, a 9-metre plastic rope and two flower pots.² Yet a few centuries ago, sperm whales were a million strong and schools of them numbered 600 to 700 (Whitty, 2011: 167; Roberts, 2007: 93). Now, with just a fraction of sperm whales left, and behemoth-sized males scarce, if a family of females and their children run into hungry killer whales – themselves suffering from toxic pollutants, food insecurity, and starvations – there may follow an agonizing ripping of flesh: the protection that numbers and sizes of sperm whales offered against killer-whale predation are gone (Whitty, 2011).

The standard answer to industrial fishing decimations of “fish stocks” has been to “‘move on’ down the food web, toward deeper waters, and to other areas or regions of the world” (Sumaila and Pauly, 2011: 25). That historical pattern continues, even as global fish catch peaked over two decades ago. Today, industrial fishing fleets from China, European nation-states, Chile, Indonesia, Canada, the US, India, Thailand, South Korea and Vietnam, to name some players, are rushing to extract the fish of their own seas, of the high seas, of Africa’s coasts, of any places fish are left to extract. The fishing methods – trawling (super-trawlers can reach the length of 1.5 American football fields), long-line fishing (with thousands of baited hooks), and purse-seine netting (which can be more than 6000 feet in length and 600 feet in depth) – are expedient at mass killing. One fishing tactic exploits the predilection of fish and other marine creatures to gather around floating objects in the open sea. Buoys called ‘fish aggregating devices’ (FADs), often equipped with sonar and GPS, are strewn across the ocean to lure fish into their vicinity before the fishing vessels arrive. In the western and central Pacific Ocean alone, there are more than 50,000 FADs legally sited (Urbina, 2019: 65). All around, the industrial-fishing machine has become ‘High-Tech Wetiko’.

People of developing nations, who rely on fish from artisanal fishers, are robbed of both livelihood and nourishment by

the industrial-fishing complex (Golden *et al.*, 2016). Along with other marine beings, fish are being exterminated at every ecological tier of the ocean, with shoddy accountability on that (legal, shady and illegal) appropriation (Pauly and Zeller, 2016). The majority of ‘fish stock’ and ‘fisheries’ – jargon that warps living seas into human warehouses – are so exploited that the trend in biomass across species is sliding downhill (Gjerde *et al.*, 2013: 540). Only 10 percent of the historical populations of big fish remain (Myers and Worm, 2005).

All the entitled taking is emptying the seas of the livelihood of marine animals. Vacuuming the herring, menhaden, anchovies, sardines and other small fish is taking its toll on seabirds, sea lions, penguins, dolphins and whales, among others. On California’s coast, sea lions and their pups have recently experienced famine (Steinmetz, 2014). Arctic terns, puffins, albatrosses, and other seabirds are taking nosedives in their numbers (van Dooren, 2014: chapter 1). Seabird populations have declined by 70% overall since 1970. With krill opined a ‘sustainable fishery’ – for such consumer niceties as aquaculture feed and health supplements – how can whales find sufficient sustenance to make a comeback? (Since the 1970s, krill populations have declined by 80% [Taylor, 2018].) Plastic bags strangle the digestive tracts of sea turtles who mistake them for jellyfish. All species of sea turtles are endangered from multiple pressures (see Crist [2019: 137–9]). Over a million seabirds, 100,000 marine mammals and uncountable fish die yearly in the North Pacific from eating plastic or getting ensnared in it (Casey, 2010). From an exuberance of life the ocean has become unsafe for its residents, yet the public seems buffered from that knowledge, society keeps up the pretense of seafood as ‘health food’, and the mainstream observes silence about the plight of the sea’s beings, thus breathing new meaning into the adage Silence = Death.

Reality versus normality

It is amazing to watch how Dr Seuss captivates the minds of children with so

many interdimensional flower-animal-beings in enchanted landscapes filled with colourful structures that protrude, intrude and levitate. We inhabit a world that makes Dr Seuss's creativity a dreamy plagiarism of its creatures, their antics, their peregrinations and their makings of worlds. We are members of a living planet that also enchants children, before they grow into the brainwash that Earth is human property composed of natural resources, providing maximum yields of, among other things, cheap seafood. Cheap seafood that can be eaten by the global consumer class – which recently passed the half point of the global population (Kharas and Hamel, 2018) – in any amount, at any time, and with much enthusiasm for all its ostensible micronutrients. Yet the counsel deserves stating that the days when eating fish was good for human fitness are receding in the rearview mirror, while the currently unknown repercussions of ingesting microplastics are undergoing a mammoth 'experimental trial'.

Where submerged continents extend out towards ocean depths, they form once-life-prolific continental shelves: In rampages of demolitions, industrial trawlers have gouged out marine beings and shattered their three-dimensional, life-created habitats. Rolling hills filled with fish, mussels, oysters, crabs, anemones, tubeworms and sponges, among others, have been smashed and levelled, while leafy glades and sea forests have been turned to muddy flats. "Today," writes Roberts, "there is hardly a scrap of suitable bottom in the world that has not felt the scrape of a trawl." As a result, where there once were "rich, complex, and productive habitats," what predominates is "gravel, sand, and mud" (Roberts, 2007: 156). "Each year," writes Ted Danson, "the world's fleet of bottom trawlers disturbs a seabed area twice the size of the contiguous United States" (2011: 82). Trawlers should have been decommissioned long ago, their parts recycled into something useful. Quite to the contrary, however, having fished out the relatively accessible waters of continental shelves, there are other ocean

wonders they have taken to vandalizing: its mountains.

Earth's seamounts jut out of ocean depths forming majestic peaks, gorges and valleys. Life has set up house on them, of course. Deep-sea coral lives there, some of it hundreds and even thousands of years old. Fish who have evolved abilities to withstand extreme conditions of pressure and cold also live there. Trans-oceanic travellers like tuna, sharks and sea turtles make stopovers. These are places dwelled in by some of Earth's strangest, most long-lived children. They are oases of gorgeous life. Here come the trawlers with their military gear and yawning steel mouths to desecrate the mounts, extract the fish and discard the by-catch. It is horror-genre material turned into a reality show in the ongoing staging of human supremacy on Earth.

The people who eat the fish live 'light-years' away from the continental shelves, high seas and seamounts and know little about them. Certainly not about the sea mounts' Seuss-like corals, sea fans and fish who are older than their grandmothers. Nor any of the cool science stories about those habitats and their endemism, or evolutionary tales from coruscating stardust to the magic of creatures who make their own light. The fish suddenly appear in the supermarket. Some of them living near Australia and New Zealand used to be called 'slime heads', but were renamed 'orange roughy' for better marketing appeal (Kurlansky, 2011). Some of them dwelling in the Southern Ocean, called 'toothfish', were renamed 'Chilean sea bass' for its exotic ring (Urbina, 2019). Having suffered the fleeting reduction into being-flesh,³ and predictable 'fishery collapses', what fragment of real life of our slime head and toothfish cousins remains, and of so many others who have suffered and are suffering the same fate (Dreifus, 2002; Victorero *et al.*, 2018)?

It is not necessary to Question Reality in whose cosmic play we are enmeshed, even as we are denied metaphysical knowledge of what lies beyond it. Questioning Normality, however, is good. For example, the octopus

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“The industrial-fishing regime has remodelled the ocean into a scrumptious food jar from which to extract cheap fish for the global consumer class. This regime will be allowed to destroy the living ocean as long as we continue to think, without explicitly thinking it, that industrial fishing is normal.”

on the menu. If you give an octopus in an aquarium a ball, she will bounce it against the walls to pass the time. It is good also to question the mass-produced shrimp, spooned into one another on the mass-produced plastic cocktail trays. For every pound of shrimp, 10 pounds of sea life are thrown overboard dead and dying (by-catch); tens of thousands of sea turtles are killed yearly by commercial shrimp trawls in the Gulf of Mexico (by-catch); and mangrove ecologies are deforested for shrimp aquaculture (Danson, 2011; Keledjian *et al.*, 2014). Let's question the parade of fish species featured in lines like Filet-O-Fish and look into the labour conditions that deliver cheap fish (Urbina, 2019). And: Do you really want to eat the factory-farmed, dyed-pink, wild-fish-fed, habitat-polluting, soon-to-be-GM salmon?

“Think about that slab of tuna in the deli case as bushmeat,” urges marine biologist Sylvia Earle (2003). More to the point, think about that slab of tuna as a crime.⁴ Question the restaurant grouper that may well not be a grouper – or worse, actually is.⁵ The swordfish steak: Can we not let them be? The tasty scallops? Along with half of the total fish catch, they come from trawling, which (it bears repeating) is among the most base assaults on nature ever orchestrated. With indiscriminating violence, in a matter of hours, trawlers devastate what it took the natural world hundreds or thousands of years to create. (The silt clouds that trawlers stir underwater can show up on satellite images.) What about the lobsters? They are still plentiful, because their predators have been decimated. Lobsters were once so beneath polite-society food, they were fed to convicts and slaves and used for fertilizer. Lobsters have had a status ‘upgrade’ because in certain places they are all that is left. When lobsters lived out their natural lifespans, they might grow to 20 pounds.

It is good to Question Normality for all the above reasons. It is especially important to question the normality of calling sea life ‘marine resources for harvesting’. A resource does not feel, think or know pleasure. It cannot die, starve, suffer or

be treated unjustly. A resource does not create exquisite worlds nor look you in the eye. It can be ‘harvested unsustainably’ or, unwanted, thrown overboard like trash. A resource can be ‘depleted’ and may even ‘collapse’. When such things happen to the resource, earnest calls entreat more sustainable harvesting (or farming). The problem with this ostensible corrective to the serial depletion of fish is that, as a solution, it will never retrieve the primordial condition of free seas of abundant, creative and ocean-churning life. The intent of ‘fisheries management’ is not to restore such living waters, but to make maximal taking from the ocean pantry sustainable. “The goal of fisheries management,” in official speak, “is to optimize society’s total benefit from the use of natural resources” (Nielsen, 1976: 15). A telling exercise would be to deconstruct virtually every word in this sentence to discern how the real is denatured into the normal.

From living artwork composed by a plenum of beings and phenomena – with dramatic, life-sustaining reverberations throughout the whole Earth system (including, notably, the air we breathe) – the industrial-fishing regime has remodelled the ocean into a scrumptious food jar from which to extract cheap fish for the global consumer class. This regime will be allowed to destroy the living ocean as long as we continue to think, without explicitly thinking it, that industrial fishing is normal.

Cosmic wealth

We can choose the real over the normal by giving the ocean back its freedom, thus enabling the restitution of its abundant life. Despite a frequent incrimination of climate change as cause of sea-life trouble, industrial fishing is the chief driver of marine biodiversity destruction (Pitcher and Cheung, 2013: 510; McCauley *et al.*, 2015). To underscore this, consider coral reefs, which *are* directly imperilled by climate change and acidification. Yet today, coral reef areas that are strictly protected from fishing (and pollution) are faring

better than those not so protected (Roberts *et al.*, 2017). This means that in order to have a shot at preserving the world's coral reefs, we must strictly protect them right now. Indeed, restoring oceanic life requires bold action. Captain Paul Watson calls for a 50-year moratorium on all commercial fishing "to give the ocean time to repair itself" (Watson, 2018: 152). Given the devastated condition of marine life, and an ocean heading towards mass extinction and decimations of wild fish, this is a self-evidently rational proposal. Is it too much to hope that some leaders might have sufficient clarity to hear it, and sufficient courage to attempt its implementation?

At the very least, we must immediately establish a vast ocean-wide network of marine protected areas. This can begin with an international agreement to stop all fishing in the high seas. By prohibiting legal fishing in the high seas, illegal fishing vessels would become more readily detectable, making law enforcement easier. Along with networked protected areas along the world's coasts, estuaries and islands, full high-seas protection would enable the renewal of marine life: research reveals that ecological revival follows in strictly protected marine areas (Warne, 2007; Roberts *et al.*, 2017).

We must end the mass extermination enterprise of industrial fishing with its collateral slaying of whales, dolphins, sharks, sea turtles and seabirds, among innumerable others (Keledjian *et al.*, 2014). Indeed, artisanal and subsistence fishers agitated for the abolition of trawling almost as soon as it was invented (Roberts, 2007: chapter 10). Calls to ban trawling have continued but been derailed by the fishing industry (Rabesandratana, 2013). At this eleventh hour, humanity must find the wisdom and the mettle to dismantle all industrial-fishing weapons, starting with trawling (Danson, 2011; Keledjian *et al.*, 2014; Rabesandratana, 2013).

For a life-filled ocean to return we must also stop polluting it at all point sources, and reverse, to the greatest extent possible, the pollution already plaguing it. This requires, among other measures, ending

plastic production and use. "What we are witnessing in the global ocean," states scientist Marcus Eriksen, "is a growing threat of toxin-laden microplastics cycling through the entire marine ecosystem" (quoted in Mooney [2014]). Ending ocean pollution also means embracing agroecological food production and phasing out industrial agriculture with its estuary-killing fertilizer and pesticide run-off, and its hefty contribution to climate upheaval.

In the medium-to-longer term, we must work towards humanely lowering our global population considerably in order to support the substantial lowering of fish consumption and to enable the deindustrialization of all food production (Crist, 2019). Even as it is an ecocentric imperative today, in a downsized future people can also opt for eating fish sparingly, so that the cosmic wealth of marine life is preserved. The choice of eating *no* fish is also prudent – especially where people are not dependent on fish for basic nourishment – to avoid the infliction of unnecessary suffering. As author Jonathan Safran Foer states (2009: 193): "No fish gets a good death. Not a single one. You never have to wonder if the fish on your plate had to suffer. It did."

In a world of globally trading billions, the mass consumption of fish equals the mass extermination of beings and ecologies that we, and our descendants, might explore and witness instead of eating without restraint. "The great majority of sea species are badly depleted," Jackson rues. "But they still exist. If people actually went away, most could recover" (quoted in Weisman [2007: 266]). We do not literally have to go away. Just lay the weapons down. In exchange, we will feast our eyes and minds with the pleasures of life's marvels, encountering forms of awareness unlike our own, and bathing the fire of our sight in the colour and dance of diverse sea animals and plants. We will behold the living ocean, which has the distinction, in all time and space, of resembling nothing other than itself. Creating a global culture that valorizes the arts of snorkelling and scuba diving (practised mindfully), as much as it values

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the gifts of education and healthcare for all – that is a culture worthy of the highest aspirations of the human.

Coda

Before this option can open to our collective consciousness the worldview of human distinction – and its nature-mutilating and mind-numbing framework of “natural resources” – must be jettisoned. For now, that worldview and its idioms shape how many people think, are conditioned to think, about the seas. Humanity’s entitlement over the Earth is distilled in language deployed to reason with. For example: “Common-pool fish stocks are often open-access, and fishing effort can push stock levels beyond maximum sustainable yield. In those cases, price increases lead to reduced seafood production” (Smith *et al.*, 2010: 784). (Actually, price increases can fuel hunting down creatures to [regional, commercial or global] extinction, as happened to California’s sea otters and abalones and is happening today to bluefin tuna.) Back to the language: “Common-pool,” “fish stocks,” “open-access,” “fishing effort,” “stock levels,” “maximum sustainable yield,” “price increases,” “seafood production” – none of this anthropocentric babble has anything to do with marine life: It is resource-contortionist vocabulary twisting the ocean into a human manor.

Before our eyes and under our watch stretches the endless night of marine life decimations and extinctions, with the global ocean turned into a natural-resources-for-harvesting and fish-factory-farm domain, as well as garbage dump, mining frontier, ship lane terrain and ‘carbon sink’. Alternatively stretches the sweet delight of a life-filled ocean we can restore, preserve, commune with, and imbibe with body, senses and mind.

A civilization that chooses endless night over sweet delight slumbers. A civilization that orchestrates the pretension that industrial fishing is normal, and that the abolition of industrial fishing is radical, lacks judgement. A civilization that treats the seas like a human food pantry is a hungry ghost. A civilization that cannot see

that ocean pollution is an extremely urgent problem is blind. A civilization incapable of choosing to be in love with the ocean does not deserve our respect. We must disidentify human *being* from this civilization and evolve it to a higher octave. ■

Part 2: Leave it in the ocean! Halt plans for deep-sea mining

A new chapter of Earth pillage is in the works: the commercial venture of deep-sea mining. The deep sea, over 200 meters below sea level and comprising roughly 65% of Earth’s surface, is being encroached on by nation-states and industries slaving over “mind-boggling quantities of untapped resources” (Mengerink *et al.*, 2014: 696).

The setup

Deep-sea mining has gotten quietly under way since the turn of the century. The International Seabed Authority (ISA), a United-Nations-created body of 168 states, has already conceded 29 exploratory mining contracts for the high seas covering over 1.2 million square miles (Wedding *et al.*, 2015; IUCN, 2018). Additionally, nation-states and corporations have brokered deals for mining national waters. For example, Papua New Guinea has given permission to Canadian company Nautilus Minerals to mine deep-sea sulphide deposits off its coast for copper and gold (Davidson and Doherty, 2017).⁶

There is no doubt about the obscenity of the unfolding enterprise of deep-sea mining, nor about its significance. Ours is the long-overdue time to put down the warring weapons against Earth, scale back humanity’s presence, cease our invasions into the natural world and withdraw from large-scale portions of the ecosphere. Yet what do we see? A human-supremacist coalition of nation-states and corporations preparing to deal out more death in exchange for ‘natural resources’.

It’s never been a matter of *whether* deep-sea mining should proceed. Just a well-

planned, technologically ready raid about to be fast-tracked into business as usual. It is blithely dubbed “the new gold rush” (e.g. *The Economist*, 2017), as though we don’t know how depraved the old one was. The new venture is not only for gold but also for other metals and minerals like silver, copper, cobalt, nickel, manganese, zinc, rare earths and yttrium. Filching this stuff from Earth’s seas is deemed necessary for making ever more cell phones, iPads, PCs, Kindles, batteries, LED bulbs, flat-screen TVs, fuel cells, wind turbines and so on, not to mention “essential parts of advanced military technology,” like missile guidance, laser targeting and radar surveillance (Kato, 2017).

Piling on the cheap cliché of “the new gold rush,” the deep sea is being called “the last resource frontier.” That “resource frontier” is neither. The deep sea is filled with beautiful life, amazing adaptations, abiding mystery, primordial being. There are millions of species in the deep sea, Earth’s largest biome, yet we know next to nothing about its biodiversity (University of Oxford, 2017; www.savethehighseas.org). The places targeted for violation – hydrothermal vents for sulphides, seamounts for cobalt and the abyssal seabed for polymetallic nodules – are life-abundant and largely life-created (Vanreusel *et al.*, 2016; Van Dover *et al.*, 2018). All harbour a great diversity of endemic and mostly unknown species, yet they are currently being wrecked by mining machinery – even before commercial deep-sea mining ‘regulations’ are in place.

The destruction of life forms and habitats that commercial deep-sea mining will cause will be enormous and irreparable in human timescales (Koslow, 2007; Van Dover *et al.*, 2017; Niner *et al.*, 2018). Given the extensive endemism of living beings in the targeted areas, exploratory mining has almost certainly already caused extinctions. Commercial deep-sea mining will cause many more – the kind EO Wilson calls anonymous extinctions since most deep-sea species are unknown (Wilson 1999: 243). In addition to the outrage of this impending assault on life poised to quicken the sixth mass extinction, there

is the outrage of a political-economic human-supremacist posse that has the gall, at this historical moment, to introduce a new chapter of Earth desecration – in the name of servicing a ‘green economy’ to boot (Carrington, 2017; *The Economist*, 2017).

Humanity’s common heritage – not

In 1982, UNCLOS declared the seas beyond national jurisdiction – the high seas or ‘the Area’ – “the common heritage of mankind.” Let’s bring that one up to speed with current language-use decorum. UNCLOS surely meant “the common heritage of *humankind*,” as contemporary reports are rectifying (see, e.g., Jaeckel *et al.* [2017]). That one raises virtually no eyebrows. On the contrary, it is avowed a *principle* – one “generally understood to require access and benefit-sharing arrangements, especially for developing [nation]-states” (Jaeckel *et al.*, 2017: 150). The common heritage of humankind raises the dutiful mandate to ensure that “financial and other economic benefits” of deep-sea mining “will be equitably shared among all states” (Kim, 2017: 135). “UNCLOS recognizes,” as echoed in another anthropocentric skin-deep hoopla for justice, “the right of all states to access marine living resources in ABNJ[s] [areas beyond national jurisdiction]” (Danovaro *et al.*, 2017: 453).

How is it that calling the high seas “the common heritage of humankind” pulls the wool over so many eyes? An ancient living landscape, pre-existing *Homo sapiens* by millions of years – *humanity’s* common heritage? In response to the species- and habitat-demolishing spectre of industrial-scale deep-sea mining, well-meaning scientists and analysts engaged with this topic are scrambling for damage control couched in environmental pleas: for ‘preservation reference zones’, ‘remediation obligations’, ‘balancing trade-offs’, ‘environmental impact assessments’, ‘mitigation strategies’, ‘baseline data’, ‘holistic management of deep-sea use’ and so on and so forth. The very political-economic establishment that is destroying

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the Earth and endangering so much of humanity seems to have successfully whipped a host of experts into submission as it gears up for a united-front gold rush on the last resource frontier.

Indeed, that establishment is consummately skilled at procuring near-universal compliance to its ecosphere-wrecking dictates by means of a two-tiered mode of operation: one discursive, the other operational. The discursive one is the long-standing appropriation of planet Earth as human property, enabling the embezzlement of all geographical space for human exploitation, use, control and management. For the high seas, this indoctrination spins out in their 'declaration' as the common heritage of humankind. People hesitate to call out such pompous drivel for fear of being dismissed as foolish, idealistic or radical. Most choose instead to defer to official discourse, and do their best to make the seemingly 'inevitable' deep-sea mining a little less destructive. The second strategy by which the human-supremacist regime secures near-universal submission is operational: *Just do it*. Exactly what has been orchestrated with deep-sea mining: it is underway; most states are already involved (now or in principle) given the ISA's international composition; the technologies are developed and being tested; and the regulations to dress it all up as 'sustainable' are being ironed out.

The cognitive schema of Earth-ownership and the operational schema of Earth-looting work together. Planetary ownership authorizes getting an operational head-start, which subsequently invites more: after all, it has already begun, certain players are currently more involved than others, and, when it comes to politically correct Earth-ravaging, everyone in the posse needs to get a turn. To mirror the vulgarity of deep-sea mining and its squalid creep: spitting into the soup is the surest way to ensure you get to eat it. How fitting for a species-killing and habitat-destroying political-economic global regime, which is "never contented but always encroaching," in the words

of Shawnee Chief Tecumseh (quoted in Waters [1972: 278]).

The ecocentric response

Not only must deep-sea mining and current projects be immediately halted, but today's crisis of life in the global ocean calls for placing the high seas off limits to *all* extractive activity: for fish, fossil fuels, and metals and minerals. We must rename the Area 'the common heritage of all life' to reflect what it actually is. Human presence in the high seas can be limited to the lightest of touches, for the elevated purpose of witnessing, learning about and teaching our children the marvels with whom we share the ecosphere. With the high seas designated a marine protected area (MPA), marine-life abundance will rebound and be able to cope (and help humanity cope) with climatic upheaval and ocean acidification (see Roberts *et al.* [2017]). Coastal seas and continental shelves (critically endangered and endangered, respectively [Jackson, 2008]) are also in urgent need of robust MPA networks. Ocean protection levels can thus achieve upwards of 80%.

Along with setting vast areas of the ocean free, we must turn the spotlight on the high-tech industry – the one poised to most benefit (if profiteering counts as 'benefit') from deep-sea mining. The high-tech industry needs to change fundamentally and clean up its act, rather than trying to buy another century's worth of time for its wasteful, dollar-hungry workings. First, engineering, investing and public policy must focus resolutely on recycling metals and minerals (Teske, 2017). Even though recycling potential for materials connected with deep-sea mining is high, actual recycled contents remain low; for example, less than one per cent of rare earths are recycled (Kim, 2017: 135–6). The focus of turning an extraction industry into a recycling one will give Earth a rest, while forcing governments and industry to quit dumping their e-waste on the disempowered – human and non-human.

Second, the high-tech industry must put an end to the profligate production of ever-more devices, to be replaced by

“Human presence in the high seas can be limited to the lightest of touches, for the elevated purpose of witnessing, learning about and teaching our children the marvels with whom we share the ecosphere.”

ever-more new lines. (The same applies for the production of other commodities like cars and appliances.) Instead, the high-tech industry – calling here on any conscientious leadership therein – needs an immediate paradigm shift toward the durable: stuff must be made well, made to last, and made to use not flaunt (McKibben, 2008). Devices can indeed be long-lasting, made to be repairable if they malfunction, and only upgraded when hugely meaningful increases in efficiency, or changes in energy sourcing, warrant ‘new generations’. Finally, civil society has to figure out how to create a culture of sharing this stuff.

One last response to the spectre of deep-sea mining is to raise a question: If this planned Earth violation does not reveal the imperative to achieve a lower global population, what does? The global middle class – the clientele of high-tech products – is growing rapidly. The middle-class population is projected to reach 5 billion before mid-century (Kharas, 2017). All these people are expected to want cell phones, PCs, flat-screen TVs, hybrid cars, solar panels and so on. Making materials recyclable, durable and shareable is critical, but it will only get us so far. Design changes and behavioural shifts will not offset the commodity-supply surges that the growing global middle-class population portends. Therefore, we must ramp up without further delay the human-rights campaigns – for women’s equality, state of the art family planning, and comprehensive sexuality education for all – that will steer the human population towards a ballpark figure of 2 billion (Engelman, 2016; Kaidbey and Engelman, 2017; Crist *et al.*, 2017; Crist, 2019).

We cohabit living Earth with countless Earthlings we know and more we have still to meet. Are we awake yet? ■

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Notes

- 1 This is a must-read work about the history of human impact on the ocean.
- 2 See the video *It’s a Plastic World*, which is available at <https://is.gd/xYe4Um>.
- 3 For critical explorations of the reduction of animals to meat, see Plumwood (2013) and Calarco (2014).
- 4 Something that Jeremy Jackson does (see, *e.g.*, <https://is.gd/qjY3SE>).
- 5 Seafood fraud is apparently common (see Danson [2011]).
- 6 Fortunately, that relationship has run into political and economic controversy, forestalling or derailing mining plans, though Nautilus Minerals continues to hold the deep-sea mining licence from the government of Papua New Guinea (The Economist, 2018; Heffernan, 2019).

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Greater flamingos in a nature reserve in the Camargue, France

‘Making hay’: A conditional defence on ecocentric grounds of various co-created habitats

This article begins with an argument and delimiting conditions for the place of certain traditional anthropogenic, or ‘co-created’, habitats within ecocentrically minded conservation. Next, four examples of such co-created habitats are explored: lowland meadows, heathland, coppiced woodland and old orchards. The examples are drawn from the lowlands of Great Britain but their discussion has geographically broader implications. Such habitats, it is argued, have a place within an ecosphere that elsewhere evidences a major stepping back of humans; within this wider context, they can act as ‘reservoirs’ from which biodiversity can radiate again once the time comes. In other words, they represent a means of widening the bottleneck through which life is passing. They also offer not only a liberation from the destructive nature of approaches to land management forged by industrialism but also a roadmap for a revival of forgotten skills in a future culture of simplicity and creativity.

It was the right book at the right time. When I read *Keeping the Wild* (Wuerthner *et al.*, 2014) shortly after it was published, I was nearing the completion of a personal journey to ecocentrism.¹ This anthology brought together new and republished writings that emphatically defended the protected-areas movement against the attacks of Anthropocene boosters.² At the same time, it provided a deliciously radical challenge to the things I was beginning to loathe in my life in a small city set in a human-dominated landscape. I’m almost certain that I will never read a book that influences me more strongly.

In regard to Earth’s biodiversity crisis – the focus of this special issue – the message from that anthology and subsequent related pieces is a compelling one. For the sake of wildlife, wild places, and ecological processes, we need to protect all remaining intact ecosystems (*e.g.* Watson *et al.*, 2018), and we must also scale back the negative impacts of modern human society on the ecosphere (Crist, 2019), opening up opportunities for ecological rebounding. As coherent as this is, though, a dangerous caricature of ecocentrism can emerge from such a grand vision. The caricature, which, if taken seriously, will harm not just the ecocentric worldview’s credibility but

wildlife too is this: *Ecocentrism calls for all land to be returned to a self-willed state, free of major human intervention, except where humans have their homes or are managing land to produce the most essential of goods, such as food.*³ As Batavia and Nelson (2016) have noted:

This position is characteristic of what ethicists call “natural law theory,” in which what is “natural” is right and ought to be. [This is] often used to justify a “hands-off” approach to management or nonintervention.

I reject this outlook’s inherent human–nature dualism, but in doing so I’m mindful of the potential trap that is set when humans are rolled into the concept of ‘natural’ applied here. The poisoning of a river, say, would thus become ethically acceptable. On the one hand, then, not all human interventions in a landscape can be considered good just because humans are part of nature.

On the other hand, it seems perverse from an ecological perspective to automatically judge human intervention in landscapes as necessarily bad, when examples abound of non-human species, from African elephants to yellow meadow ants, shaping

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“Evolution and other unguided ecological dynamic processes are ethically good in their own right, as well as being unrivalled in their creation of complexity and diversity, and we should be neither quelling nor guiding them on a grand scale.”

habitats and engineering ecosystems. For just as these ants – to use the example of the smaller of those creatures – build mounds with altered soil properties that provide biodiversity-enriching micro-niches (Boots and Clipson, 2013), there are well-known and cherished examples of human interventions that, in a similar way, can benefit biodiversity, at least on a local or regional scale.

Hay meadows provide one example of such an opportunity, hence the wordplay in this piece’s title. Later, I will consider in detail these and several other instances of traditional anthropogenic habitats that I feel can have a place within ecocentrically minded conservation. As will be seen, changing economic circumstances mean that the human interest in these habitats has shifted away from production, opening up opportunities for an alternative focus. Before this, I will offer a tentative set of conditions to delimit my support for traditional anthropogenic habitats within the framework of ecocentrism.

In proposing these conditions, I must stress that I am not clearing an intellectual path towards treating the Earth as a global garden (rambunctious or otherwise). First, on a pragmatic note, ecospheric ecology is far too complex for us to hope for anything approaching universal success in determining positive, gardening-type conservation interventions, even if the vast financial resources necessary for such gardening were channelled in its direction. Secondly, on a philosophical level, evolution and other unguided ecological dynamic processes are ethically good in their own right, as well as being unrivalled in their creation of complexity and diversity, and we should be neither quelling nor guiding them on a grand scale. To do so would be to behave not as a “plain citizen and member” of the “land-community,” in Aldo Leopold’s indelible wording (Leopold, 1968: 204).

On the subject of grand interference in evolution specifically, Christof Schenck (2015: 100) cautioned:

Human-directed conservation is changing species in the long run. This means that

even in conservation areas, set aside for nature protection, humans take a lead in evolutionary processes, with limited understanding of the results.

Responding to this warning, I proposed, with Patrick Curry, the concept of conservation “exit strategies” (Gray and Curry, 2015).⁴ In short, this involves drawing up intervention plans for protected areas that still meet the short-term, often urgent, needs of wildlife (e.g. through placing bird boxes), while also including a longer-term vision to allow these needs to be met without human direction (by letting trees – using the same example – reach maturity and senescence so that nesting holes abound). In areas where agents of major disturbance, such as wild free-roaming bovines, have been extirpated, reintroductions of ecologically similar life forms will be necessary for conservation exit strategies to be fully realized. The empirical examples discussed later are drawn from the context of Great Britain, and so it is pertinent to mention that the aurochs – the wild ancestor of domestic cattle – was extirpated from this island, owing to habitat loss and other factors, at some point between 2000 and 3500 years ago (Wright, 2013).

By raising here the ecological importance of lost agents of disturbance, I have looped back to the subject of traditional anthropogenic habitats: human interventions, as will be discussed in the empirical examples, are of a greater significance as biodiversity-enhancing disturbance processes in light of our ancestors’ extirpation of certain other habitat shapers.

An ecocentric delimitation of traditional anthropogenic habitats

Immediately below, I present four conditions that delimit my support for traditional anthropogenic habitats within ecocentrically minded conservation. The first three refer to individual sites, while the last relates to such sites *en bloc*. I offer this as an unofficial addendum to *Keeping the Wild* and a counter to the dangerous

potential caricaturing of ecocentrism that I mentioned earlier.

- **Quality:** Such sites should be more biodiverse than they might otherwise be – over a short or long time frame – if interventions ceased. The biodiversity considered in this qualitative reckoning should comprise native species and long-established non-invasive alien species. Species that are rare, especially on a global scale, should be given greater weighting in considerations.
- **Focus:** The focus of the interventions should be supporting biodiversity for biodiversity's sake. Material goods that are available and non-material instrumental values that can be derived (including spiritual pleasure and preservation of cultural heritage) should be celebrated, but they should never be key drivers.
- **Future:** Opportunities for reducing human intervention in the long term without a negative overall impact on biodiversity should be pursued if they present themselves.
- **Extent:** Taken as a whole, these sites should not dominate on a landscape scale. Rather, they should be set within a wider landscape that evidences a major stepping back of *Homo sapiens*.

This set of conditions is intended as a skeleton for future work. I will leave the philosophers to pick at the bones, but in the hope that at least something will remain, I will press on with real-life cases of what can be called *co-created habitats*.⁴ When I walk in these habitats, I'm aware of the presence of human hand, but my experience is of a place overwhelmingly dominated by non-human life. This is a good balance when one considers humans as plain citizens.

The examples are all habitats that I can get to on foot from my home near the River Ver, a chalk stream that cuts a minor incision in the geologically diverse hunk of rock known as Great Britain. They are not unique, though, to my local area or this medium-sized Atlantic island. And there will be different co-created habitats in other places to which the argument I am making may apply.

Example habitats

Lowland meadows

At temperate latitudes, grassland typically occurs in places that are too dry or too far above sea level for trees to dominate (Rackham, 1994), or where there is sustained pressure from herbivores. Great Britain is mostly low lying and relatively wet and its land thus tends to a forested state. Non-anthropogenic fires play only a minimal role in the island's ecology, while the challenges to tree establishment – and prospects for grassland – presented by free-roaming grazers have lessened in recent millennia through the decline and extirpation of the aurochs (Vera, 2000), among other factors.⁶ Under these conditions, humans equipped with scythes emerged as significant agents of species-rich grassland, in the form of meadows (Figure 1).

For the two millennia between their “pre-Roman origins and post-Medieval demise,” meadows were “a key component of traditional farming and were often more valued than any other land” (Peterken, 2013: 119). They allowed farmers to exploit – typically on soils that were neither strongly acidic nor strongly calcareous – the flush of growth that comes in spring and summer in order to remove plant material that could be prepared and stored, as hay, to provide winter fodder for domestic animals. Farmers would have been well aware that the scything prevented the encroachment of scrub and the establishment of mature

“Opportunities for reducing human intervention in the long term without a negative overall impact on biodiversity should be pursued if they present themselves.”



Figure 1. Wild flowers and grasses in a lowland meadow.

“The outcry against the plummeting of meadows was slow in coming.”

trees, a development that would have been very difficult for them to reverse in a time with no chainsaws or heavy machinery. What they would not have known, though, is that this removal of matter counteracted the deposition of nutrients from the excreta of winter-grazing domestic animals and from the atmosphere, keeping fertility at a ‘Goldilocks level’ that gave many plant species a chance to thrive and stopped runaway species from dominating. This, in turn, supported a richness and abundance of insects and other life forms.

In modern agriculture, farmers have tended towards specialization, external inputs and monoculture, and more profitable land uses than meadows have emerged (with some combination of drainage, ploughing, re-seeding, herbicides and nutrient applications being used to adopt them). Under these conditions, the total area of species-rich meadows in Great Britain has declined by 97% since the 1930s (Plantlife, 2018); a major contributor to the steep downward trend was the need, during the Second World War, to bring more land under the plough for growing cereals on a suddenly isolated, and densely populated, island. Despite the scale of the loss of this habitat, it went relatively unnoticed for a long time. As Trevor Dines, Botanical Specialist at the charity Plantlife, observed (Plantlife, 2018):

People tie themselves to trees as the chainsaws arrive, but nobody lies down amongst meadow buttercups in protest at the ploughing up of ancient meadows.

The outcry against the plummeting of meadows was slow in coming: calls for their conservation only began to mount in the late 1960s (Peterken, 2013). While losses continued, the efforts of the early advocates and their followers has helped some meadows to emerge through the bottleneck as nature reserves, and hobbyist purchases have also played a role in stemming the decline. The finances have changed to such an extent from those of traditional agriculture, however, that removing hay is now something that can cost money, or rely on the goodwill of volunteer scythers,

rather than generating income (Peterken, 2013). In other words, hay as a product is not the primary purpose. This means that the focus for humans in this example of co-creation can be on supporting favourable conditions for a range of wild grasses and flowers and the other life that they sustain, rather than on maximizing yield or palatability of hay.

There seem to be as many theories for what the best practice is in meadow conservation as there are people with a view on the subject, and efforts to synthesize scientific evidence have not given clear answers (Tälle *et al.*, 2018). A broadly supported overall approach would be a single late annual hay cut, allowing plants to set seed and insects to complete their life cycles, and avoiding disturbance of ground-nesting birds (Peterken, 2013). This would preferably be performed not with a mechanical mower but by a team of scythers (see Kingsnorth [2012]), as this is less destructive to the life of the meadow. The fodder will be of very poor quality – formerly, late-cut hay would have been used as bedding for animals. As mentioned above, though, this is not a major issue in a conservation context, and the material still has potential uses within an ecological culture and economy, such as in insulating the walls of eco-friendly buildings. There are, however, a couple of more significant caveats. The first applies to a restoration context, in which earlier and more frequent hay cutting may be needed over a number of years in order to counteract the legacy of nutrient applications and the resulting species-poor grassland. The second is that a major change from existing practices may make conditions unfavourable for the species that a meadow currently supports (Buglife, 2019b), and the plants and other life forms for which the altered meadow might be suitable may be slow to colonize it or never find it (*e.g.* Woodcock *et al.*, 2012). As Aldo Leopold wrote in his journal: “To keep every cog and wheel is the first precaution of intelligent tinkering” (Leopold, 1993: 146). A compromise might be to adopt a more heterogeneous approach, in which existing practices are maintained

in only a part of the meadow (personal communication with Ian Carle). Further heterogeneity will result from so-called aftermath grazing, in which domestic animals feed on the meadow in winter. In a conservation context, this can be done with a low density of grazing animals, very high welfare standards and a prudent approach to medication; the dung alone can support many species (Laurence, 1954).⁷

The role of lowland meadows in supporting biodiversity

As George Peterken (2013: 219) has noted: “Meadows are paradoxical. They are amazingly diverse at a small scale, but [they] contribute little to regional diversity, because their constituent species have been drawn from various habitats, and most still inhabit versions of those habitats or scraps of meadow-like vegetation.” In other words, their role is not so much in helping save threatened species as it is in supporting an ethic of bio-proportionality, in which both diversity and abundance matter deeply (Mathews, 2016). Just as the leaf litter of mature woodland teems with springtails and other invertebrates, one only need examine a handful of flowers or a few grass seed-heads to get a sense of the tremendous abundance of life that is to be found in meadows (Figure 2).

Heathland

Heathland is unploughed, open or semi-open land on which plants in the group called heaths grow, the most common of which is ling (also known as heather). Beyond heaths, the characteristic flora of this habitat includes bracken, as well as shrubs such as gorse (Figure 3). As Oliver Rackham summarized – slightly underestimating, perhaps, the openness of a landscape in which aurochs roamed (Vera, 2000) – heathlands are “composed entirely of wild plants, yet they would hardly exist without past and continuing human activities” (Rackham, 1994: 130). This is the essence of a co-created habitat.

Heathland soil is typically acidic, sandy and nutrient poor and was unsuitable for traditional farming. In the Middle Ages,



Figure 2. The grass-bug *Megalloceroea recticornis*, one of many insects that can be very abundant in meadows (photographed at Chorleywood Common, UK).



Figure 3. A gorse shieldbug on gorse, a typical heathland shrub.



Figure 4. Wild-roaming ponies contribute to the open areas of acid grassland in the New Forest, UK.

heathlands were nevertheless used for many purposes. Gorse was removed for fuel as it produced an efficient hot blaze for ovens and home-heating fires. Ling served as both a fuel and a low-grade thatch. And bracken was used as a fuel, as litter for livestock, as thatch, as an ingredient in potash (for glassmaking, soaps and detergents), and also for a range of minor functions from contraception to rain-making. Traditional heathland products fell out of common usage in the 19th century – although there is potential for a revival of some uses within an ecological culture and economy. Furthermore, farming technology that arose in the agricultural revolution made it possible to cultivate previously uneconomic land such as heathlands (Rackham, 1994). In the 20th century, the decline was exacerbated by the timber industry's fad for planting non-native conifers and the intervention

of developers. All told, around 85% of Great Britain's heathland has been lost over a span of 150 years (Wildlife Trusts, 2019).

As with meadows, many surviving examples of heathland are now nature reserves, where a chief concern is that the habitat will quickly scrub over and develop into secondary woodland without removal of some plant growth. As is the case with open grassland, discussed in the previous and following sections, a relevant factor here is the extirpation of the aurochs and the resulting shift in ecological dynamics to favour closed-canopy conditions. In the New Forest National Park – a large matrix of woodland, bog and heathland – the grazing of wild-roaming ponies (Figure 4) and other mammals keeps significant areas open, but other heathlands generally receive less attention from grazers. Some combination of rotational cutting, scraping of the

soil surface and controlled burning may be undertaken on heathlands to offer a heterogeneous habitat with a multitude of niches (Buglife, 2019a). An important goal for conservationists in removing plant material is to prevent a build-up of nitrogen from atmospheric deposition, which would work against an established plant community that thrives in nutrient-poor conditions. As with meadows, there are many different viewpoints on what the optimum approach might be.

The role of heathland in supporting biodiversity

Heathlands, while providing a home for many common species, also support a number of threatened species. These include birds like nightjars, stone-curlews and Dartford warblers (Figure 5), reptiles such as smooth snakes (Figure 6), and many rare invertebrates (Rackham, 1994; Buglife;

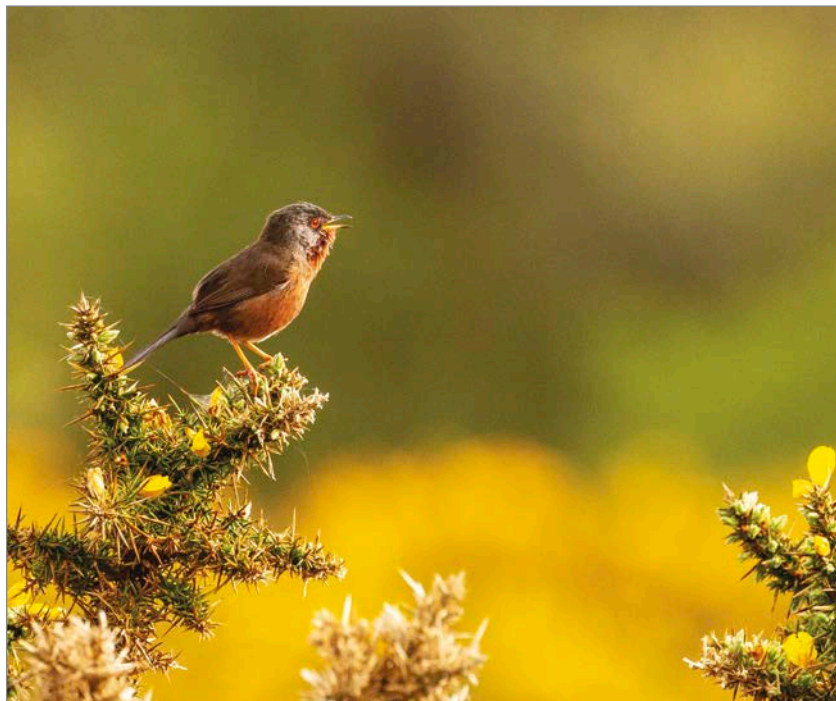


Figure 5. A Dartford warbler on heathland (photo: James West [CC BY-NC-ND 2.0; <https://creativecommons.org/licenses/by-nc-nd/2.0/>]).



Figure 6. A smooth snake on heathland (photo: Paul Ritchie [CC BY-NC-ND 2.0; <https://creativecommons.org/licenses/by-nc-nd/2.0/>]).



Figure 7. A sandy bank on Oxshott Heath, UK, which is used by many species of solitary bees and wasps for nest construction.

2019a). Regarding the last of these, the hard-packed sandy banks that can be found on heathlands (Figure 7) are invaluable for the nest construction of many solitary bees and wasps (Buglife; 2019a). And, more broadly, as Oliver Rackham (1994: 146) cautioned, heathland is a “special responsibility” of Great Britain, since “the Dutch, Danes and Swedes have been even more single-minded in destroying their heaths, and most of what is left in Europe is ours.”



Figure 8. Regrowth after coppicing in Stanmer Park Great Wood, UK (photo: Dominic Alves [CC BY 2.0; <https://creativecommons.org/licenses/by/2.0/>]).

Coppiced woodland

Coppiced woodland comprises a co-created series of compartments felled in different series of growth stages; there are also typically present some large trees with single trunks that are not cut as part of the cycle. In the long-established practice of coppicing, trees are cut to their base, or stool, and new growth sprouts from dormant buds.⁸ Coppicing and regrowth (Figure 8), which probably evolved as a response to damage by large herbivores, also greatly extends the longevity of individual trees – in the case of common ash from, perhaps, two centuries to eight (Rackham, 2012).

An active coppicing cycle involves stools being re-coppiced before the stems have become too difficult for a woodcutter to chop using a simple hand tool. Coppiced stems can be used for fuel, including as charcoal, and also in traditional craft-making; they could be a welcome item in a future ecological culture and economy. Indeed, for traditional woodcutters, the coppicing cycle gave a steady supply of essential materials. As an accidental consequence, it also kept glades as shifting but ever-present features of woods, supporting a range of heat-loving animals and light-loving plants. The animals track the shifting openness, while the plants thrive periodically within each compartment for a period of two or three years (Rackham, 2012), before bramble and coppice regrowth shade them out.

A changing economy and new technology saw traditional woodland practices generally either replaced by modern commercial forestry operations or abandoned, so that between 1900 and 1970 there was an estimated ten-fold decline in the area of actively coppiced woodland in Great Britain (Fuller and Warren, 1993). Coppicing does continue, though, on many nature reserves and in some woods owned by hobbyists or individuals striving for green self-sufficiency.

The role of coppiced woodland in supporting biodiversity

Woodland openings, such as those that occur with coppicing, can be hotspots

for a range of flora and fauna. They are generally sheltered, may have dead wood present, offer a great nectar resource, and typically have soils that have not been subjected to fertilizers. These openings are especially important for rare wild flowers like wood vetch, crested cow-wheat and oxlip (Figure 9), as well as insects such as woodland-dwelling fritillary butterflies (Fuller and Warren, 1993). Nightingales are among the threatened birds that may benefit from the dense understory that develops after the open phase of the cycle. The hazel dormouse (Figure 10), another threatened species, also benefits from the structure of coppiced woodland, and its decline has been linked to the reduction in coppicing (Mammal Society, 2019).

Old orchards

Many of the considerations raised in the section on lowland meadows apply to old orchards, because they can be a haven for wild grasses and flowers, but there is also something distinct about them from the three habitat types discussed above:



Figure 9. Oxlip in Hayley Wood, UK, a woodland where coppicing is practised.



Figure 10. A hazel dormouse, a species that can benefit from the structure of coppiced woodland (photo: Frank Vassen [CC BY 2.0; <https://creativecommons.org/licenses/by/2.0/>]).



Figure 11. Old apple trees in an orchard in Highfield Park, UK.

domesticated species – namely, fruit trees – form a significant portion of the biomass (Figure 11). Importantly, many decades of nurturing the fruit trees of old orchards has seen them live through maturity to develop senescent features such as decaying branches and rot holes, which are essential to the life cycle of many invertebrates. These, in turn, provide food for bats and other wildlife.

As with the habitat types discussed above, changing technologies and economic circumstances have driven a steep decline in orchards, and many surviving examples



Figure 12. A noble chafer, a beetle associated with old orchards (photo: gailhampshire [CC BY 2.0; <https://creativecommons.org/licenses/by/2.0/>]).

are now nature reserves. The fruit picked each year may be eaten fresh or used for making juices, alcoholic beverages and food products. These items represent a bounty that can be enjoyed by local residents in harmony with the needs of other species and, like products from coppiced stems, should be an essential component of a future ecological culture and economy. In addition, the abundant windfall apples that are left on the ground provide sustenance for birds and other life forms. Moreover, since yield is not a concern on nature reserves, there is no motivation to use insecticides and life-destroying ‘tree washes’.

The role of old orchards in supporting biodiversity

Old orchards abound in common species, and are thus refuges for abundance, but they also support certain threatened invertebrates, such as the noble chafer (People’s Trust for Endangered Species, 2019; Figure 12). The larval stage of this beetle feeds on rotting heartwood within live trunks and branches, favouring mature fruit trees. Another threatened species that depends on rotting heartwood and is associated with this habitat is the orchard tooth fungus, while the old bark of the fruit trees provides a substrate for a plethora of lichens and bryophytes (People’s Trust for Endangered Species, 2019).

Role within a future ecological culture and economy

A recurring theme in the examples of co-created habitats has been their potential role in a future ecological culture and economy. Significantly, each has cultural heritage predating the watershed of the industrial revolution. Each was thus born in an era of simple tools, such as handsaws, scythes and rakes, rather than great machines. And each offers not only a liberation from the destructive nature of approaches to land management forged by industrialism but also a roadmap for the “revival” of “forgotten skills” that Victor Postnikov (2018: 148) has called for in his vision for a culture of simplicity and creativity. Similarly, the co-created

habitats discussed represent pieces in the puzzle for John Michael Greer's (2009) vision of an 'ecotechnic' future.

In addition to the benefits of co-created habitats for non-humans and humans that have been described above, it should be mentioned that these places also offer great scope for fostering connections with nature – through immersion, learning, working, participating and simply breathing – including in people who may not have been lucky enough to have previously had such 'nature exposure' in their lives.⁹ These connections are essential, I believe, if an ecological culture is to become widely established.

The wider landscape context

As I note in the 'Extent' condition of my delimitation, traditional anthropogenic habitats should be set within an ecosphere that evidences a major stepping back of humans. As part of this stepping back, our agricultural practices must be re-shaped to support and mesh harmoniously with non-human life, rather than obliterating it, and we must greatly reduce our plundering of aquatic life. Extractivism must be superseded by a circular material economy. And independently of reforestation efforts – for which only a 'one-time carbon win' is available in any honest accounting system (Rackham, 2012) – we must dramatically reduce our release of gases contributing to climate breakdown.

At this wider scale, then, traditional human-shaped habitats – like human settlements and ecological agriculture – should form relatively small patches within a greater rewilded landscape. But this does mean that their role is insignificant. First, co-created habitats are unique and thus complement the variety within a wider rewilded landscape. Secondly, they can serve as 'reservoirs' from which biodiversity can radiate again once the time comes. Thirdly, they are an insurance policy. On this last point, I believe that ecocentrically minded conservationists must be realistic about the chances of achieving large-scale rewilding and keep options open for biodiversity in a landscape

that retains a strong human presence during a protracted collapse.

Closing remark

At a time when the conservation movement is struggling for traction on a greased slope, I believe that we should see the types of co-created habitat that I have discussed – tempered by my proposed delimiting conditions – as a gift. We know that they can offer broad benefits for non-human life, especially when they are not being driven by narrowly focused human needs, and, along with protected wild areas, they represent an additional effective means of widening the bottleneck through which life is passing. ■

Acknowledgement

I am very grateful to Eileen Crist and Chris Gibson for their constructive comments on this article.

Notes

- 1 I describe this mental journey in Gray (2017).
- 2 In this piece, I have side-stepped the term 'wilderness' and the ongoing debate on its reality and relevance. To properly dissect the various arguments would require an article in its own right, and: (a) I doubt I'd do the task justice; (b) there is already an excellent examination of the topic from an ecocentric perspective in Crist (2019: 113–36).
- 3 This caricature is propagated by conservationists who seek to discredit all intervention-based conservation, as Christof Schenck (2015) seems to do in *Protecting the Wild*, the generally stellar follow-up volume to *Keeping the Wild*.
- 4 Up till this point, I have used somewhat technical language in order to help set the ideas within the broader literature, and I have drawn terms from the lexicons of conservation and wildlife ecology, which have been shaped by human–nature dualism and anthropocentrism. A word I have used particularly often is 'intervention', favouring it over more domineering alternatives such as 'management' and 'stewardship'. The term 'intervention' fails, though, to erode that dualism and fully support ecocentrism. I am thus grateful to Eileen Crist, co-editor of the present special issue, for suggesting an alternative: *co-creation*.
- 5 A lighter alternative to conservation 'exit strategies' has been proposed by Shefferson *et al.* (2018): "Conservation biologists should incorporate evolutionary prediction into management planning to prevent the evolutionary domestication of the species that they are trying to protect."

“Co-created habitats can serve as ‘reservoirs’ from which biodiversity can radiate again once the time comes.”

“At a time when the conservation movement is struggling for traction on a greased slope, I believe that we should see the types of co-created habitat that I have discussed as a gift.”

- 6 The extinction of the wild boar and local extirpations of red deer would also have been significant for ecological dynamics. Countering this somewhat in recent decades has been the increasing populations of several species of wild deer.
- 7 For readers who are against the idea of using domestic animals, it should be noted that scything alone is adequate for humans to fulfil their part in co-creation.
- 8 I am aware that some readers will be against the idea of repeatedly cutting trees back to their stools, but I would challenge them to offer greener alternatives to the materials that are taken from the wood and also stress that some wood removal is needed, in any case, in order for the shifting glades to persist. Additionally, I would refer these readers to my set of conditions that delimit such habitats within ecocentrically minded conservation.
- 9 Conversely, there is a need to guard against excessive recreational pressure on such habitats. Horse riding and motorcycle use can be very detrimental to heathlands, to give one examples (Buglife, 2019a).

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Sensory pollution and the biodiversity crisis

Imagine you are a female frog on a warm spring night in the year 1719. In the distance, you can hear a chorus of male frogs calling at a wetland, calling to you through the darkness. You like that sound – these chaps sound like the right chaps for you. The only light comes from the stars, white and shiny, far above. You set off towards the sound, hopping across uneven ground, making steady progress. When you arrive, the chorus is loud and insistent with hundreds of voices, overlapping and urgent. You move around slowly, listening hard; it's only possible to distinguish a few individual voices at a time. Eventually you make your choice – a fellow with a low-pitched, energetic call. He sounds like he's got the resources, the stamina and the experience to be a high-quality father to your children. You make contact with that lucky fellow, make your intentions known. He climbs on your back in a close embrace and as a pair you position yourselves at the edge of the wetland. You deposit hundreds of eggs into the water; he fertilizes them. And then you say goodbye to your instant family, confident that most of your eggs will hatch to become strong and healthy tadpoles. Not all of them will make it to the next life stage, and fewer will make it to adulthood. But the water is clean and well vegetated, and your tiny children are already equipped with the chemical and behavioural defences they'll need to avoid predators and make their own way in the world.

Imagine now you are a female frog on a warm spring night in the year 2019. In the distance, a chorus of male frogs is calling at a wetland, calling to you through the semi-darkness. But it's difficult for you to hear them over the sound of traffic

from a nearby highway. What was once a communication distance of a kilometre or more has been reduced by a factor of ten – you need to be much closer to be sure of what you're hearing, to be sure that the chaps who are calling are the right chaps for you. Although it is night time, light is all around, reflecting down from the sky and shining directly from street lamps that march away into the distance. There are no stars to be seen. When you arrive at the wetland, there are fewer voices but they still overlap each other in their urgency. With a constant, low rumble of urban noise in the background, it is easier for you to hear the higher-pitched voices in the chorus, which tend to belong to smaller males. Do these squeaky fellows have the resources and experience to be a good father to your children? Eventually you make a choice, and as a pair you and your selected partner position yourselves at the edge of the wetland. You deposit hundreds of eggs into the water; he fertilizes them as best he can, although his sperm count is significantly lower than that of his ancestors from 300 years ago. The wetland has an urbanized watershed and contains a vast array of chemical pollutants: heavy metals, pesticides, antibacterial agents and traces of human pharmaceuticals. Even at low concentrations, these substances can impact on the survival of your children – directly through increased mortality, and indirectly through behavioural changes that will leave them more susceptible to predation. How can you be confident that they will make it to the next life stage, and then on into adulthood?

This scenario is just one of millions that play out every day in human-altered environments; it highlights only a few

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Amphibians are among the many organisms vulnerable to the negative effects of sensory pollution (pictured are European common frogs [*Rana temporaria*]).

of the ecological impacts of sensory pollution. Sensory pollutants – including anthropogenic noise, artificial light at night and chemical contaminants – disrupt the sensory processes of wildlife across the evolutionary spectrum (Halfwerk and Slabbekoorn, 2015). Anthropogenic noise impairs hearing and acoustic communication in groups as diverse as insects, fish, frogs, birds and mammals, impacting behaviour, reproductive success and the detection of predators and prey (Parris, 2015; Shannon *et al.*, 2016). Artificial light at night disrupts natural photoperiods

and changes the spectral properties of nocturnal light, with far-reaching impacts on the physiology, behaviour, ecology and evolution of animals and plants (Longcore and Rich, 2004; Gaston *et al.*, 2013). Globally, its effects are expected to increase further with the move from sodium lamps to cool-white light-emitting diode (LED) lamps for roadway lighting (Gaston *et al.*, 2015). Chemical pollutants disrupt olfaction (smell), including chemical communication between individuals of the same species and the olfactory detection of predators (Lüring and Scheffer, 2007). Many chemical

pollutants also act as endocrine disrupters, affecting invertebrates and vertebrates alike with significant consequences for development, behaviour and fitness (Clotfelter *et al.*, 2004; Hayes *et al.*, 2011). However, the combined effects of the myriad sensory pollutants experienced by wildlife remain poorly understood (Halfwerk and Slabbekoorn, 2015; Hale *et al.*, 2017).

Reducing the ecological impacts of sensory pollution is conceptually simple but will take a coordinated effort between policy-makers, land managers, urban planners and the general public. Legislation to protect people from excessive urban noise (including road-traffic and air-traffic noise) should be extended to protect other species and their acoustic environments, particularly threatened species and those that rely heavily on acoustic communication (Parris, 2015). Detailed guidelines for reducing light pollution are available from the International Dark Sky Association (www.darksky.org); the general principles are to reduce the duration and brightness of artificial lights, ensure that lights are targeted where they are needed and shielded to prevent upward glow, and to avoid lights with a predominance of energy in the blue portion of the spectrum (Longcore *et al.*, 2018). Mitigating the ecological impacts of chemical pollution in agricultural and urban areas will require the protection of wildlife from chemical contaminants that already exist in the environment, removal of these contaminants where feasible, and a much greater effort to prevent further additions to terrestrial, freshwater and marine ecosystems. Ensuring that unpolluted habitats are available for and attractive to wildlife will also be crucial (*e.g.*, by ensuring urban wetlands intended for biodiversity do not receive storm-water run-off, and by discouraging wildlife from using polluted wetlands [Hale *et al.*, 2019]). It is also worth remembering that a quieter, darker and cleaner environment will bring substantial benefits for human health and well-being – for we, after all, are wildlife too. ■

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“Reducing the ecological impacts of sensory pollution is conceptually simple but will take a coordinated effort between policy-makers, land managers, urban planners and the general public.”



A European green lizard in a nature reserve in the Crau, France

The thin green line: Scientists must do more to limit the toll of burgeoning infrastructure on nature and society

Given its wide-ranging and transformative impacts, the global explosion of built infrastructure is arguably the most urgent environmental threat today (Laurance *et al.*, 2014; Laurance and Arrea, 2017; Laurance, 2018b). This tsunami of infrastructure has many contributing factors, including human overpopulation and the short-term thinking that arises from consumptive growth-oriented economies. The consequences will be many, from massive loss and degradation of wildlife habitat to increasing pressures on the global climate, and they will reverberate across nearly every sector of society.

China's Belt & Road Initiative, Africa's 'development corridors' and other world-changing ventures are unleashing a tidal wave of new transportation and energy projects, extractive industries and land-use change. More and improved infrastructure is unquestionably a vital component of humanity's pursuit of economic and social development – with estimates for needed investments of US\$3–5 trillion per year (Zarfl *et al.*, 2015) – but ongoing ventures vary greatly in their risks and rewards. Here, I argue that many proposed projects have such striking hazards that they should never have left the drawing board.

My approach is pragmatic. Some level of development is inevitable and urgently needed, especially in poorer nations. But there is still a dire need to challenge many proposed infrastructure projects from environmental, economic, social, financial, political and other perspectives. One need not invoke ecological ethics (*e.g.* Curry, 2018) or reverence for the Earth and biodiversity to arrive at such conclusions. Hard numbers and rational cost–benefit arguments reveal that many proposed

projects are foolhardy. Our immediate goal should be halting projects that will have the greatest costs for nature and marginal benefits for humanity.

The effort to advance smart, sustainable infrastructure transcends scientific disciplines – linking engineering and environmental sciences to governance and economics. However, for many reasons, scientists have struggled to provide urgently needed guidance and leadership. Some scientists are swayed by promises of sweeping socio-economic benefits for host nations, or assume that environmental impact assessments or promised mitigation measures provide reasonable safeguards against project risks. Others are daunted by complex environmental, economic and socio-political elements of large developments, or are being pressured or drowned out by project proponents. Some find it all too depressing, and essentially give up (Laurance, 2018b).

The perils of poor decisions are underscored by the stunning pace of infrastructure expansion. Globally, paved roads are expected to increase by 25 million km in length by 2050 – enough to encircle the Earth more than 600 times (Laurance *et al.*, 2014; see Figure 1). At least 3700 major hydropower projects are planned or underway (Zarfl *et al.*, 2015). Mining, fossil-fuel and other extractive projects currently threaten nearly 1 million km² of intact tropical forest (Grantham and Tibaldeschi, 2018). China's Belt & Road is projected to cost US\$8 trillion and will include over 7000 infrastructure and extractive-industry projects that will span much of the world (Ascensão *et al.*, 2018). If completed as planned, Africa's massive development corridors (Laurance *et al.*, 2015) and South America's Initiative for the Integration

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Figure 1. Rainforest in the Congo Basin being destroyed for a Chinese-funded road construction project (photo by William Laurance).

of Regional Infrastructure will criss-cross entire continents while slicing through remaining wilderness and hundreds of protected areas. In addition to their many direct impacts, such schemes also indirectly intensify illegal or unplanned road-building, deforestation, mining, poaching and land speculation (Laurance *et al.*, 2014; Alamgir *et al.*, 2017).

Why are we failing?

After decades of work in this realm, I believe the general failure of scientists to provide coherent views on infrastructure can be linked to several factors. One is ambivalence around the notion that 'development is good'. In fact, much development is 'bad' – in the sense of being wasteful, inefficient, financially risky,

inequitable or environmentally destructive (Flyvbjerg, 2009; Laurance, 2018a).

The repercussions of ill-advised developments can be astonishing. In Malaysia, for example, escalating national debt, soaring project costs and corruption have forced the cancellation of over US\$40 billion in ongoing Belt & Road projects financed by Chinese loans (Laurance, 2018c). If completed, these projects would have led to staggering environmental degradation. The scale of alleged bribery and misappropriation – including the arrest of Malaysia's former Prime Minister, Najib Razak – beggars belief. Comparable scandals have led to the collapse of dozens of planned megadams in Brazilian Amazonia, spurred economic disarray in Pakistan and Sri

Lanka, and provoked open warfare in Papua New Guinea (Laurance, 2018c).

The reluctance of many scientists to engage in development controversies – which can be complex, time-consuming and personally confronting – also promotes poor decisions on infrastructure. It might be tempting for researchers to assume that environmental and social non-governmental organizations (NGOs) provide an adequate safety net for decision-making. In fact, most NGOs are overwhelmed, especially in the technically complex realm of major infrastructure ventures (Laurance, 2018b).

Scientists can also be plagued by anxieties around political appropriateness. For instance, in seven years of co-chairing the Conservation Committee of the Association for Tropical Biology and Conservation, I found a recurring impediment was agonized doubts by certain members as to whether a scientific organization should take public positions on environmental issues, often involving new infrastructure, in developing nations. Some argued that only researchers from the affected countries were in a morally defensible position to voice their reservations. With nine-tenths of all infrastructure slated for developing nations – which harbour most of the world's mega-biodiverse tropical and subtropical ecosystems – such arguments, though clearly well intentioned, seem naive and disempowering.

Scientists must avoid a dangerous perception that environmental impact assessments and recommended mitigation measures provide adequate safeguards. They rarely do (Laurance and Salt, 2018). Most assessments are short-term and myopic in nature and systematically biased toward project approval – partly because the project proponent must pay for the assessment and thereby has manifold means to influence its outcome. For example, the environmental impact assessment for Brazil's 900-km-long BR-319 Highway, which is slicing into the heart of Amazonia, concluded that the project would cause *no net increase*

in deforestation. Independent analyses suggest it will provoke a dramatic acceleration of forest loss – by an additional 5–39 million hectares by mid-century (Ritter *et al.*, 2017). Similarly, the provincial government of North Sumatra, Indonesia, formally approved the environmental impact assessment for a hydropower project that would cut across the scarce remaining habitat of the critically endangered Tapanuli orangutan (*Pongo tapanuliensis*), a species which numbers only 800 living individuals (see Figure 2). My colleagues and I found the assessment to be rife with inaccuracies and misrepresentations, which ALERT reported to Indonesian President Joko Widodo (ALERT, 2018), and has been vigorously challenged by an NGO lawsuit.

Finally, some scientists who attempt to engage in development issues are pressured, paid off or attacked by project advocates. Project proponents long ago learned the strategy of hiring leading experts to force their silence or complicity. Principles of financial and professional transparency that help govern the behaviour of researchers must appear quaint to some project proponents. In 2001, a research team I led (Laurance *et al.*, 2001) was so stridently criticized by advocates of the dramatic expansion of Amazonian roads and dams that one of Brazil's leading newspapers ultimately slammed the campaign for 'attacking the messenger'. Some suffer a far worse fate. Globally, around 200 environmental advocates and park guards are murdered each year (Global Witness, 2018).

Strategies and solutions

The global infrastructure tsunami is advancing so rapidly that there is no time for pie-in-the-sky solutions. The most urgent priority is to halt, or at least delay, ill-advised infrastructure projects, ideally before they gain political and financial momentum. This can be a fraught goal as most infrastructure proponents strive to do the opposite, railroading projects through the approvals process before their risks can be fully exposed and publicly

“Scientists can also be plagued by anxieties around political appropriateness.”



Figure 2. The Tapanuli orangutan is the world's rarest great ape and is being imperilled by a Chinese-funded hydropower project in Sumatra, Indonesia (photos by Sumatran Orangutan Conservation Programme).

debated. One must realize, however, that large-scale projects have relatively high rates of attrition. Delaying tactics can be effective because corporate and government advocates of projects operate under tight time constraints – such as annual profit statements and limited terms of political office (Laurance, 2018a).

Opposing ill-advised projects is not at all 'anti-development' but rather pro-smart development (Alamgir *et al.*, 2017; Laurance, 2018c). All nations have finite assets available for construction and maintenance of infrastructure. Monies that are borrowed for new projects must be repaid with interest; natural resources that are squandered might not be recuperable; and failed projects typically have heavily intertwined financial, social, political and environmental costs. For instance, a project that increases wildfires and air pollution, or landslides and flood risk, has – alongside environmental liability – major financial, political and reputational burdens.

Actively working to halt risky or ill-planned infrastructure projects differs

strikingly from the status quo (Laurance, 2018b). Prevailing strategies for 'greening' planned infrastructure are varied, but they rarely involve halting projects entirely. The emphasis, typically, is on adjusting projects to make them more benign and publicly palatable (Alamgir *et al.*, 2017). Examples of such measures include construction of fish-ladders for hydro-dams and of wildlife underpasses, overpasses and rope-bridges for highways, to help maintain vestiges of animal movement. But such measures are often expensive and of uncertain benefit (Corlatti *et al.*, 2009), especially for species of high conservation concern. They also fail to counter the many indirect impacts of projects – such as illegal deforestation, encroachment and poaching (see Figure 3) – which are frequently their most dangerous consequences (Alamgir *et al.*, 2017; Laurance and Arrea, 2017).

Thus, I argue, the most essential element of greening is screening out bad projects. But how does one decide which projects to eye most critically? In fact, we know enough now to identify broad

categories of projects whose rewards can be swamped by their risks. A good example is infrastructure planned for high-rainfall or steep environments, typical of many areas in the tropics. Here, engineering and long-term maintenance costs can be prohibitively high, as are risks of disasters such as flooding, fires and broad-scale erosion (Alamgir *et al.*, 2017). A second category includes projects in remote locales (Laurance *et al.*, 2014), such as those intended to integrate frontier communities into cash economies or expand large-scale electrification. Such projects generally have modest *per capita* benefits and arrays of important environmental, social and economic hazards. Globally, trillions of dollars are currently being invested in projects in steep, remote or rain-drenched environments (Laurance *et al.*, 2015; Alamgir *et al.*, 2017; Ascensão *et al.*, 2018; Laurance, 2018c).

Proactive approaches for environmental and social planning, such as ‘global road mapping’ (Laurance *et al.*, 2014), can further identify high-danger zones for new infrastructure. One such area is the Leuser Ecosystem in northern Sumatra, Indonesia, the last place on Earth where Asia’s megafauna (rhinos, tigers, orangutans and elephants) still persists. Here, the need for large, unbroken areas of high-quality habitat cannot be overstated. Other examples include geopolitically sensitive areas, such as segments of the India–China, Peru–Brazil and Indonesia–Papua New Guinea borders (Laurance, 2019), where infrastructure is being driven by territorial or nationalistic ambitions rather than plausible cost–benefit arguments. Other factors – such as unstable governments, land-ownership conflicts and fluctuating prices for export commodities at the heart of big projects – can create major risks for infrastructure (Laurance, 2018c). In sub-Saharan Africa, a quantitative comparison of the potential agricultural benefits and environmental costs of 33 massive development corridors suggested that all but six were marginal or inadvisable (Laurance *et al.*, 2015; see Figure 4).

In promoting ecologically non-destructive infrastructure, tactics and messaging are crucial (Laurance, 2018a). The most effective strategies will incorporate many angles, focusing as much on the financial, social, economic and political risks of projects as on their environmental impacts. Above all, scientists must accept and embrace the view that each nation has a fully sovereign right to determine its own development priorities and trajectories.

An upshot of sovereignty, however, is that few decision-makers are adequately trained to see the many shoals of risk on which infrastructure ventures can easily founder (Laurance, 2018c). Compounding

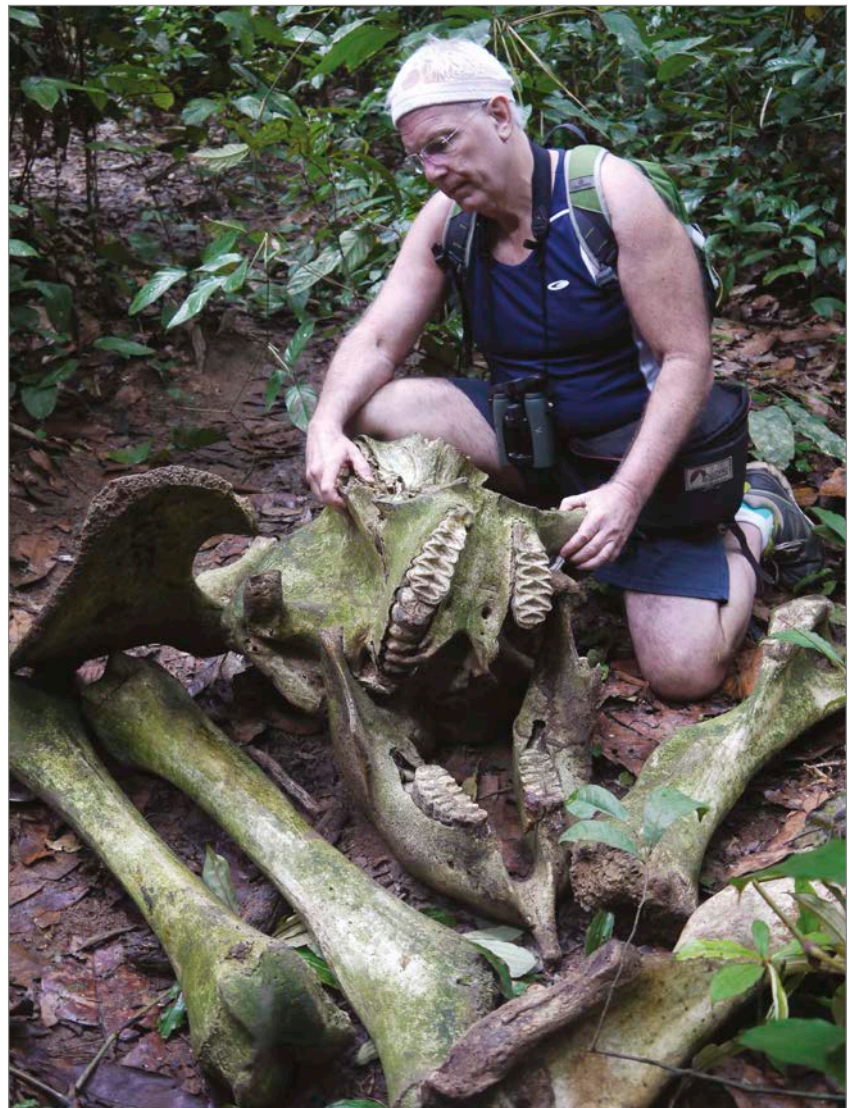


Figure 3. The author examining a forest elephant slaughtered by poachers in the Congo Basin. The elephant’s face had been hacked off to extract its valuable ivory tusks (photo by Mahmoud Mahmoud).

“In the many arenas where infrastructure projects are debated, experts ready to grapple with real-world challenges could play a pivotally important role.”

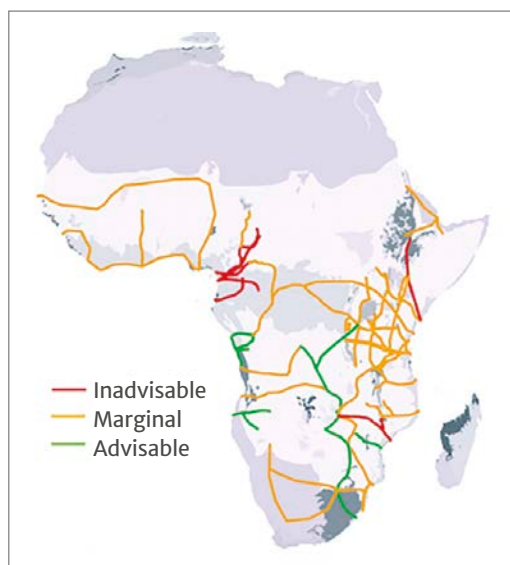


Figure 4. Most of the 33 massive ‘development corridors’ proposed or underway in sub-Saharan Africa are poorly justified when evaluated using transparent cost–benefit criteria (after Laurance *et al.*, 2015).

this is an absence of self-regulation by project advocates, who often stand to gain financially from major ventures, and behave accordingly. In the People’s Republic of China – overwhelmingly the biggest driver of new infrastructure – the public almost never sees reports critical of the Belt & Road because of overt or tacit media censorship (Laurance, 2018c). Beyond this, China has no history of corporate transparency and no political will to halt corrupt overseas business practices. According to Transparency International, “There have been no investigations or charges ever laid in China against its companies, citizens, or residents for foreign corrupt practices” (Dell, 2018; emphasis added). Despite its incessant greenwashing to obscure reality, China’s prevailing approaches are a formula for promoting bad business practices, social abuses, environmental crimes and predatory development.

Thus, efforts to green and screen the tsunami of China-funded projects appear especially challenging, although some Chinese enterprises, facing growing scrutiny, are showing interest in social and environmental safeguards (Ascensão *et al.*, 2018). For the Belt & Road, the most

urgent opportunities are to influence its many financiers outside China, as well as the roughly 130 host nations worldwide where new projects will be located.

Given their magnitude and myriad risks, it is in the best interests of nations, financiers and the public to view investments for infrastructure both conservatively and critically. In my view, an ideal conceptual model for evaluating infrastructure proposals is a Darwinian struggle, with projects that survive transparent cost–benefit assessments prevailing, whereas those with weaker prospects are delayed, diminished or driven extinct. Beyond all else, smart, sustainable infrastructure will require convincing and credible arguments – from scientists, economists and technical experts. In the many arenas where infrastructure projects are debated, experts ready to grapple with real-world challenges could play a pivotally important role.

How you can help

Please follow ALERT’s efforts to promote smart infrastructure and development (www.facebook.com/ALERTconserv) and receive free updates to become involved (www.alert-conservation.org). We need your help. Bad projects thrive in the shadows, and it makes an enormous difference if we can shine a bright light on ill-advised development. ■

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Beyond the North American Wildlife Conservation Model and towards Earth rights

For nearly 150 years, the view of wild animals as ‘renewable natural resources’ and ‘property’ to be managed, controlled and used has dominated wildlife management and conservation in the US. The North American Wildlife Conservation Model is the driver of this strong anthropocentric and utilitarian stance, which has not only led to an annual killing spree where millions of wild animals lose their lives to hunters and trappers nationwide but has also resulted in a staggering spiral of plant and animal extinctions globally. This article examines the worldview of the North American Wildlife Conservation Model and its dangers, and it points out the need for compassion for all Earthlings and for the embrace of Earth rights. The author also provides steps everyone interested in changing the paradigm of lethal management of wild animals can take to help accelerate the transition.

On a sunny winter day more than a decade ago, my partner and I came across a pine marten hanging by a front arm from a leghold trap on the limb of a tree in the woods. After we freed her from the trap, she limped away and then stopped, turned around and gave us a long look, perhaps of thanks. This traumatic experience set me on my path of inquiry into what makes this cruelty against wild animals possible and still legal. My journey led me to the little-known North American Wildlife Conservation Model. Along the way, I was dumbfounded to learn that our releasing the poor pine marten was illegal – that creature was property of the trapper.

An invisible force with powerful, received beliefs, the North American Wildlife Conservation Model (hereinafter, the Model) has been directing wildlife-related policies, regulations and laws, and shaping also how society relates to wild animals and nature. Owing to similar temporal and social circumstances in the US and Canada, the Model conceptually includes both countries. Its history reaches back to the 1800s, a time when European settlers mercilessly slaughtered wild animals for commerce, driving several animal species to extinction or near extinction. This also led to a conflict with another group – the wealthy, urban ‘sport’ hunters, who saw

their favourite animal species (and hunting opportunities) disappear. Ideas and actions taken by these early recreational hunters to stem the decline of certain ‘game’ species, such as elk, deer and antelope, caused by market hunters developed over time into principles. These were collectively described as the North American Wildlife Conservation Model in 2001 (Geist *et al.*, 2001).

Some of the early ‘sport’ hunters, including Theodore Roosevelt, George Bird Grinnell and Gifford Pinchot, also spearheaded the establishment of national parks and wildlife refuges. They led the historic transition from unmitigated slaughter of wild animals to regulated hunting, fishing and trapping. However, by replacing commercial hunting with the concept of sport hunting, early recreational hunters succeeded in *conserving* wild animals for human use, and at the same time *preserving* methods to exploit them: hunting and trapping.

Strikingly, today, a growing sector of the American public is shifting its beliefs about wild animals and increasingly embracing mutualism, an egalitarian ideology that views non-human animals, including wild individuals, as if they were members of an extended family, deserving rights and care. This was one of the findings by a recent US report that surveyed public and

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“The United States Department of Agriculture’s Wildlife Services agency relies heavily on leghold traps and strangulation snares among other indiscriminate devices in their annual slaughter of millions of wild animals under the guise of livestock protection.”



Figure 1. Raccoon skins at the North American Fur Auction in Stoughton, WI, USA (photo: Wisconsin Department of Natural Resources [CC BY-ND 2.0; <https://creativecommons.org/licenses/by-nd/2.0/>]).

governmental staff’s attitudes towards wild animals and showed that mutualists (35%) have now outpaced traditionalists (28%), who believe that non-human animals should be used for the benefit of humans (Manfredo *et al.*, 2018). Yet at the same time, the relationship between humans and non-human animals conveyed by the Model, and reflected in federal and state fish and wildlife agencies’ policies, remains firmly locked in the historic grip of anthropocentrism tethered to strong utilitarianism. The Model’s approach – which has no consideration for the intrinsic value of non-human animals – is responsible for legitimizing an annual killing of millions of individual wild animals. It has been estimated that hunters in the US alone kill between 100 and 200 million animals annually, the majority for ‘recreation’ (Bekoff and Pierce, 2017). In addition, trappers kill between 6 and 21 million wild fur-bearing animals annually (Figure 1; White *et al.*, 2010). Furthermore, the United States Department of Agriculture’s Wildlife Services agency – a body that one documentary rightly exposed as an “unaccountable, out-of-

control, wildlife killing machine” (Predator Defense, 2014) – relies heavily on leghold traps and strangulation snares among other indiscriminate devices in their annual slaughter of millions of wild animals under the guise of livestock protection. The federal agency killed more than 2.3 million wild animals in 2017, down from 4.4 million animals in 2013 [United States Department of Agriculture, 2019]). Given the task of conservation to curb society’s destructive relation to the more-than-human world, it is disturbing to see the acceptance – and even promotion – of the Model’s tenets by certain conservationists. Unwittingly perhaps, they are thus legitimizing another strand of destruction – the recreational killing of wild animals.

Nevertheless, state and federal wildlife agencies, most hunting organizations, and even professional wildlife associations such as The Wildlife Society, promote and defend the Model. The Congressional Sportsmen’s Foundation (CSF; www.congressionalsportsmen.org), a body based in Washington, DC, is perhaps the Model’s most powerful lobbying force. Together with partners, including the

National Rifle Association, the Sportsmen's Alliance, and the Safari Club International, CSF applies high-pressure political influence in protecting their interests in hunting, angling, shooting and the trapping of wild animals. This has been exemplified by two main supporters, who stated: "the Model has ensured that hunters are a force to be reckoned with, despite representing only about 6 percent of the North American population (13.7 million hunters in the US in 2011)" (Mahoney and Jackson, 2013: 454).¹ Indeed, the pro-hunting and trapping industry comes out in full swing whenever the public attempts to curtail recreational hunting and trapping or governmental lethal management of predators. Nevertheless, several national and state-focused organizations fight either through legal challenges or through grassroots efforts, including ballot initiatives against the cruelties involved in the recreational killing of wild animals. Examples include the Center for Biological Diversity, WildEarth Guardians and Footloose Montana. The last of these, of which I am a co-founder, is a non-profit organization based in Missoula, MT, that promotes trap-free public lands.

The Model's seven tenets

The seven tenets of the Model are as follows (The Wildlife Society and the Boone and Crockett Club, 2012):

- 1 **"Wildlife resources are a public trust"**: Wildlife is a common resource and held in trust by the government for the benefit of present and future human generations.
- 2 **"Markets for game are eliminated"**: Historic markets for game species were eliminated; trapping for fur and markets for animal pelts are exempted.²
- 3 **"Allocation of wildlife is by law"**: 'Surplus'³ of wildlife is allocated to the public for consumption by law, not by the market, land ownership or special privileges.
- 4 **"Wildlife can be killed only for a legitimate purpose"**: This principle legitimizes killing wildlife for "food, fur, self-defense or property protection" (Geist *et al.*, 2001: 178), and then goes on to describe the concept of "fair chase" and rejection of frivolous and wasteful killing.
- 5 **"Wildlife is considered an international resource"**: Many wildlife species are of international importance (see, for example, the transnational *Migratory Bird Act* established between Canada and the USA in 1916), and management of wildlife is an issue of international concern.
- 6 **"Science is the proper tool to discharge wildlife policy"**: The implementation of policies, such as hunting and trapping seasons or protection of endangered species, should have a scientific basis at a certain level.
- 7 **"Democracy of hunting is standard"**: Aldo Leopold called this idea the "democracy of sport" (Meine, 1988: 169), reflecting the Model's inherent focus on hunting as a democratic process, where everyone has a right (*i.e.* access to), and a responsibility for, wildlife.

The Model's detrimental impact on society: Reflecting and reinforcing anthropocentrism

The Model is one of many forces that have historically created and continue to maintain the human–nature dichotomy and a strong hierarchy. Because the Model's priority is the (lethal) use of wild animals, its tenets are a moral structuring of the relationship between humans and non-humans. Here, humans are considered subjects with moral value (they matter), while non-human animals are assigned an inferior status as public or private 'property', or as a 'natural resource' (tenets #1, #2, #3, #5 and #6). The tenets describe acceptable purposes for killing animals (#4), and also claim the right of humans to kill animals for sport touted in the 'democracy of hunting' (#7). Underlying such a strong sense of entitlement to decide over wild animals' lives and deaths are certain widely shared beliefs: "that the Earth belongs to humanity; that the planet consists in resources for the betterment of people; and that human beings are 'obviously' superior to all other species" (Crist, 2017: 62). According to this perspective, humans are not perceived as a part of nature, but, instead, our species

"The Model is one of many forces that have historically created and continue to maintain the human–nature dichotomy and a strong hierarchy."

“With the rise of sport hunting legitimized through the Model came the displacement of wild animals, along with natural entities such as trees, plants, soil, water and rocks into a legally defined category of natural resources.”

is arbitrarily elevated into a realm deemed separate from, outside of and above nature. This is a worldview with disastrous consequences, as it is playing out globally in the unprecedented extinction crisis.

The Model's clear-cut separation between humans and wild animals demands a strong hierarchical view of the world (*scala naturae*) in order to justify its grand-scale exploitation of wild animals for 'recreation and use'. This is also a moral scaling that justifies the non-vital desires of hunters and trappers, while demoting the vital and basic needs and interests of wild animals of staying alive, unharmed by humans. Let us take a closer look at how the Model ontologizes wild animals for use. First, it directs its focus on the ecological collective, not the individual animal. Second, it downgrades the status of wild animals to 'natural renewable resources'. And third, it categorizes wild animals as property.

The Model's view of the whole

The Model's allegiance is to the collective – the ecosystem, the animal species and population. In this sense, the individual animal has no moral worth because the individual essentially does not exist. The message here is that the individual animal is expendable, interchangeable and “only valuable insofar as it carries the genetic coding to perpetuate the species, which in turn is by evolution adapted to its surroundings and helps to perpetuate the healthy functioning of the ecosystem” (Mallory, 2001: 69). Focusing on abstract constructs ensures that the individual animal conveniently vanishes into the mist of the species or population and that he or she can be sacrificed for the greater good of the whole or for the experience of the *individual* sport hunter (Kheel, 2008). This view ignores non-human nature's intrinsic standing and value. It utterly dismisses compassion and respect for the lives of individual animals. It denies that they are good for their own sake and therefore ought to be protected. Of course, this view is far from being universal within the conservation community. For example, the late biologist Gordon Haber, who spent 40 years documenting the lives

and societies of wolves in Denali National Park, captured non-human individuality by pointing out that every wolf is embedded in a net of relationships within and outside their families, and thus every wolf is not only *an individual* but essential (Haber and Holleman, 2013). In the same vein, a group of conservationists and animal ethicists recently urged for conservation strategies to include concern for collectives and individual animals, “particularly for those who possess sophisticated capacities for emotion, consciousness and sociality” (Wallach *et al.*, 2018: 1).

Animals as 'natural resources'

With the rise of sport hunting legitimized through the Model came the displacement of wild animals, along with natural entities such as trees, plants, soil, water and rocks into a legally defined category of natural resources. The added epithet of 'renewable' turned animals into a resource that “with wise management, can be perpetuated indefinitely for the enjoyment of present and future [human] generations” (Bolen and Robinson, 2003: 3). And while humans are bestowed with the right to manage (control, manipulate and kill), wild animals are denied what they share with us – biological kinship, self-will and independence, autonomy and self-determination, sentience and cognition, and species-specific culture and morality. This outdated view of fellow creatures is no longer congruent with scientific and ethical advancements (Singer, 1975; Midgley, 1979; Regan, 1985; Adams, 1990), both of which are aligned in urging us to change our view of non-human animals – wild and domestic – from objects to subjects, sentient beings with lives, rights, interests and needs like humans. “Science is confirming the obvious: other animals hear, see, and smell with their ears, eyes and noses; are frightened when they have reason for fright and feel happy when they appear happy” (Safina, 2015: 23). And not only that, but scientific discoveries now include the existence of sentience in taxa other than mammals, including octopuses, reptiles and fish. In addition to widespread cognition, moral behaviour as

well as personality differences exist among non-human individuals of many animal species (Bekoff and Pierce, 2017). All such recent findings point to the same: Life is one and experienced by all.

From rats chirping (laughing) when tickled and bees dancing to polar bears sliding down a snowy hill for fun, there is no longer any doubt that biodiversity consists of bodies *and* minds. This is further supported by the 2012 Cambridge Declaration on Consciousness (Dvorsky, 2012). Sentience obviously gives an animal an advantage in survival and did not arise *de novo* in humans but developed from species already equipped with emotions and the capability of suffering both from physical pain and from fear, anxiety and stress (Rollin, 1998). Thus, the Model's focus on human interests that seemingly outweigh animals' sentience is morally bankrupt and its view of wildlife individuals as non-sentient natural renewable resources is scientifically unsound.⁴

Animals as 'human property'

The Model continues to rely on the archaic ancient principle of Roman common law, which classifies animals as 'things'. Accordingly, all wild animals in the US are either public human property, owned by the nation's citizenry and held in trust by state wildlife agencies for present and future human generations, or become private property when physically immobilized by a human with a license to kill, via bullet, hook, arrow, trap or snare. With that, the Model has cast an all-encompassing net over wild animals, granting them no protecting from abuse, torture and death. Unsurprisingly, states' animal cruelty laws exempt the practices of hunting and trapping. In practical terms, this means, for example, that when a bobcat gets caught in a snare or trap, he or she transitions from public 'property' to the trapper's private 'property' and, as such, is entirely at the trapper's mercy. As I mentioned at the start of this article, anyone finding and releasing a trapped animal can be fined for illegal interference. Contrast the Model's perspective with that of writer

and naturalist Henry Beston (1956: 25), who described our fellow creatures so beautifully: "they are not brethren, they are not underlings, they are other nations caught with ourselves in the net of life and time."

The Model's promotion of aggression, violence and cruelty to wild animals is detrimental to society's efforts to increase pro-social behaviours

Reflective of the global destruction of nature caused by a separation between humanity and more-than-human nature, the Model's disconnect between human and non-human animals breeds abuse, cruelty and violence against wild animals. Nowhere is this more apparent than in trapping wild animals for their fur or just for 'fun'. Trapping is clearly an act of violence against unsuspecting and defenceless wild animals, who are lured into a baited snare, leghold or conibear trap. Common injuries include broken teeth and broken bones, and psychological and physiological trauma. In such desperate situations it is common for a trapped animal to chew off his or her foot or twist off an entire limb to escape the pain and panic (trappers call this "a wring-off"). Trappers commonly kill a trapped animal by stomping, strangling or beating him or her to death, by shooting, by poisoning, by chemical injection or by drowning. For example, the *Trapper Education Manual* encourages inexperienced trappers to use submersion techniques and recommends that trappers who are underage or otherwise not legally permitted to carry a firearm "strike smaller furbearers such as raccoon, opossum, and fox hard at the base of the skull with a heavy wooden or metal tool to kill or render them unconscious" (International Association of Fish and Wildlife Agencies, 2005: 98). This manual then instructs such trappers: "Placing your foot over the head and chest area and compressing these organs will lead to death." There is no mandate as to how a trapped animal should be killed 'humanely', nor is there monitoring of, let alone a charge, for these crimes in the woods. No thought is given

"The Model's disconnect between human and non-human animals breeds abuse, cruelty and violence against wild animals."

“The Model’s obsolete and crassly anthropocentric construction of wild animals hampers societal efforts to increase empathy and compassion for all beings.”

to the death by starvation of offspring of animal mothers killed in traps.

Trapping’s inherent callousness and lack of empathy for wild animals has been a cause for great societal concern in the US since at least the turn of the 20th century. Indeed, no fewer than 450 anti-trapping bills were introduced in state legislatures or in the US Congress between 1901 and 1982 (Gentile, 1987). The link between animal cruelty, domestic violence and murder has long been established (Phillips, 2014). However, I believe that there also needs to be more research into links between the killing of wild animals and human aggression, including violence against humans and other crimes. This is critically important since studies have shown that belief in human superiority over animals is associated with greater prejudice against human outgroups, such as immigrants and other minorities, and vice versa (Kymlicka and Donaldson, 2014).

Notably, the Model is silent on the issues of lack of empathy and absolving animal cruelty. It is entirely out of kilter, if not undermining of, the mandate to address the most pressing threats to the integrity of our planet – human population growth, habitat loss and fragmentation, global climate change. The Model’s obsolete and crassly anthropocentric construction of wild animals hampers societal efforts to increase empathy and compassion for all beings.

From anthropocentrism to Earth Rights

While the Model originated in the US and Canada, its ideas and practices, particularly the view of wild animals as mere trophies, have spread globally. In fact, one of the Model’s early pioneers, President Theodore Roosevelt, founded in 1887 the Boone and Crockett Club, which is an organization that measures, scores and tracks ‘big game’ animals killed through any legal means in North America. In 1909, Roosevelt went on a safari expedition to East Africa, which ended with more than 11,000 wild animals shot, including elephants and lions (Pollak, 2012). Global trophy hunting and killing

wild animals for ‘recreation’ in the 21st century, disguised as a ‘conservation tool’ that controls populations and funds conservation efforts (contentions that have both been discredited [Baker, 1985; Smith and Molde, 2014; Murray, 2017]), are most certainly part of the legacy of the Model. At a time when close to 1500 vertebrates and invertebrates are listed as either endangered or threatened with extinction (U.S. Fish & Wildlife Service, 2019), and a warning has been published of the imminent extinction of 1 million species (IPBES, 2019), killing animals for fun and trophies continues to be rampant in the world, perpetuated and glorified by such notorious trophy-hunting organizations as the Safari Club International (a partner organization of the Boone and Crockett Club). With partnerships like this has come a global, powerful and wealthy lobbying force in support of killing for conservation that is not only culturally ingrained but also legally and politically entrenched and sheltered. Wild animals are caught in the net cast between hunters, governmental wildlife agencies and policy-makers, with the segment of the public who are against hunting and trapping being excluded. However, while the lobbying force may be with wildlife killers, the national and international public is increasingly objecting to the recreational killing of wild animals, as shown by the overwhelming global outrage over the killing of Cecil the lion shot by an American trophy hunter (Bekoff, 2018).

I think that, with leadership from a conservation community that recommits to intrinsic valuation in order to help transform our relationship with nature (Piccolo *et al.*, 2018), now is the time to inspire people nationally and globally towards more ecocentric values. As Manfredo *et al.* (2018) have shown, a growing sector of the American public is shifting its value orientation from utilitarianism to mutualism, which involves love and empathy for wildlife individuals characterized by trust and the desire for a mutually respectful relationship with wild animals. People with a mutualistic orientation are “less likely to support actions resulting in death or harm to wildlife”

and “are more likely to engage in welfare enhancing behaviors for individual wildlife, and more likely to view wildlife in human terms” (Teel and Manfredi, 2010: 130).

I applaud Thomas Berry’s approach in our goal to overcome our ingrained sense of superiority when he proposed that “the Earth is a communion of subjects, and that rights originate where the universe originates and not from human jurisprudence” (Cullinan, 2003: 108). This means “we cannot claim that humans have human rights without conceding that other members of the Earth Community also have rights” (Cullinan, 2003: 108). For this to happen, nature and its non-human denizens need to be released from their legally enshrined property status. Instead, the more-than-human world must be recognized as having rights to exist, persist and flourish, with people having a moral obligation and authority to enforce nature’s rights on behalf of ecologies and their denizens. This enormous transformation of our relationship with nature has been taken up by the rights of nature movement (Sólon, 2018) and associated legal initiatives (e.g. Earth Law Center, 2019), which provide us with a much-needed holistic ethical and legal framework that re-embeds humans into the ecological context and gives nature a voice. This spiritual and practical, justice-based vision of Earth democracy has already begun to shape a crucial egalitarian relationship with the more-than-human world. For example, in 2008 Ecuador included rights of nature in its new Constitution and, more recently, the Maori tribe in New Zealand achieved the legal recognition of a large river as an ancestor with legal personhood. This revival of a long-standing sensibility of interconnectedness with the more-than-human world also presents an opportunity to strengthen our potential for healing what we’ve torn apart. Survival, and hopefully flourishing, in a much-depleted world profoundly depends on the awakening of love and respect.

Ways forward

One way in which you can effect change is to get involved in your country’s or

state’s legislature, where all too often bills detrimental to wild animals are being passed. Consider running for office to promote wildlife- and Earth-friendly policies and vote for legislators who champion these. Bring attention to the plight of wild animals by writing letters to your local newspaper. If you belong to a congregation, the peace movement, or any social justice, political or conservation organization, question them on their stance on wildlife individuals (you’ll be surprised). You can also join an Earth rights group or a Community Environmental Legal Defense Fund chapter, or support the Earth Law Center. And you can make a profound difference for all animals, domestic and wild, and for the health of the planet more broadly, by switching to a vegan diet. ■

Notes

- 1 In 2016, the number of hunters was 11.5 million, compared with 86 million bird watchers and photographers (U.S. Fish & Wildlife Service, 2016).
- 2 This is just one of many contradictions within the Model.
- 3 In a wildlife management context, the term ‘surplus’ refers to the manipulation of animal populations through lethal means, when an “accelerated growth rate provides a surplus of animals beyond the number required for replacing the losses—a surplus that may be harvested by hunters or other predators” (Bolen and Robinson, 2003: 185).
- 4 This is against the backdrop as Curry (2018) and Gray (2018) have argued, that sentience is not essential to an individual having intrinsic value and moral standing – agency and interests do not require sentience but do qualify for value and standing.

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How biodiversity is both impacted by and a solution for climate change

The field of climate change biology has changed a lot over the years. It began in one sense in 1987 with a conference at the Smithsonian funded by the National Science Foundation, although there was a 1985 conversation with Stephen Schneider when I inquired how what I studied (biological diversity) fitted with his focus (climate change). Steve later characterized that as a eureka moment.

The conference ultimately turned into the 1992 book *Global Warming and Biological Diversity* (Peters and Lovejoy, 1992). At that point one could mostly just try to project from changes engendered by past climate change to the current day and future. By 2005, Lee Hannah and I produced a new volume titled *Climate Change and Biodiversity* (Lovejoy and Hannah, 2005), and at this point one could see the fingerprints of climate change virtually everywhere.

Yet there was only one mention of ocean acidification in that volume. Only during that very year (long after the book had gone to press) had that suddenly become noticed, even though in the end it was a matter of simple high-school chemistry – that some of the CO₂ absorbed by the oceans was altering the acidity of the oceans. Today the oceans on average are about 0.1 of a pH unit more acid: in absolute terms that is 30% more acid than in pre-industrial times.

Now we are in 2019 and Lee Hannah and I have produced a completely new book – *Biodiversity and Climate Change: Transforming the Biosphere* (Lovejoy and Hannah, 2019). It hadn't taken long for us to realize that so much had changed since the previous volume that there was no point in a revision: a completely new book was in order.

Changes in the annual cycles of plants and animals are ubiquitous. More importantly,

geographic distributions are changing as species move to track their required conditions, among other things moving upward in altitude or poleward (northward in the northern hemisphere), tracking their preferred conditions. Marine organisms seem to be changing in distribution even more rapidly than terrestrial ones.

Decoupling events are also occurring when one member of a pair of closely synchronized species depends on temperature for its cycle, while the other uses day length. An example would be the snowshoe hare, which changes its pelage from winter white to summer brown using a relatively immutable response to day length, as opposed to the vegetation it inhabits, which loses its white snow cover earlier in the spring. Another example is that of migratory organisms (e.g. birds), which may arrive in their summering grounds after the spring flush of key food supplies.

Organisms moving upward will run out of upslope opportunities, in what has been termed an 'elevator to extinction'. Sea level rise is imperilling some species. The first extinction from sea level rise is a mammal, the Bramble Cay melomys, a small rodent that was native to a single Australian island (clearly, island species face a particular challenge). The salt marsh sparrow in eastern North America is vulnerable as it must nest successfully between two spring tides. The key deer of the Florida Keys will only have a future if translocated elsewhere.

Basically, these individual cases are only minor adjustments in the fabric of life. Nonetheless, it is a statistically robust finding that nature is responding to climate change anywhere it is studied.

What is more worrying is what things will be like looking ahead.

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Biodiversity; climate change; conservation; sixth mass extinction

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- We know that glaciers came and went in the past with little apparent loss of biodiversity. What is different today is that as species attempt to track their required conditions, they mostly must do so in highly fragmented landscapes, which have essentially become obstacle courses for dispersing organisms. That challenge can be alleviated if we restore natural connections in landscapes. Restoring riparian vegetation is a good place to start but obviously not sufficient.
- It is also clear from past climate change events that as climate shifts increase, individual species move each in their own direction and at their own velocity. Ecosystems essentially disassemble, and new assemblages take place which are hard to imagine in advance.
- This relates to abrupt changes in ecosystems that can occur when some particular aspect of biology proves more sensitive than climate or vegetation modelling can forecast. For example, muskoxen are today raising underweight calves because their winter forage is now covered more frequently with frozen rain than with snow, which is easily brushed aside (Berger *et al.*, 2018).
- Sometimes climatic shifts can lead to abrupt ecosystem changes. A prime example is when not very much warming for not very long causes coral bleaching: the symbiotic relation between the coral animal and the alga with which it partners breaks down and the entire coral reef, with all its diversity and productivity, collapses. Sixty per cent of the Great Barrier Reef bleached last year. In another example, in North America's coniferous forests, longer summers and warmer winters have tipped the balance in favour of native bark beetles, with massive tree mortality from southern Alaska to southern Colorado.
- At an even greater scale, Earth system change is taking place, such as the aforementioned acidification of the oceans.
- The future of biodiversity looks very grim if warming goes beyond 1.5°C above pre-industrial levels. The climate movement 350.org and others advocate a reduction from current carbon dioxide levels of 415 to below 350 parts per million. Use of fossil fuels – actually the remains of ancient ecosystems and photosynthesis – should stop immediately, but that would only halt further rise in carbon dioxide concentrations in the atmosphere.
- Largely overlooked is the immense amount of carbon dioxide in the atmosphere from destroyed and degraded nature. It is shocking that it is roughly equal to the carbon that remains in extant nature – about 450 to 500 billion tons of carbon (Erb *et al.*, 2018). Ecosystem restoration has the potential to pull enormous amounts of carbon dioxide from the atmosphere and convert it to living organisms and ecosystems (Lovejoy and Hannah, 2018). If we stopped fossil fuel emissions this instant, ecosystem restoration could bring us back to 350 parts per million through sequestration in living ecosystems of 143 billion tons of carbon.
- To do something of that scale is not impossible. It basically requires recognizing that we inhabit a living planet that works as a linked biological and physical system. Ecosystem restoration always brings immediate tangible benefits (e.g. an agricultural system that accumulates carbon gains greater soil fertility).
- People tend to think of forests first because they do in fact sequester enormous amounts of carbon, but all kinds of ecosystems can contribute to carbon sequestration while simultaneously providing wildlife habitat and other benefits. Restoration is also an activity to which individuals can contribute, alleviating the kind of helplessness that some people feel about climate change. Anyone can help plant a tree, restore a wetland or support agroecology.
- In the geological past the planet has twice reduced very high carbon dioxide levels from geological activity like volcanic eruptions to pre-industrial levels of carbon dioxide. We know it works – in fact it has worked twice. That took tens of millions of years, which we cannot afford, but we are quite capable of re-greening the emerald planet. ■

The unnoticed collapse of big freshwater animals

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It's the largest animals who tend to occupy the most space in our hearts. They might be imperilled – indeed they usually are, as it's not easy being big in a human-dominated world – but at least people know and care. There's one group of large animals, however, whose decline has gone mostly unremarked: those who live in lakes and streams and rivers.

"Globally, freshwater megafauna populations declined by 88 percent from 1970 and 2012," write biologists led by Fengzhi He and Sonja Jähnig, both of Germany's Leibniz Institute of Freshwater Ecology and Inland Fisheries, in the journal *Global Change Biology*. "Compared to megafauna in terrestrial or marine realms, they have received much less research, conservation efforts, and public attention."

Big or small, the situation for freshwater animals in general is quite grim. According to the Living Planet Index, their populations fell by 80% in the last 40 years – roughly double the declines experienced by terrestrial and ocean-dwelling vertebrates. During the 20th century, freshwater fishes went extinct at rates unsurpassed by any other guild.

He and Jähnig are especially concerned, though, about the largest of these creatures. They tend to live a long time but reproduce very slowly, and travel between far-flung spawning and feeding areas; when combined with heavy human impacts on freshwater ecosystems, these traits make them especially extinction-prone. The researchers suspected that their rates

of decline exceeded even those of other freshwater species.

Despite all this, write He and Jähnig and colleagues, "monitoring of freshwater megafauna species remains limited, particularly at continental or global scales." To fill the gap, they gathered worldwide population data for 126 freshwater species – 81 fishes, 22 mammals, 21 reptiles and two amphibians – who can attain a size of 30 kg or more.

Number-crunching yielded the aforementioned 88% contraction of freshwater megafauna. Declines were especially precipitous in Europe, Asia and northern Africa, with losses of between 97 and 99%. Large fishes were hit hardest, followed by reptiles; mammals, interestingly, appeared to be increasing in population, though the researchers cautioned that data for them is sparse.

"Our results show a clear decline of freshwater megafauna across the globe," write the researchers. And since many megafauna are so long-lived, individuals may survive long after species reproduction has ceased, their lingering presence masking the full degree of their peril.

Such sharp declines are thus a harbinger of extinction – and fighting to protect them isn't just about preserving Earth's biological heritage, say He and Jähnig. Just as terrestrial megafauna like grizzly bears and elephants are often apex predators or keystone species, so are their aquatic counterparts. Their loss leaves ecosystems simplified and prone to collapse.

Future healthy freshwater ecosystems may well depend on the preservation of these animals. As of now, however, "monitoring and targeted conservation actions for the vast majority of freshwater megafauna appear inadequate," write

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Keywords

Biodiversity; sixth mass extinction; water



Figure 1. A Eurasian beaver, a species which has been reintroduced to many parts of Europe (photo: Matteo Tarengi [CC BY-NC-ND 2.0; <https://creativecommons.org/licenses/by-nc-nd/2.0/>]).

the researchers. Basic knowledge of their migratory routes and spawning grounds is limited.

Further information is needed to protect them – but, even more than that, people need to care. The researchers suggest that conservationists tap into the fascination people naturally feel for big animals,

turning giant salmon carp and river turtles and crocodiles into the next generation of so-called charismatic megafauna and flagship species.

With overexploitation continuing and some 3700 large-scale hydroelectric dams now under construction or scheduled, it won't be easy. Yet it is possible: in the US, populations of thirteen sturgeon species are now increasing. Beavers have been reintroduced to many parts of Europe (Figure 1); in South Asia, Irrawaddy river dolphin numbers recently rose for the first time in two decades (Figure 2).

“Despite the plight of freshwater megafauna described in this study,” write He and Jähnig and colleagues, “opportunities to protect them still exist.” ■

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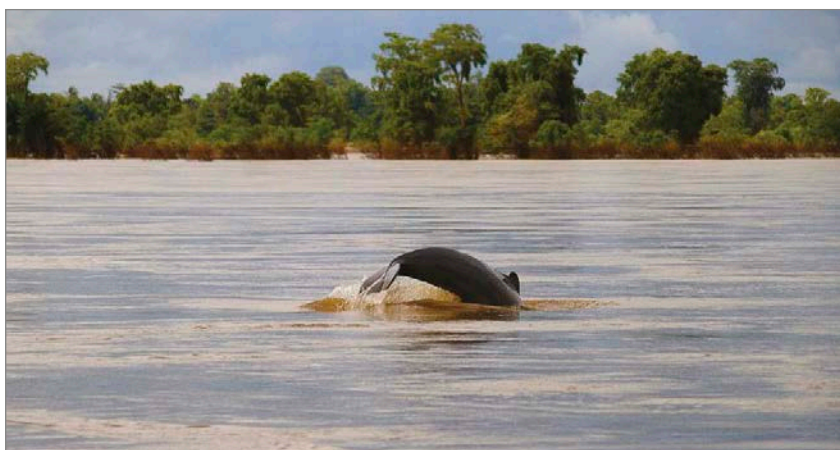


Figure 2. An Irrawaddy river dolphin in Cambodia (photo: Jim Davidson [CC BY-NC-ND 2.0; <https://creativecommons.org/licenses/by-nc-nd/2.0/>]).

The endangered phenomenon of animal migration, and the dissonance between doing science and achieving conservation

For conservation to succeed across broad scales, more than science and more vocal scientists are needed. The public must be motivated and attendant concerns rendered into policy actions. Despite burgeoning data sets coupled with substantive concerns about the persistence of land, water, and aerial migrations, sadly not enough is being done to sustain Earth's animal migrations. Among an array of bold tactics that will help are these: Universities, among other educational institutions, need to restructure their internal reward systems so that faculty can be incentivized for biodiversity activities to benefit ecological health. And, regardless of age or background, spokespersons from all walks of life must emerge and defend migration as an intrinsic and important component of biodiversity and its conversation.

If all the people of this country were assembled and a rising vote taken on the question – Are our birds and mammals worth preserving? – we believe every man, woman, and child would stand up to be counted.

(Source given in main body)

We've all probably asked why a conservationist should remain optimistic with the world's population growing toward 8 billion and beyond. Indeed, any wistful dreams I may have had were shattered by the numbers presented in the recent *Global Assessment Report on Biodiversity and Ecosystem Services* (IPBES, 2019): 1 million species threatened with extinction and greater than three-quarters of the planet's terrestrial habitat in serious trouble. Exacerbating the loss of biodiversity and habitat is the deterioration of ecological processual phenomena, and among the most greatly threatened are long-distance migrations (LDMs) – defined, most elementarily, as the seasonal movement to and from a given area. Already, many aerial, marine and terrestrial migrations have collapsed (Harris *et al.*, 2009; Berger *et al.*, 2014). Yet, a bewildering and impressive array of migrations still continue and inspire:

- red knots (*Calidris canutus*) – roughly 15,000 kilometres in travel between

Patagonia and the Arctic (Wilcove and Wikelski, 2008);

- Antarctic krill (*Euphausia superba*) – oceanic ascents and descents of 40-plus metres (Tarling and Johnson, 2006);
- Atlantic horseshoe crabs (*Limulus polyphemus*) – from shoreline to at least 100 kilometres beyond (Swan, 2005).

For large-bodied terrestrial animals, the situation differs and the conservation of LDMs represents a massive challenge because substantive amounts of unfettered space are required; already most African elephant (*Loxodonta africana*), plains zebra (*Equus quagga*) and wildebeest (*Connochaetes* spp.) LDMs are lost. Others, like those for wood bison (*Bison bison athabasca*) expand in Alaska's and Yukon's northern boreal realms; however, in Mexico, the US and Canada, plains bison (*B. bison bison*) LDMs were gone nearly 150 years ago (Sanderson *et al.*, 2008).

What's an optimist to do?

What's an optimist to do? Wear thick skin and change hats. Communicate broadly and simply about animals and their behaviours, including LDMs. It is not that the science banner *per se* should be ignored or dismissed. When I give public talks – unlike presentations to

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Biodiversity; conservation; conservation movement

“In 2016, 2018 and 2019, US Senator Tom Udall (New Mexico) and Representative Don Beyer (Virginia) have proposed a Wildlife Corridors Conservation Act to Congress. If the bill is successful, a protected network would be created to sustain biodiversity at different scales.”

professional audiences or government or appointed officials – I do not tout the data on the spectacular journeys of Monarch butterflies (*Danaus plexippus*), reindeer (*Rangifer tarandus*), Arctic terns (*Sterna paradisaea*) or humpback whales (*Megaptera novaeangliae*). I do not discuss scientific details of salmon (*Salmo* spp.) or sturgeon (27 species within Acipenseridae) or mention ecological function or intrinsic value. I talk not about millions of migrating individuals, young or old, or about tenacious journeys across hostile environments. I make no mention that such phenomena have repeated for thousands of generations, across millions of years, subject to evolutionary and ecological pressures. Instead, I simply ask a few members of the general audience to raise their hands. I ask each to tell the group about their favourite migratory animals. I ask what actions will be required to sustain their migrations in an increasingly human-dominated world. I ask these questions whether the audiences are indigenous or not, hunter or vegetarian, poor or rich, English speaker or other. And, they answer with examples including x, y and z animal species. They are drawn into the conversation; it is clear that they care.

People indeed adore nature and wildlife. Support for this love affair is evident from a simple metric – attendance at cherished pastimes. Annual visitation to US national parks or zoos, for example, singularly exceeds that of the combined number of attendees to professional American baseball, football and basketball games (Berger *et al.*, 2014). It's easy therefore to imagine that the italicized quote that introduced this article was written today. It was not. The quote derives from a 1901 New York Zoological Society (now, the Wildlife Conservation Society) report in which the ethics of wildlife conservation were becoming institutionalized (Hornaday, 1901).

Fortunately, across the nearly 120 years that have now elapsed, biodiversity is being valued at levels from genes to ecological processes. At least two countries

– Namibia and Bhutan – have the word ‘biodiversity’ in their founding legislation, and phenomena such as migrations are often showcased by ecologists for their sea- and land-shaping properties, which include nutrient transport and cycling, regardless of whether the animals are fish, terrestrial mammal or aerial aficionado (Bauer and Hoyer, 2014). The Convention on Migratory Species – instituted 40 years ago under the auspices of the United Nations Environmental Program – and the Neotropical Migratory Bird Conservation Act of 2000 underscore demonstrable progress.

Baby steps and not giving up

Optimism and public engagement aside, progress on the protection of LDMs is painfully sluggish, or more likely stifled, when scientists refuse to move beyond their data-shields to mobilize support for a biodiverse and healthy environment. At the plenary lecture of the 2011 North American meetings of the Society of Conservation Biology (SCB) in Oakland, California, Michael Soulé – the *de facto* founding father of SCB – was interviewed by journalist and writer Mary Ellen Hannibal (Hannibal, 2011). When asked about successes for protection of corridors and migratory pathways, Soulé acknowledged with chagrin only one formal case of federal protection, in the USA, dating to 2008: *Path of the Pronghorn*, a 70-kilometre-long and 2-kilometre-wide strip leading south from Grant Teton National Park in Wyoming (Berger and Cain, 2014). More than a decade later, no others have been added.

Staying with the American context, the failed efforts to safeguard some of its great land migrations have not resulted from a lack of cumulative effort (Aycrigg *et al.*, 2016). In 2016, 2018 and 2019, US Senator Tom Udall (New Mexico) and Representative Don Beyer (Virginia) have proposed a Wildlife Corridors Conservation Act to Congress. If the bill is successful, a protected network would be created to sustain biodiversity at different scales. A Yellowstone to Yukon model (Chester *et al.*,



Figure 1. Pronghorn movements in mass helped motivate public interest in migration in the US.

2012) might be envisioned that includes diverse habitats and protected areas to bolster connectivity across thousands of kilometres in a mosaic with humans; specific pathways are envisaged to assure finer-grained animal and plant movements between important habitats. The bill provisions for enhanced interagency cooperation (Udall, 2019). Principles from the proposed corridor act follow components of the unanimously passed 2007 resolution of the Western Governors' Association led by Dave Freudenthal, then Governor of Wyoming. This promised to "protect wildlife migration corridors and crucial wildlife habitat in the West." My colleagues and I had met previously with the governor to seek advice and to offer our data-based insights. He indicated support for our concept of statutory protection but only if his constituents, the Wyoming citizenry, favoured it. Freudenthal was right, I feel, to back such ideology, which was, and remains, immensely polarized by bipartisanship (as it was during 2007–08 with George W Bush and Dick Cheney in the White House).

It was not the science that created the victory for federal protection of *Path of the Pronghorn* during this acrimonious period (Berger and Cain, 2014), though this was of course required for identification of a corridor through which the animals move, one they have used for nearly 6000 years (Berger, 2004; Berger *et al.*, 2006). *Path of the Pronghorn* became a reality by petition and by vote, and by advocates for science and for people who donned thick skin and wore many hats. Success came from engaging the public with simple messages, sharing a beer or coffee with strangers, attending untold meetings in administrative offices, pitching ideas, taking risks with the people who can implement change, and accepting many insults for meddling. Indeed, beyond the science lies the real work in achieving conservation goals (see Figures 1 and 2).

A decade after this first federally protected corridor, the phenomenon of migration has arrived into the public lexicon. Migration is discussed broadly and in local municipalities; the *New York Times* and *Washington Post* – even the *Salt*

“Conservation failures derive in part because of academic timidity to engage at levels required to bring forth policy change.”

Lake Tribune – carry stories. As recently as ten years ago, when I asked state management agencies about their most endangered migrations, eyes dimmed. There was little recognition. Because of the work of many practitioners and non-profit organizations (e.g. the Yellowstone to Yukon Conservation Initiative), this has changed. States have wildlife action plans, many including migrations. Practical solutions will always be complex and fraught with controversy because, in the times we still live in, land cannot simply be tucked away for animals at the exclusion of humans.

To further facilitate our conservation goals, I will make two general points about LDMs. First, we need clarity in the words we use. The concepts of ‘connectivity’, ‘corridors’ and ‘crossings’ frequently blur when reported under the migration umbrella and popularized in social media, digital communications and outreach. This has had an unfortunate effect in political and agency circles when taking

up challenges and considering solutions for LDM protection (Beckmann, 2010; Hilty *et al.*, 2012). Second, despite substantive data collection steeped within the ecology of migration, conservation failures derive in part because of academic timidity to engage at levels required to bring forth policy change (compare this with medical professionals engaging with societal health issues). Climate scientist James Hansen, in a different, albeit related, context, called this “scientific reticence” – an unfortunate reluctance on the part of many scientists to speak in a forthright manner about the ecological predicament and become involved in policy and activist struggles (Hansen, 2016).

Confusion – connectivity, corridors, and crossings

Words such as migration and dispersal carry important process-based meanings; these vary from gene flow to colonization, and from immigration and emigration to movements from birth areas. Table 1 offers provisional

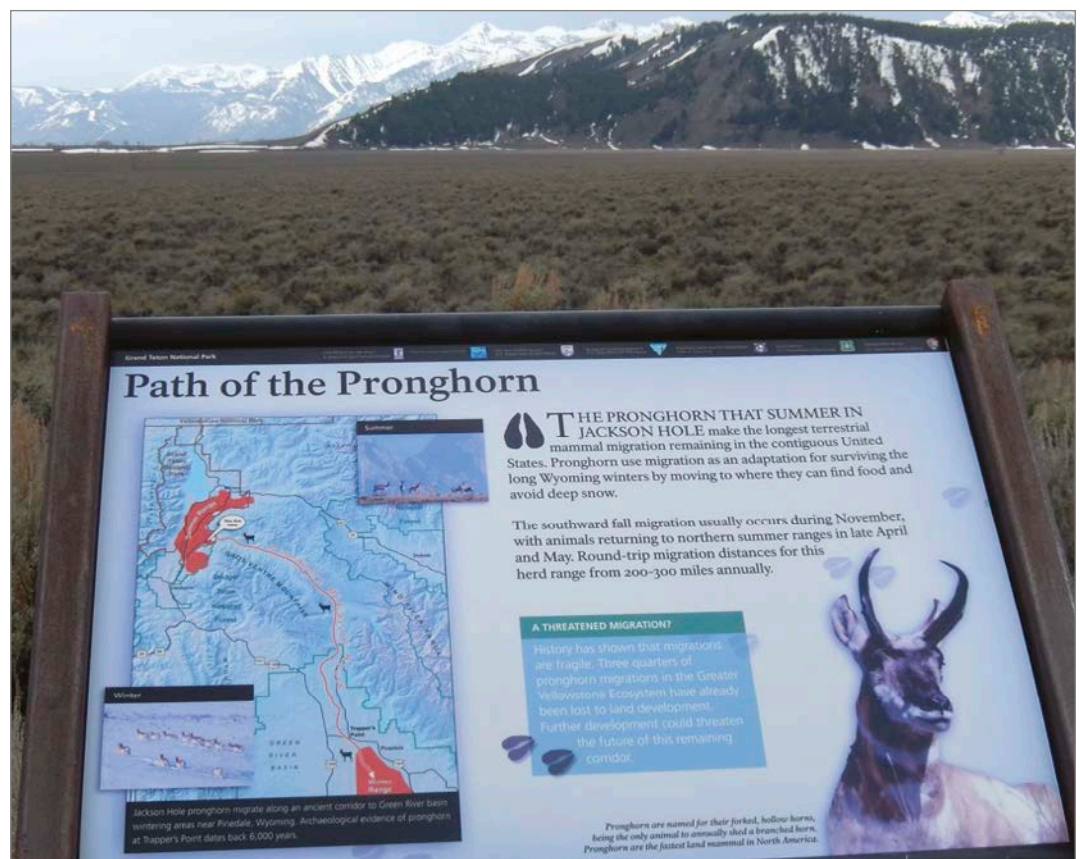


Figure 2. One of several public outreach signs in the US to commemorate migration.

Table 1. Commonly used words in migration literature (used more loosely in media).

Theme	Operational definition	Comment and examples
Migration	A two-way temporal movement involving a shift from one area and then a return to the previous general vicinity	Typically a seasonal phenomenon, but not uniformly true; yellow warblers, rattlesnakes, elk and grey whales ¹⁻⁴
Corridor[†]	A fixed place that links habitats; can be stepping stones or continuously fixed microhabitat locales that pass through unsuitable landscapes	Wetlands as stop-over sites, riparian zones, vineyards and mountain tops ⁵⁻⁷
Dispersal	Movement away from natal area or philopatric range	Mostly one-way movements in the parlance of behavioural ecology ⁸
Connectivity	Offers individual movement between appropriate habitats and links populations to assure gene flow	The term is also used to facilitate access to seasonal habitats ⁹⁻¹¹
Crossing[‡]	Allows for traversing inimical zones (e.g. roads or mountain passes)	Typically human constructs which promote connectivity (e.g. under- or overpasses); these mitigate against death by funnelling animals safely past danger zones ⁵⁻⁶

[†]The phrase “migration corridor” is sometimes used although not all corridors connote ‘migration’ though ecological function may be similar. [‡] These are physical sites which may be human or natural constructs where animals pass.

¹Berger, 2004; ²Sawyer *et al.*, 2009; ³Sawyer and Kauffman, 2011; ⁴Wilcove, 2010; ⁵Hilty *et al.*, 2012; ⁶Beckmann, 2010; ⁷Beckmann *et al.*, 2012; ⁸Pusey, 1987; ⁹Berger, 2004; ¹⁰Berger *et al.*, 2006. ¹¹Berger *et al.*, 2014.

definitions of key terms associated with pathways and migration as commonly accepted in the peer-reviewed scientific literature. Sometimes these meanings mutate and reify when used popularly but conservation messages must be clear and simple. For instance, a concrete bridge that links habitat across a major highway is a *crossing* structure, which might serve as a conduit for migrants; it is not a *migration corridor* although it may be placed in a *corridor*. It may also facilitate *migration* by assuring *connectivity* to enhance gene flow, and in the process reduce road mortality (Table 1). Differing from true migrations are movements of individuals who spread across landscapes nomadically in search of food or mates. Even the 2019 massive swarm of ladybirds (ladybugs) – numbering in the millions, spanning an area of 30 kilometres by 130 kilometres and detected by weather service radar – was clearly an occurrence involving movement but not a migration event (Dobuzinskis, 2019).

Academic timidity

There is no question that science underlies all biodiversity conservation, including the conservation of migrations. An empirically documented understanding of migration has led to substantive gains for aerial, aquatic and terrestrial migrants, resulting in such actions as removal or restriction of impediments (e.g. dams, roads and fencing), while bolstering wetland protections and expansion (Berger *et al.*, 2014). Overpasses and underpasses have been constructed – their placement would not have been possible in the absence of data. To cite some American examples, new ones will soon be deployed in California (for deer and cougars), as well as in Nevada, Oregon, Idaho and Wyoming. On Montana’s Flathead Reservation, more than 40 crossing structures aid species from fish and amphibians to grizzly bears. Yet, owing to backlash or repercussions for speaking out, numerous scientists remain quiescent in public arenas, even though

“When people do not have favourite animals, lack ecological champions, shut down in the face of endless scientific debate, are engaged only with statistics or data, fail in their compassion for other species, remain uninspired, or care disproportionately about money, then optimism will fade.”

the reality is that we must convey simple messages, have those beers and coffees, and meet in untold administrative offices. Such work beyond the science does not compromise scientific objectivity, rigour or calibre.

Understanding biology above all else is no longer the critical tool in a conservationist's toolkit, because challenges are frequently neither biological in nature nor related to data vacuums. There exists a broad portfolio of tactics available to specialists too timid or reluctant to speak directly on behalf of conservation interests. These include writing opinion pieces, blogging, offering services or making presentations to non-specialists, helping non-governmental organizations, developing podcasts and working more with journalists and other media specialists (Wittemyer *et al.*, 2018). Other productive means of engagement include liaising with the Connectivity Conservation Specialist Group (within the IUCN's World Commission on Protected Areas), which aims to shore up support for reducing the rate of habitat fragmentation so that migrations continue. Among other related conservation easement initiatives are the work of the Center for Large Landscape Conservation (<https://largelandscapes.org/>) and the Freedom to Roam campaign started by outdoor clothing company Patagonia.

Why not these two actions?

While there are no uniformly single best steps to achieve actionable conservation, some bold approaches will help.

■ Conservation is about *doing* and not about publishing *per se*. First, then, college- and university-level systems that operate as land-grant institutions (and thus have a mission to serve the public good) must go beyond just rewarding their faculties for the number and quality of peer-reviewed publications and grants. Although such incentive systems have helped make some American universities enviable in many parts of the world, faculty are not incentivized to engage in conservation action, especially when tenure and promotion are at risk. If this cannot

change, why would we expect faculty commitment? Fortunately, there are simple solutions. A number of universities have adopted new approaches, including the University of California's faculty-based extension agents (people tasked with applying research findings to practice) focused on biodiversity. A similar approach has been taken by the University of Nevada's College of Agriculture, Biotechnology and Natural Resources. Intrepid reform is required. Modifying tenure policies to recognize practical contributions to conservation achievement is an easy start. Similar considerations apply in other countries.

■ Second, we need more Greta Thunbergs to inspire future generations. In this case, it would be to highlight migration as a critical component of biodiversity. Greta, of course, is the sensational Swedish student lauded in 2018 Presidential candidate Bernie Sanders for chastizing world leaders for a lack of leadership on climate change (Newburger, 2018). Conservation scientists cannot achieve the success we would like to see if we rest behind doors touting our science but somehow expecting others to be the spokespeople.

The Wildlife Corridors Conservation Act proposed by Udall and Beyer has relied, in the initial phases, on science. In the end, however, success will come only if, as conservationists, we wear hats that reach beyond our comfort zones and enjoin distant partners. In 1901, Hornaday suggested something along similar lines. Non-governmental organizations, ranchers, farmers, painters, corporations, outdoor recreationists and citizen scientists must care. When people do not have favourite animals, lack ecological champions, shut down in the face of endless scientific debate, are engaged only with statistics or data, fail in their compassion for other species, remain uninspired, or care disproportionately about money, then optimism will fade. Attitudes change with activism (Teel and Manfredo, 2010). ■

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“The Wildlife Corridors Conservation Act proposed by Udall and Beyer has relied, in the initial phases, on science. In the end, however, success will come only if, as conservationists, we wear hats that reach beyond our comfort zones and enjoy distant partners.”



A **cramp-ball fungus weevil** on a cramp-ball growing out of a dead ash tree in St Albans, UK

Nature needs half: Implications for population, consumption and inequality in the ‘other half’

Conservation biologists have called on human society to give half the Earth back as natural habitat for our fellow species. This idea has prompted debates about population size, economic production and *per capita* consumption, and the distribution of conservation’s benefits and burdens, in the ‘other half’. This paper reviews some key aspects of these debates, and presents an empirical analysis of the relative importance of population versus *per capita* consumption as drivers of environmental impact. It concludes by asserting an overall synergy, rather than any fundamental trade-off, between the half-Earth and de-growth movements.

To turn the tide against the worldwide collapse of biological diversity, Wilson (2016) urged great expansion of the area protected as natural habitat, to include at least 50% of the Earth’s surface. This idea goes under the name of ‘half-Earth’ or ‘nature needs half’ (NNH). Dinerstein *et al.* (2017) refined Wilson’s proposal, to aim at 50% protection within each of the 846 terrestrial ecoregions that collectively span the entire land surface of the planet. This refinement could also apply to the 232 marine ecoregions identified by Spalding *et al.* (2007).

Surely our 10 million fellow species collectively deserve at least half an Earth on which to exist, flourish and continue to evolve (Nash, 2011; Mikkelsen, 2019). However, some critics have sounded the alarm that such a dramatic increase in the area kept off limits to industrial activity “would have widespread negative consequences for human populations” (Büscher *et al.*, 2017b). These same critics argued that tackling economic growth and inequality would preserve species more effectively than NNH’s focus on protected areas. NNH supporters have, in turn, defended the idea against these charges. Below, I review these defences and a reply to them by Büscher *et al.* (2017a). To adjudicate on one aspect of the debate – about the relative environmental impacts of human population size versus *per capita*

production and consumption – I employ a data set compiled from public sources.

Nature getting half: Social and economic correlates

To allay the fear of harm to human populations, Dinerstein *et al.* (2017) stressed that expanding protected areas can empower and otherwise benefit indigenous and other local communities. They cited “[m]any indigenous reserves in Latin America, Asia, Africa, and Australasia” as precedents. And they highlighted Namibia and Nepal as two countries “advancing to or already surpassing Half Protected” thanks largely to engagement in conservation by local peoples.

Cafaro *et al.* (2017) responded to another argument, that “instead” of NNH, society should take “alternative radical action [...] shifting the global economy from its current foundation in growth” (Büscher *et al.*, 2017b). Cafaro *et al.* agreed on the necessity of challenging the “neoliberal growth economy.” But they pointed out that rather than posing an alternative to NNH, a challenge to growth would actually result from NNH’s protection of much larger areas from the economy’s “ravenous demands for natural resources”. They thus echo an insight expressed in a recent book on ecological economics, that protected areas play an important role in limiting economic throughput (Dietz and O’Neill, 2013).

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“Another bone of contention between supporters and opponents of the NNH idea concerns the relative importance of human population size versus economic production and consumption *per capita*.”

Büscher *et al.* may have posed a second false dichotomy in declaring that “cutting inequality in half would do more for conservation than attempting to protect half of the Earth from humanity”. Studies by colleagues and myself have indeed shown that countries and US states with lower Gini indices of income inequality have lower rates of biodiversity loss (Mikkelsen *et al.*, 2007; Mikkelsen, 2013). In fact, we found that for each one per cent drop in inequality, metrics of biodiversity loss fall by even more than one percent. However, I speculate that one reason for this connection is precisely that more equal societies tend to protect natural areas more effectively against harmful human activities like commercial extraction of natural resources, industrial agriculture, and urban, suburban and exurban sprawl. If this is true, then it is misleading to propose less inequality as an alternative to more protected areas, since the two go hand in hand.

The relative importance of population size versus *per capita* production and consumption

Another bone of contention between supporters and opponents of the NNH idea concerns the relative importance of human population size versus economic production and consumption *per capita* (henceforth ‘consumption’ for short), as drivers of biodiversity loss. While Cafaro *et al.* accused Büscher *et al.* (2017b) of ignoring the contribution of population increase to overall economic growth, Büscher *et al.* (2017a) implied that Cafaro *et al.* were “focusing attention on the reproductive habits of the poor rather than the more environmentally damaging consumption habits of the rich.” Is consumption indeed more “damaging” than population? Historical data on population size, gross domestic product (GDP) *per capita* and ecological footprints permit us to compare the strength of these two primary drivers of environmental impact.

Ecological footprints quantify the renewable resources depleted, and carbon emitted, to produce the goods consumed within any given region, and support

the built infrastructure there. Footprints allow different categories of depletion and pollution to be compared in terms of standardized ‘global hectares’ (gha): the area of forests, fields, farms and fisheries needed to renew the resources depleted, and absorb the carbon emitted, to sustain the region’s current level of consumption. The Global Footprint Network (2018) compares this measure of demand for ecological sources and sinks to the corresponding measure of supply, termed ‘biocapacity’ – the gha of the region’s biologically productive land and water. Ecological footprints are perhaps the most comprehensive measure of environmental damage that is currently available (Wackernagel and Beyers, 2019). Since they reflect human expropriation of habitat area and greenhouse gas emissions – two leading proximate drivers of other species’ depopulation and extinction (WWF, 2018) – footprints have significant relevance for conservation.

Perhaps the simplest way to compare the environmental damage done by population versus consumption is to apply the well-known IPAT equation to the global economy over time. The IPAT framework (Ehrlich and Holdren, 1971) considers total negative environmental impact (*I*) as a function of population size (*P*) times production and consumption *per capita* (*A* for ‘affluence’) times environmental impact per unit of production or consumption (*T* for ‘technology’). In this case, we can measure *I* as humanity’s total ecological footprint, *P* as global population size, *A* as world GDP *per capita* (corrected for inflation) and *T* as gha of ecological footprints per dollar of GDP. The good news is that ecological footprints per US dollar have declined steadily over the period tracked by the Global Footprint Network. Whereas it took 6.1 gha to produce US\$10,000 of world GDP in 1961, it took only 2.6 gha in 2016 – a decrease of nearly 60%. This reflects dramatic improvements in resource efficiency and pollution control.

However, the bad news is that population and consumption both exploded over the same period, to the point that either one, by itself, would have more than offset the gains in efficiency. Human population size

ballooned from 3.1 billion people in 1961 to 7.5 billion in 2016. Meanwhile, GDP *per capita* surged proportionally even faster: from US\$3700 to US\$10,400 (Global Footprint Network, 2018). As a result, humanity's total ecological footprint mushroomed from 7.1 billion gha in 1961 – well within world biocapacity at the time – to 20.5 billion gha in 2016. This nearly three-fold expansion has taken us to a state of overshooting Earth's biocapacity of 12.2 billion gha by almost 70%. If we apportion this rise in ecological footprints to population and consumption according to how much the latter two variables increased over that same period, we can conclude that consumption slightly outweighs population as a driver of environmental impact. To wit, while population growth contributed 44% of the increase in footprints, consumption growth contributed 56%.¹

Data on individual countries afford a more detailed comparison of population versus consumption as drivers of ecological footprints. Public sources make available the populations, GDPs *per capita* and ecological footprints of 120 countries over 56 years (1961–2016), for a total of 5705 data points – (i.e. combinations of one country and one year; see [Appendix 1](#) for more detail about sources and methods). Across these countries and years, ecological footprints increased by 1.2% for each one per cent of population growth, but only 0.5% for each one per cent of growth in GDP *per capita*. By themselves, these two figures suggest that population has more to do with environmental degradation than does consumption.

However, we must also take into account the fact that GDP *per capita* has generally grown much faster than has population size. Within this sample, populations grew at an average rate of 1.1% per year, whereas GDP *per capita* grew by an average of 2.9% per year. Multiplying these average rates of increase by the corresponding footprint expansion attributable to each one per cent of increase yields the following estimate: while population growth drove 47% of the expansion in ecological footprints across this extensive set of countries and years, consumption growth drove 53%. This confirms the inference made above

on the basis of humanity's total footprint: consumption slightly outweighs population as a driver of environmental degradation.

This suggests these two root causes deserve nearly equal attention when it comes to relieving and reversing biodiversity loss and other ecological disasters unfolding in the 21st century. Crist *et al.* (2018) rehearsed ways of easing population pressure. Reduction of working hours may be the most promising way of easing down *per capita* production and consumption. Working hours have stronger ties to both ecological footprints and income inequality than does any other of the following basic determinants of GDP – population size, the employment rate or labour productivity (Mikkelsen, in review). Given all of the above, we can predict that de-growth in population size and working hours would interact synergistically with NNH. The project of slowing, stopping or reversing growth in GDP, while distributing it more equally within and among societies, therefore fits in well with NNH.

Conclusion

The idea of giving half the Earth back to nature promises to help incite the bold action required to reverse the current, incipient mass extinction. Already, NNH has inspired scholarship bridging gaps between natural science, social science and the humanities (and, in particular, ecocentric environmental ethics, on which see, for example, Washington *et al.* [2018]). Like any bold proposal, it has also attracted criticism, and responses to that criticism. Above, I essayed to adjudicate on three aspects of the debate, concerning economic de-growth, economic equality and the venerable question of whether it is more important to reduce population size or *per capita* production and consumption in order to reverse environmental degradation. I sided with defenders of NNH in framing de-growth as a natural correlate of NNH, rather than a competing alternative as imagined by NNH critics. I added that enhancing economic equality would probably also go along with NNH, thus dispelling another false dichotomy posed by NNH critics.

I delved deepest into the question of population versus consumption as drivers

“The idea of giving half the Earth back to nature promises to help incite the bold action required to reverse the current, incipient mass extinction.”

“NNH has inspired scholarship bridging gaps between natural science, social science and the humanities.”

of ecological damage. Based on analyses of ecological footprints over nearly six decades at the global level, as well as among 120 countries over that same period, I sided with NNH critics in holding consumption more responsible than population as a cause of environmental impact. However, since the two differ only slightly in the magnitude of their effects, it would be horrifically irresponsible to ignore either one. Reducing each requires strong measures that, happily, would enhance human well-being along with the survival prospects of our fellow species (Götmark *et al.*, 2018; Mikkelsen, in review). Thus, while local trade-offs certainly exist between conservation and true human development, in general they go hand-in-hand. ■

Notes

¹ Some sources have misleadingly implied that, to the contrary, population far outweighs other root causes of environmental impact. For example, Gerlach *et al.* (2018) began their working paper by stating “The historical increase in [greenhouse gas] emissions is for [sic] one-fourth attributable to the growth of emissions per person, whereas three-fourths are due to population growth.” The problem with this statement, and others like it, is that they hide increases in GDP *per capita*, by collapsing together the last two factors in the IPAT equation.

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Appendix 1. Further information on the methods used in the author's empirical analysis.

This appendix is presented as supplementary information, in the form supplied by the author, and has not undergone the same level of peer review as the main article.

The empirical analysis reported above draws on data from the Conference Board and Global Footprint Network. The Conference Board (2019) supplies information about countries' population size and gross domestic product (GDP) *per capita*, corrected for inflation over time and differences in purchasing power between countries (2018 US\$, purchasing power parity). Data on ecological footprints come from the Global Footprint Network (2018). Estimates are available for population size, GDP *per capita* and ecological footprints; in anywhere from 5 to 56 years between 1961 and 2016; for 120 countries.* This makes for a total of 5705 observations.

To estimate the relationships among these variables, I performed a two-way panel regression of the natural logarithms of ecological footprints on the logs of population and GDP *per capita*. This method estimates the logged footprint in a particular country and year as a linear function of the logged population size and GDP *per capita* in that same country and year, while controlling for both the time-invariant characteristics of individual countries, and the characteristics of individual years that are common to all countries. Using logged variables entails that the slope estimates are elasticities (Bailey, 2015). In this case, this means the per cent increases in ecological footprints that are associated with one per cent increases in either population or GDP *per capita*, while holding the other constant. To estimate the average yearly percent increases of population size and GDP *per capita*, I took the means of those increases across the

whole sample, weighted by the ecological footprint in any given country and year.

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*Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Burkina Faso, Côte d'Ivoire, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Democratic Republic of Congo, Ecuador, Egypt, Estonia, Ethiopia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Latvia, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Moldova, Morocco, Mozambique, Myanmar, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal, Serbia and Montenegro, Singapore, Slovak Republic, Slovenia, South Africa, South Korea, Spain, Sri Lanka, St Lucia, Sudan, Sweden, Switzerland, Syria, Tajikistan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, UK, USA, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia and Zimbabwe.

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Pyrenean violets in
a national park, Spain

Excerpted chapters from *On Beauty: Douglas R. Tompkins* —aesthetics and activism

This piece comprises two chapters from *On Beauty: Douglas R. Tompkins— aesthetics and activism*, which was published by the David Brower Center in conjunction with the art installation *On Beauty*, mounted in 2017 in Berkeley, CA, USA.

Universal Beauty

Tom Butler

“There is no synonym for God so perfect as Beauty.”

— John Muir

Before John Muir became the great prophet of American wilderness and champion for national parks, he took thousand-mile walks to the Gulf of Mexico, botanizing along the way, and rambled widely through California’s mountains, puzzling out the geology and glacial shaping of the landforms he traversed. The largely self-taught naturalist was a mountaineer and endurance athlete of prodigious boldness and skill. Even when carrying a plant press to save specimens, Muir typically traveled light, often with little more than a satchel containing bread, a book or two, and his journal.

One day in December of 1874, while Muir hiked alone in the northern Sierras, a storm gathered. A cautious mountaineer would have sought shelter in the low country. Muir instead went up, climbing a ridge to experience the weather’s full force. At the height of land, he noted a cluster of hundred-foot-tall Douglas fir trees whose “lithe, brushy tops were rocking and swirling in wild ecstasy.” Muir was accustomed to climbing trees for his botanical studies; he easily ascended the tallest fir and spent hours riding the storm’s currents.

“The slender tops fairly flapped and swished in the passionate torrent, bending and swirling backward and forward,

round and round, tracing indescribable combinations of vertical and horizontal curves, while I clung with muscles firm braced, like a bobolink on a reed,” he later wrote. During his time aloft, Muir reveled in the “the high festival” of fragrant air, sublime light, and the “music” of windswept trees. “The sounds of the storm,” he noted, “corresponded gloriously with this wild exuberance of light and motion.”

While this recounting of “wild ecstasy” in the treetops is particularly thrilling, Muir’s prose generally tended toward the effusive, with praise of “Nature’s open, harmonious, songful, sunny, everyday beauty” a leitmotif. Later sought out by presidents and captains of industry, the then-obscure naturalist would become famous through his writings, which form a running commentary on his own rapturous relationship with nature, the “freedom and glory” he enjoyed in “God’s wilderness.”

A Scotsman by birth who emigrated to America with his family at age 11, Muir’s early years on a hardscrabble farm carved from the American wilderness were filled with toil and cruelty at the hand of his devout, evangelical father, whose strain of Calvinist-influenced Christianity was as severe as the beatings he inflicted on his son John. The younger Muir’s theological leanings would later evolve toward pantheism, but his deep familiarity with the King James Bible not only influenced the quality of his prose but also laid the foundation for his evolving worldview.

Like most people of his place and time, Muir would have been able to recite by

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heart the opening passage of Genesis, which formed the dominant creation myth of his culture:

In the beginning God created the heaven and the earth.

And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters.

And God said, "Let there be light:" and there was light.

In that account, God goes on to separate the heavens and earth, the land from the waters, to fill the Earth with plants and animals, to create men and women, and then to give humans "dominion" over all of the Creation. It's a rich story, beautiful in its drama and poetry, albeit problematic once one gets to the granting of ownership of and divine exhortation to "subdue" the Earth.

Muir, a man of science as well as believer in the sacredness of nature, would later explicitly reject the anthropocentrism inherent in the Genesis story, writing, "No dogma taught by the present civilization seems to form so insuperable an obstacle in the way of a right understanding of the relations which culture sustains to wildness as that which regards the world as made especially for the uses of man. Every animal, plant, and crystal controverts it in the plainest terms."

In another work he asked, "Why should man value himself as more than a small part of the one great unit of creation?" In another, while railing against humanity's hubris, he noted: "I have precious little sympathy for the selfish propriety of civilized man, and if a war of races should occur between the wild beasts and Lord Man I would be tempted to sympathize with the bears."

Don Worster's brilliant biography of Muir, *A Passion for Nature*, includes a scene wherein Muir comes upon a bear carcass and stops to mourn his fallen ursine neighbor. The notion that the bear was kin, a relative in the community of life, was an idea at odds with Muir's cultural heritage but of course commonplace in indigenous

cultures around the world. If Muir had been born to any of numerous native North American tribes, he would have learned stories in which bears figured prominently in the cultural mythology and would have been able to recite his tribe's creation myths as readily as the young Scotsman quoted scripture.

The Miwok Indians who thrived for millennia in the western Sierra foothills down to the Pacific Coast before a conquering civilization disrupted their culture, have a creation story featuring a female silver fox and male coyote who sing and dance the world into being. Without digressing into Muir's interactions with Native Americans (suffice it to say he was both a progressive thinker as well as a product of that colonial civilization with its racial bias), Muir's writings and those of other early thinkers in what came to be the American wilderness conservation movement reflected earlier, indigenous ways of experiencing the world.

Muir's description of nature's intrinsic "order and beauty," his familial reverence toward other forms of life, the way he believed that it was a property of humans to glow "with joy" when "exposed to the rays of mountain beauty"—these values are aligned with the sentiment encapsulated in the Navaho/Diné people's traditional prayer, "The Beauty Way":

In beauty I walk

With beauty before me I walk

With beauty behind me I walk

With beauty above me I walk

With beauty around me I walk

It has become beauty again

It has become beauty again

It has become beauty again

It has become beauty again

Along with the needs of food, shelter, and sex, there may be no more fundamental human yearning than this—to be connected, to be in harmony, to feel rooted to place and people, to walk in beauty. "Biophilia," the term coined by biologist Edward O. Wilson to describe our innate inclination to affiliate with the diversity of life, captures that longing.

"Along with the needs of food, shelter, and sex, there may be no more fundamental human yearning than this—to be connected, to be in harmony, to feel rooted to place and people, to walk in beauty."

Almost certainly the mountaineer's compulsion—the drive that John Muir felt to climb the highest peaks in the Sierras, or Doug Tompkins's zeal to put up first ascents on multiple continents—was partly an expression of this beauty-seeking tendency. And even for us wilderness travelers who do not aspire to similar climbing exploits, it is that direct experience of wildness that kindles connection, the kind that Henry David Thoreau described when he said: "Talk of mysteries! —Think of our life in nature, —daily to be shown matter, to come in contact with it, —rocks, tree, wind on our cheeks! the solid Earth! the actual world! the common sense! Contact! Contact!" (For his many virtues, we'll forgive Thoreau's excessive use of the exclamation point.)

While people naturally inclined to spiritual introspection may discuss such matters unashamedly, many of us leave such topics unexamined, or fear to say it out loud: this search for connection is inextricably tied to life's existential questions: From whence do we come? Where do we return? While sauntering through this mortal plane, are there times and places we can brush up against the eternal? (And must we climb to the top of stormswept Douglas fir to experience that primal unity?)

If the desire to be connected is indeed one of our deepest human inclinations, how ironic is it that modernity, at least in the supersized, techno-industrial-capitalistic form we see in the overdeveloped world, presents an almost perfect set of cultural conditions to thwart that desire. The economic, political, and cultural superstructure that shapes and constrains daily life in countless ways undermines life-affirming relationships and erects barriers to the formation of an integrated understanding of an individual's place in the biotic community.

The foundation of the great wall separating people from all our relations in the community of life is language and the way language presupposes and reinforces

a worldview. The way that language shapes our thinking and undergirds the dominant human-supremacist worldview is a largely unexplored topic in the popular literature of nature conservation, and, unfortunately, one can find a million examples of common language in "environmental" discourse that reinforces a resourcist worldview. The language of ownership and dominion is built on talk of "stewardship" (a word that originally referred to the "ward" of the "sty," the person who tended the domestic animals) and positively framed "working landscapes" (places where natural habitat is removed or manipulated to support resource extraction, such as logging or livestock grazing). Note in the next direct mail appeal or calendar you receive from an environmental nonprofit the ubiquitous use of the possessive "our"—as in, "we must protect our oceans" (as if the oceans belonged to us).

In its bias toward human-centeredness we can see that our reductionist, mechanistic, and increasingly cyber-metaphor-infused language is quite unlike that of earlier human cultures, where stories of communion and reciprocity between the human and other animal nations were ubiquitous. Beyond the pseudo-tribal gyrations of professional sports and the clichés of regional identity (Don't mess with Texas!), there is little common language that anchors people to place, and to other creatures in the land community.

Nearly twenty thousand years after humans painted extraordinary images of animals on the cave walls at Lascaux—and presumably participated in a sophisticated ritualized relationship with the creatures depicted—how can our present discourse on beauty and the relations between our species and others be so bereft and trivial? How much we have lost.

In our time, what passes for concern for beauty is mostly thin and cheap, oriented toward crass commercialism and celebrity worship. On the other end of the spectrum, a river of academic writing about art and aesthetics is intentionally insular,

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“Like an ecosystem whose integrity and beauty are linked to its diversity, a language of beauty for our times will include the indigenous voices not well represented in the canon of the classic nature tradition, as well as the nonhuman voices we hear around us, if we listen.”

inscrutable to nonexperts, and powerless to shape any broadly meaningful cultural transformation.

If the idea of beauty as a potent elixir to help heal the world is to have any chance, then first we must speak of beauty in a way that is not trivial. That is not superficial. That is not corrupted by the values of a society oriented toward perpetual economic growth. If we are to be successful in gestating a new cultural conversation about beauty’s motive power to kindle ecological and social recovery, this discussion must be broadly accessible and attractive.

With a foundational orientation toward ecocentrism, that conversation might borrow from the Norwegian ecophilosophers whose writings deeply influenced Doug Tompkins to orient his life’s work toward beauty. It might also include the “sense of wonder” Rachel Carson articulated, as well as the poetry of Wordsworth and his English Lakes District contemporaries who later influenced Emerson, Thoreau, Muir, etc. Like an ecosystem whose integrity and beauty are linked to its diversity, a language of beauty for our times will include the indigenous voices not well represented in the canon of the classic nature tradition, as well as the nonhuman voices we hear around us, if we listen.

A language of beauty needs to evoke the voices of those creatures on the cave walls at Lascaux as well as the creatures with whom we share our backyards. It might invoke, to borrow Derrick Jensen’s phrase, “a language older than words.” It need not necessarily replace the creation myth of any particular culture, but can include and enhance them in a holistic narrative that gains power from its cultural diversity.

Whether our preferred creation story includes the Miwoks’ Silver Fox or Hopi people’s Grandmother Spider or the astrophysicists’ Big Bang, whether we understand the spark of life/beauty emanating from the hand of a Divine Creator or the miraculously creative unfolding of what Aldo Leopold called

the “evolutionary odyssey,” the results we see around us—life’s diversity—are astounding. If we take seriously the scientific explanation of our species’ evolutionary heritage, then we are not just metaphorical neighbors to all organisms in the community of life, we are literally related, a genetic connection we can describe through science or absorb through the stories of indigenous cosmologies. The spleenworts, sequoias, and humans have common ancestors. This is worth repeating for emphasis: all our relationships with other living creatures are, ultimately, familial.

Whether we recognize it or not, we are connected. Our sense of autonomy is an illusion, resulting from biological (our sensory apparatus) and cultural factors. Disconnection is practiced artifice, underlaid by philosophical, linguistic, and cognitive training, most of which is entirely unnoticed and unexamined. A conscious effort to practice beauty, however, can help override the cultural conditioning of disconnection.

It may not be John Muir’s transcendent moment of ecstasy in the delirious treetops, but for some of us not so bold, the unlearning comes with daily practice of greeting the neighbors. Recognizing our common origins, conjoined journey, and common fate, we echo the warm acknowledgment issued by the poet Mary Oliver to “the moss grazing upon the rock”: “I touch her tenderly, sweet cousin.”

Of a spring morning, when I rise early to spend time with arriving warblers in their springtime finery, Blackburnian with his iridescent orange breast, Canada with his decorative black necklace, Chestnut-sided with his incessant chatter that he’s pleased to meet me, I say yes, I am pleased to meet you too.

Radically mysterious, the epic of evolution’s long unfolding is a pageant of pulsing and contracting life, the universe breathing beauty. We, along with the wildflowers and wolves, cicadas and jaguars come from beauty, and like every living thing, will return to beauty. ■

The Kinship of Beauty and Life

Sandra Lubarsky

“The greatest wholeness is organic wholeness, the wholeness of life and things, the divine beauty of the universe.”

— Robinson Jeffers

Part of the deep psychosis of our time is that we measure the world in terms of our own pleasure. It’s an old riddle, whether something pleases us because it is beautiful or whether we think it is beautiful because it pleases us. For most of western civilization, almost every major thinker—Plato, Aristotle, Augustine, Aquinas—resolved the riddle in favor of beauty’s presence in the world. Old-growth coastal redwoods, filtering sunlight and sheltering bundles of huckleberry, are beautiful in their structure and their relations. An encounter with these fog-catching trees yields a surge of delight in their beauty, a spontaneous primordial “wow!”

And yet, the convention of our times is to claim that “beauty is in the eye of the beholder,” that instead of being a fact of the world, beauty is something formulated by our minds and dependent on individual preference—and then imposed on the world. People decide for themselves whether something is beautiful or not, and that decision is usually based on pleasure. Those towering sequoias with their furrowed bark and burlled torsos shift from being beautiful in and of themselves to being beautiful because they please us. The eye of the beholder becomes a barometer of personal satisfaction—and pleasure becomes the measure of beauty rather than the result of beauty.

This human-centered approach to beauty is so fully threaded into the fabric of our modern way of thinking that we are scarcely aware of its consequences. But in turning inward to find value, we turn away from the world. In believing that value is something generated only by humans, we conform to the idea that the world lacks its

own value. And in making our pleasure the primary measure of value, we imply that all life on earth is for the purpose of serving human life. The result is a relationship with the world that is destroying the world.

The belief that beauty is in the eye of the beholder is part of the larger cultural story of human exceptionalism, with its justification of human dominion and entitlement to use the earth as we desire. We split the world between intrinsically valuable humans and everything else, valued only for their usefulness to us. But this image of a hollow-shelled world, devoid of value (except for the value imposed on it by the human species), is not supported by our lived experience. Every time we look out the kitchen window to enjoy a sunset crackling with gold or step into the night to catch a blaze of meteors in the sky we enact a rebuttal to this parsimony of value. Every time we spontaneously shift our awareness toward the orange-tipped curve of an ocotillo blazing in the desert or a sweep of purple jacaranda petals carpeting the sidewalk, we break the narrative that the human mind alone produces beauty. What was thought to be hollow is resonant with merit and our response to it is visceral and unpremeditated. In that moment, we know that the world generates its own value, that the world was beautiful before humans arrived on the scene, and that we are shaped, enchanted, and sustained by it. We know that beauty is something more than human invention and personal opinion. And we know that the pleasure we experience when we walk in the world is a pleasure given to us, the consequence of beauty arising from the living relations of the world.

When we remember this, we begin a rotation back toward the world. Spinning like dervishes, we abandon the deep loneliness of separation and realign the axis of human experience with the life that infuses our life. Our direct experiences of beauty can guide us. Begin with sunsets, meteors, ocotillos, and jacarandas, the extraordinary familiars of the world. Admit with poet Arthur Sze that “the infinite glitter of the world’s here in our arms, here or

“In believing that value is something generated only by humans, we conform to the idea that the world lacks its own value. And in making our pleasure the primary measure of value, we imply that all life on earth is for the purpose of serving human life.”

not at all.” Abandon the idea that beauty is a small subject, best kept within the confines of the arts or women’s fashion. Recognize that the question, “What is beauty or the beautiful?” is a metaphysical question about the make-up of the universe and that to ask it is to replace the conventional picture of the world-as-machine with the image of the world-as-alive.

In remembering, we free ourselves to admit that beauty is a quality of life that overflows individual judgment and narrow, personal pleasure. It is a matter that belongs in the open space of public discourse.

* * * * *

But it isn’t easy to talk about beauty. Language systems are nested in metaphysical systems and language and culture are intertwined, producing and reproducing each other. The words and concepts we use and the way we use them are permeated by assumptions about how we understand reality. Our modern, western culture is largely dominated by the idea that the best way to describe the way things function is in terms of a machine and that, like a machine, reality is made up of dead matter that has no intrinsic value. We talk about hearts pumping blood, bodies needing fuel, and brains operating like computers. Because in some ways and to some extent, reality is machinelike, these are helpful metaphors. But the trouble is that we have tended to move from “is like” to “is,” and we have accepted these machine-based metaphors as a fully accurate description of reality. Mechanism has become an idea so deeply embedded in our culture that we are hardly aware of it. It is the primary reason why we have lost our proficiency in the language of beauty.

The lexicon of beauty includes words that have no application to machines: feeling, emotion, value, participation, inspiration, creativity, spontaneity, openness, and aliveness. These words, spoken in a mechanistic world where proper language is expected to be definite, precise, and quantifiable, sound soft and indeterminate, like a private language with no common rules. We stammer, struggling to answer

the peremptory question that demands a sound bite answer, “What is beauty?” Out of embarrassment or exasperation we censor ourselves. But a language unspoken is a language endangered and a culture impoverished. Not to speak about beauty is to contribute to the diminishment of a vital part of our experience.

Yet, after so many years of cultural indifference, it is challenging to speak about beauty as a value that deserves our attention. It is, by contrast, shamefully easy to point to the cost of silence: clear-cut forests and disfigured mountains, spoil tips and tailing heaps, strip malls and swaths of concrete parking lots. In our failure to make beauty a public concern, vast tracts of formerly healthy ecosystems have been transformed into discarded landscapes. Ecological decline always involves the loss of beauty. At the very least, for the sake of curtailing the wreckage, we had better find our tongues and relearn the language of beauty.

The most important conversation we can have today is about how to live well on our beloved Earth without destroying it. It is the conversation about sustainability. But it isn’t customary to speak of beauty as a critical dimension of sustainability. There is no place for beauty in the popular “three-E” formula for sustainability: economics, environment, and equity. Beauty plays no role in the mainstream hope that we can manipulate and manage complex ecological systems or that we can develop technological innovations that will preserve our first-world lifestyles and protect the planet’s biotic health and climatic stability. But these are notions of sustainability that are rooted in the very worldview that has steered us toward this most precarious period in human history. We are in need of a broader, deeper foundation for sustainability.

Though the word “sustainability” seems to suggest endurance as its paramount goal, in fact it bears a greater intention: a concern with flourishing. The question is not meant to be, “How can we endure endlessly on the planet?” or “How can we maintain the status quo?” At the heart of the notion of

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sustainability is an axiological question about value and what is worth sustaining. It is a question that goes beyond mere persistence, though certainly reproductive capacity is a necessary part of the answer. A far greater ethical-aesthetic vision informs the practical work of sustainability, one in which the convergence of beauty and goodness is assumed. The question we need to ask is, “How can we live in life-affirming ways?” and it is synonymous with the question, “Can we live in ways that promote beauty”? Sustainability is a practical guide for arriving at a world flourishing with the beauty of life-supporting relations.

* * * * *

The most important thing to know about beauty is its kinship with life. Rather than denoting a thing in isolation, beauty signifies life-in-relationship. Most importantly, it is evidence of the cooperation of incalculable forms of life, shaping themselves into a life-supporting community. In this labor of life adjusting to life, each individual life aims both for reproduction and for an intensity and fullness of life. That intensity and fullness depends on a million delicate adjustments that simultaneously strengthen the vitality of the individual and the whole, achieved only over great stretches of time. The outcome is a world where diverse forms of life belong, in the very literal sense of the word: holding membership of place and sharing interest and concern. The outcome of belonging, of right relationship, is a place of beauty. It is where our own vitality is nursed and fortified. When we experience this beauty, we feel the quickening of our being, an intensifying of our individual lives in right relationship with the life of the whole—and the revitalization of our deepest and oldest desire to belong to the world.

This way of understanding beauty makes it clear that beauty is more than an inconsequential subject of fashion or a matter for debate among artists. It is fundamental to an ecological paradigm; beauty is the name for the value associated with aliveness. Inextricably

bound up with the morphology of individual organisms and communities of organisms, it is the way we talk about patterns and relationships that create and sustain life. In its partnership with the deep structure of life, beauty is most visible in our encounter with life-affirming experiences. Flowing water, buds and blossoms, young children—these are familiar instances of beauty in association with vitality. There are a million ways that beauty appears both with regularity and surprise, and always, like life itself, ephemerally. When they arise from a place of health, they produce a manifold of beauty. In a diminished environment, they are brief, tilting moments, undone by the absence of vigor and coordination.

Because beauty is so diverse, there is no one best or final form. There is great beauty in the high desert of the Colorado Plateau and great beauty in the lush temperate rainforests of the Chilean coast; there is great beauty in the simplicity of a Zen meditation hall and great beauty in the vibrant aesthetic of artist Frida Kahlo's blue house. There are many manifestations of beauty and as with all experience, beauty is specific to its environmental and cultural conditions and to the experiencing subject. But the diversity of beauty, its plural forms, does not mean that beauty is simply a matter of opinion. It is a mistake to move from the diversity of beauty to the claim that beauty is completely subjective, entirely a matter of individual perspective. When we see images of mining operations on the Alberta tar sands with its tailing piles, open pits, and clear-cut Boreal forest, or images of a living body in pain or decay, perhaps a baby albatross in the process of dying from the tiny bits of ocean plastic it ingested, it is fair to say that there is widespread agreement—nearly universal agreement—that these things are ugly. This agreement helps us to understand that judgments of beauty, like those of ugliness, are not simply subjective. We may disagree on details and we may choose to ignore or repress our immediate relational rapport but we share a deep receptivity to experiences that increase or decrease life.

“The most important thing to know about beauty is its kinship with life. Rather than denoting a thing in isolation, beauty signifies life-in-relationship.”

“To separate beauty from life and life from beauty is to do great injury to both.”

To separate beauty from life and life from beauty is to do great injury to both. The same goes for undoing the bond between beauty and goodness, treating them as different kinds of value. In fact, goodness is a form of beauty, one that depends on the free and conscious actions of persons. It is nested in the broader category of beauty, the value in which all of life, conscious or not, participates. To repress the one is to distort the other. We speak of ethical actions as “beautiful” for the very reason associated with beauty: they are life-affirming. Both beauty and goodness are ways of coordinating life to life and enabling each individual life to flourish. Both evoke action directed toward increasing and intensifying value. Both are teachers of care, drawing us into relations beyond ourselves. Work on behalf of justice and fairness, efforts to alleviate poverty and suffering—all are acts of beauty, enabling all members of society to freely and fully engage with life. Years ago the Jewish theologian, Abraham Joshua Heschel wrote, “It takes a great deal of inner cultivation to attain real love and real compassion. It takes also a new conception about the relevance of beauty and the marvel and mystery of everything that exists.” Acts that sustain value, increase value, and heighten the enjoyment of value are part of the relevance of beauty. Our ability to create communities that are life-affirmative depends on recognizing

that aesthetics and ethics are cooperating constituents in the social order that is the confederacy of beauty.

An ecological understanding of beauty as the value related to life affirmation shifts the way we think of the natural world—from a storehouse of resources for human use to a web of relationships teeming with life, filled with intrinsic value, and directed not only toward the perpetuation of life but also toward the fullest expression of aliveness. Although in a living system neither ecological health nor beauty is guaranteed, the capacity for both exists. And it is that capacity that calls us to the practice of beauty, to cultivating ways of moving in the world that sustain and contribute to life. Because ecology and aesthetics are interrelated, the practice of beauty involves the practice of sustainability, both of which abide by the fundamental parts-whole rule of all relations: in a healthy system, the exquisite details of each singular life adds richness to the larger body of relations and is, in turn, strengthened by these relations. The practice of beauty and the practice of sustainability are one and the same, a coherent effort to value and contribute to the vividness of life. It is an effort motivated by more than our narrow desire for pleasure, though great pleasure comes in its wake. In leaning into the world, we make ourselves receptive to the world’s profuse beauty and we become exuberant, more fully alive. ■

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In defence of tears

“The advent of sentience was also the advent of suffering, but the advent also of compassion [...] Thus was empathy born [...] perhaps the most acute in our own species, paradoxically the most monstrous as well as the most merciful of them all.”

(Harnad, 2019)

I have been a vegetarian for two thirds of my life, and now find myself transitioning to a vegan diet. I would like to think reason and compassion brought me here, but a childhood experience was probably decisive. I was in France on a school outing. We walked past an industrial building; the walls may not have been glass, but the doors were open. And hanging from hooks was a row of slaughtered pigs; pink, fleshy, unmoving save that they swung gently. Every child should visit an abattoir, so as to experience first-hand the origins of animal foods (Monbiot, 2014).

My next memory is of refusing to eat some lamb mince. My mother was perplexed; I cried; she took my supper away. That is how vegetarianism began for me – through childish tears. My feelings seemed perfectly normal. My parents had brought me up with animals; I wept when they died, my upset extending to fights at school. Why, then, would I want to eat them? Much later in life I swapped childhood pets for ex-battery chickens, and still, I am embarrassed to admit, sometimes cry when they (rather frequently) die. I take their bodies, exhausted from farm-factory life, to a quiet place in our woods and say a little prayer for them. I am not sure why, but perhaps it is to acknowledge their innumerable unnamed kindred who are slaughtered without ever being mourned.

At the point in my life I finally became vegetarian, when 18, I had never heard of Peter Singer’s animal liberation nor of Jeremy Bentham’s famous dictum “not whether it reasons, but can it suffer,” and I had not made the connection between eating meat and biodiversity destruction. I did not eat meat simply because I loved animals and I could not understand why people would want to hurt them. I still can’t.

Lacking empathy for beings other than ourselves is difficult to disentangle from the ‘separation’ (Gagliano, 2018: 119) and ‘dominion’ (White, 1967) paradigm, which went on to form the bedrock of a socioeconomic system in which animals became insensate livestock, units of production to be turned into commodities. Farming ratcheted up to industrial global agriculture entails day-old chicks being flown from Heathrow to India via Nairobi, one cog in an accelerating cascade of transport links between producers and end-markets. Such global commodity chains have facilitated the transformation of millions of hectares of Brazilian forest into soya plantations for feeding incarcerated farm animals in Europe, China and elsewhere (Lymbery, 2017: 187–9).

Across the world half the forests have already fallen (Vince, 2014: 267); in the last three hundred years 12 million km² have been felled and 4 million km² of grasslands converted to agriculture (Hall, 2011: 164) – a loss on the scale of Russia (World Bank, 2019). And the deficit continues to grow: 3.6 million hectares of ancient rainforest were cut down in 2018 – most of the losses accounted for by loggers and ranchers in the Amazon (Carrington, 2019). The outcome is an overwhelmingly declensionist trajectory of population declines, species extinctions and ecological impoverishment. People

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born since 2012 have inherited a planet with fewer than half the number of animals than those before 1970 (Waughray, 2018), and now we teeter on the cusp of extinguishing a further million species primarily by extirpating habitats through their conversion to agriculture, combined with an animal killing spree (being called 'defaunation'), climate breakdown and pollution (IPBES, 2019).

The extinguished and extinct no longer suffer, but I am haunted by them. Humanity has caused the loss of over 60% of wild

animals since 1970 (WWF, 2018), and it takes little imagination to conjure into one collective anguished utterance the life we quashed in preceding centuries. We must and should do all we can to preserve and restore wild places, as habitat destruction is among the greatest sources of wildlife decline and suffering, and also do all we can to stop the global plague of animal killings across land and seas (Czech, 2013: 171; Maxwell *et al.*, 2016).

Anthropomorphism is encouraged in bedtime stories, but when we put away

A photo taken in a slaughterhouse in 2005 (Shperniko88; CC BY-SA 4.0 [<https://creativecommons.org/licenses/by-sa/4.0/>]).



‘childish things’ most of us leave our empathy for animals behind too. I did not because I still see those pigs, hanging in a row, and am awkward in social situations when I have to sit at the same table as people consuming meat. I like to believe explaining that animal agriculture and industrial fishing are among the biggest drivers of global defaunation and extinction would make a difference, but rarely do I have the opportunity, and if I did it would probably not change things. As Richard Powers suggests twice in his novel *The Overstory* (2018), the best arguments do not change a person’s mind; instead, what we need is a good story. He may be right, but in my view, what makes up a person’s mind is largely how they feel, so in trying to change minds we need to make people feel differently.

Early 2019 has been marked with some optimistic episodes in the shape of school strikes and Extinction Rebellion. Alongside swelling voices of protest, the rise of veganism is a most cogent and impactful expression of the same love and solidarity for the natural world, challenging the depredations of animal agriculture and industrial fishing by increasing the demand for meat- and fish-free, dairy-free and industrial-egg-free products. In April 2018 there were in the UK some 3.5 million vegans, up from just over half a million two years earlier (Petter, 2018). More impressively still, the demand for plant-based food increased by nearly ten-fold in 2017 and the UK launched more vegan products than any other country in 2018 (www.vegansociety.com/news/media/statistics). Why do people become vegans? Is it owing to concerns about the loss of wild places and the extermination of their denizens, climate breakdown or human health deterioration? Of course all the above matter, but having emotional attachments to animals also remains central (www.vegansociety.com/go-vegan).

I have decided not to be ashamed of my tears. Feeling is more powerful than thinking. I must make it my mission to help children acknowledge and honour their emotional and spiritual

attachment to animals; when their animal companions die, they are always saddened. Embracing instead of hiding tears of love and empathy might yet save the world. ■

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“Embracing instead of hiding tears of love and empathy might yet save the world.”

Thinking and walking with *The Sonoran Desert: A literary field guide*

Louise Boscacci

About the author

Louise is an Australian writer, researcher and teacher in the ecological humanities. She is an author and co-editor of the creative non-fiction book, *100 Atmospheres: Studies in Scale and Wonder* (Open Humanities Press, 2018).

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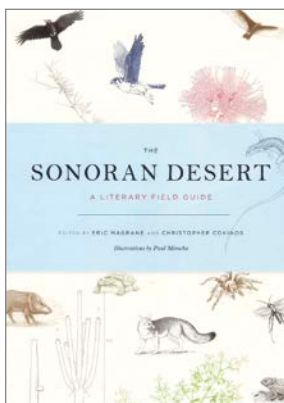
Editors: **Magrane E and Cokinos C**

Illustrator: **Mirocha P**

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Consider the White-lined Sphinx Moth of the arid lands of southwest North America. TC Tolbert does, but begins with, “Relationshapes: When we notice our breathing, we quiet it” (p 70). Read on. We are led into a vignette of prose that takes flight as would the moth pollinating evening primrose or sacred datura in the Sonoran Desert at twilight. A hover here; a dart away again there. Why are we reading about a museum exhibit on life and death, a woman in pearls, a campground full of big RVs, hummingbirds, Freud and the uncanny? These, in a field guide? “I like to think that spaces ask people to turn them into a room,” Tolbert writes. So, the sphinx moth, *Hyles lineata*, and its caterpillar are brought into focus as part of this larger desert imaginary, one that also leaves the reader with a teasing insight from the philosopher of relationscapes, Erin Manning: in order to stand still, you have to move.

“We need biodiversity of thought [...] the empiricism of science, the imaginative and cognitive leaps of poetry, the close observation of both,” Eric Magrane and Christopher Cokinos write in introducing this literary field guide (p xvi). Their bigger matter of concern is the accelerating loss of biodiversity in the contemporary Anthropocene bound, as it is, to the Earth-wide transformations of fossil-fuelled climate change. But, this book is a situated and particular composition that wants to celebrate and mark the rich more-than-human life and relations of the lands, skies and ephemeral waters of the Sonoran. Its writers recognise that a warming climate portends drought and increased wildfire activity. They know that the current ecological make-up of the bioregion will change.

The guide, as Magrane and Cokinos observe, was imagined as a form of literary biomimicry. First, because it followed on from the mode of the ‘bioblitz’ in which citizen scientists and other community participants gather and work with ecologists and biologists to collectively inventory the plants and animals on shared conservation lands. But, equally important, the project took direct impetus from a Poetic Inventory of the Saguaro National Park in the region: an inventory of poems composed by a group of 80 poets and writers to address many on the local co-species list. Here, in this wider anthology, a biodiverse mix of poets and prose writers have written poems and short fiction pieces for a cast of 64 plants, insects, birds, mammals, reptiles and amphibians that inhabit and create the Sonoran ecosystems and relationscapes. Each entry is headlined by the plant or animal’s locally known name, and subtitled with the binomial nomenclature of genus and species. The desert globemallow (a flowering plant), Arizona walkingstick (an insect), the elf owl, javelina (collared peccary) and the Gila monster (fat-tailed lizard) are a sample of representative denizens.

Biomimicry also refers to the varied approaches to writing and literary form found in the collection. A one-line poem evokes the vivid flash of a broad-billed hummingbird, a tiny bird just four inches long. A two-page micro-story follows a roaming coyote. Each entry spans two or three pages and is accompanied, not by a high-resolution colour photograph, but by a soft black and white pencil drawing by illustrator Paul Mirocha. Mirocha was artist-in-residence at the Research Library of desert ecology at Tumamoc Hill, Tucson, where the two editors also wrote for the book.

Underneath each poem or prose piece, in smaller typescript and often threatening to steal the spotlight from the main text, are the editors' crisp, ludic descriptions that riff on the more familiar field guide format of the natural sciences. These complementary micro-narratives arranged under subsections of 'Habitat', 'Description', and 'Life History' skilfully transcend any claim to a singular authoritative 'knowledge', but do so without sacrificing factual accuracy. They interpret and extract from the rich scientific lode found in existing flora and fauna almanacs to compose lively, playful accounts that may include giving soft directions to the reader: "If you wish to be terrified, locate a group of hibernating bark scorpions during winter." Or, in an eloquent mattering across scales of the individual and local to the planetary, a description cuts straight to the heart of climate and action: "As the Sonoran Desert faces increasing drought due to human-induced climate change, the [Merriam's] kangaroo rat might be an inspiration for those who are working on water conservation and policy."

Here, it is worth knowing that scientific reviewers and area naturalists were invited to read and 'fact-check' these descriptions. But those hands are invisible, and the light-touch of this clever collaboration has created a powerful model for creative interdisciplinary thinking and writing. These vignettes are truly pleasurable to read as contemporary natureculture

writing, as creative non-fiction, and as communiqués of wonder.

Wonder. I am mindful that wonder, politics and ethics are inextricably coupled in the present age of critical climate change. Magrane and Cokinos simply ask: "In a hundred years, will we look at some of the pieces [...] as elegies for species past? What will have persisted, what will have arrived?" (p xvi). Yet, and even in response to this reality, exercising the easily jaded faculty of wonder is at the *heart* of this project, the editors also intimate. Does it – this heart – work?

In order to move, you need to stand still. The literary field guide is a subtle material offering that I have returned to over a passage of months, randomly dipped into, slowly read full entries from, or picked up briefly to let a new plant or animal come into focus as a page flicked over. But, here now, inside out of the rain on an unpredictably cold midsummer day in eastern Australia, I am drawn once more to the front cover array of drawings of unfamiliar raptors, a hirsute peccary, a solid tortoise, an advancing tarantula, the giant saguaro cactus and the flower head of a fairy duster. First, I have been learning this new language of another, unfamiliar bios. But, now I want to walk that open desert field and meet them all. I would walk with this little literary guide close to hand, pause to read a passage en route, annotate sightings and soundings in the wide margins and free spaces of its pages, jot down new questions, and let new wanderings in. ■

“The light-touch of this clever collaboration has created a powerful model for creative interdisciplinary thinking and writing.”

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Mycena seynesii growing out of a pine cone, France

Last Word

“We are the killers.
We stink of death.
We carry it with us.
It sticks to us like frost.
We cannot tear it away.”

JA Baker

From *The Peregrine* (HarperCollins, 1967)

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