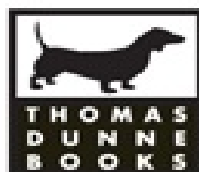


# THE SIXTH EXTINCTION

JOURNEY AMONG THE LOST AND  
LEFT BEHIND

TERRY GLAVIN



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*This book is dedicated to Vicky Husband, conservation chair of the Sierra Club of British Columbia, one of Canada's greatest conservationists, and a dear friend. This book is also dedicated to the millions of people all over the world who continue in the struggle to strengthen the things that remain.*

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*Everything one writes now is overshadowed by this ghastly feeling that we are rushing towards a precipice and, though we shan't actually prevent ourselves or anyone else from going over, must put up some sort of a fight.*

—George Orwell, in a letter to Cyril Connolly, December 14, 1938

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And lastly, my thoughts are always with Sibü Das, of Calcutta, and his family.

# Prologue

## The Valley of the Black Pig

This is a book about extinctions. It was written at the harsh dawn of an epoch that is coming to be called the Sixth Great Extinction. It is a time without parallel in the sixty-five million years that have passed since the end of the Cretaceous period.

Roughly thirty-four thousand plants, or 12.5 percent of all the plants known to science, are threatened with extinction. One in eight bird species is similarly threatened, along with one in four mammals, one in three of all known amphibians, four of every ten turtles and tortoises, and half of all the surveyed fish species in the world's oceans, lakes, and rivers. Perhaps a million of our fellow species are trailing wearily toward that final cliff edge. We lose a distinct species, of one sort or another, every ten minutes.

These tabulations constitute only the most crude sort of barometer of the great unraveling of the living world; the ecologists who calibrate extinction rates readily admit this. The greatest bleeding away of diversity is in fact occurring well below the level of what geneticists and taxonomists consider a "species." It is also happening outside that category entirely. It is happening down where the true measure of life's diversity is found. Extinction is taking away the subspecies, the local population, the particular, the neighborhood, the singular, and the specific.

And it is not confining itself to the "wild" things of the world. It is also carrying away the tamed—the functions of artificial selection. Estimates of the number of the world's vegetable varieties lost during the twentieth century run as high as thirty thousand, with one vanishing every six hours. Of the thousands of apple varieties in North American orchards at the beginning of the twentieth century, for instance, all but one-seventh are gone. Of 2,683 pear varieties, only slightly more than one tenth remain. By the 1970s, most of what remained of Europe's old vegetable varieties were threatened with extinction. Even livestock breeds are disappearing—Europe lost half its distinct breeds during the twentieth century. Of those that are left, 43 percent are close to oblivion.

Humanity's diversity is similarly withering. Though the world population has surpassed six billion, it is as though some savage ethnic cleansing is underway. The world is losing an entire language every two weeks. Fully half of the world's five thousand languages are expected to be gone with all their songs and sagas, by the middle of this century. We are losing religious and intellectual



traditions, entire bodies of literature, taxonomies, pharmacopias, and all those ways of seeing, knowing, and being that have made humanity so resilient and successful a species for so long. This is not what we had come to expect from the promise of the Enlightenment. We are not gaining knowledge with every human generation. We are losing it.

A dark and gathering sameness is upon the world, and the language of environmentalism is wholly inadequate to the task of describing it. It can't even come close. It isn't that environmentalism exaggerates the phenomenon. It's just that it doesn't have the words for it. By "environmentalism," I mean that great movement of people and ideas that emerged in the early 1970s, largely as a function of Euro-American liberalism. By "the language of environmentalism," I mean not just a narrative template that is overly burdened with outmoded ideas and cultural biases, but language that draws arbitrary distinctions between "wilderness" and everything else, and that places "nature" outside culture.

The simple premise of this book is that all these extinctions are related. The intent of this book is to explore the relationships among and between these extinctions, and one cannot even begin to do that by relying on the prism of environmentalism. As a separate category of thought, environmentalism is of little use in comprehending what is happening. Whatever name we might give the thing, the extinctions it causes are all at least properly part of the same conversation. The forces that work in the world are "not well understood," to borrow the vernacular of scientific journals. But quite clearly, they are *cultural* forces.

It's true that the current extinction crisis is distinguished from the spasms that ended the Ordovician, Devonian, Permian, Triassic, and Cretaceous periods in that it can be reliably attributed in one way or another, to a single species: *Homo sapiens*. But it is not a simple story, with human beings as the cruel villain of the piece. The many creatures that have vanished during the course of the human experience make up a staggering and fantastic bestiary. There was an elephant-sized ground sloth in Texas, a Sicilian elephant no bigger than a pony, a bear-sized Australian wombat, and a Floridian bird with the wingspan of a Cessna. It is a long, sad, and continuing story, but it is certainly not solely a "modern" phenomenon. Most of the extinctions caused by human beings in the modern period, which we know something about, have happened by accident, on account of culprits such as rats, pigs, goats, and other "introduced" species. For every sad and well-documented story of a species dying out because of humans, there is almost always an overlooked story of ordinary people struggling against the forces of extinction. For this reason, in the case against humanity, this book is offered as evidence for the defence.

The immediate causes of extinction are often quite straightforward. The epicenter of the extinction of the world's "wild" things is the humid tropics. Tropical extinctions are most often the result of a simple equation: Chop down all the trees and the animals will die. The temperate world is not at all like the tropics, but there are certain global patterns at work, patterns that involve upheaval and dispossession. Extinctions tend to follow the collapse of order in human societies. Human-caused extinctions are often the result of old "feedback loops" breaking down, and old restraints giving way

Where you have rapid advances in technology, dramatic shifts in political power, and profound economic disruption, extinction tends to follow. There is also a surprisingly direct correlation between the removal of vegetative cover—even “domesticated” plant life—and the dying out of language cultures, and ways of life.

It is not true that people started taking these things seriously only in the late 1960s, when astronauts beamed back pictures of this lovely blue planet, or when the United States senator Gaylord Nelson conceived the idea of Earth Day. People have been taking these things seriously for a long, long time. Deep within the human consciousness is an ancient and abiding desire to be in the presence of flourishing, abundant, and diverse forms of life.

To make sense of the world, people tell stories. The way novelist Doris Lessing puts it, “our brains are patterned for storytelling.” Just as an enchantment with the beauty, utility, and diversity of living things is an inescapable aspect of human nature, so is the desire for narrative to make sense of it all. And because this is a moment in time when the world is filled with dread and foreboding, when the great master narratives we’ve relied on to understand things are collapsing all around us, I reckon there should be some virtue in going for a walk through the hills and coming back at the end of the day with an account—a story—of what’s out there.

So that’s what I attempted.

\* \* \*

I set out from the townland of Coolreagh, a place of rolling hills, bogs, and woods within the parish of Bodyke, in the northeastern corner of County Clare, in the Republic of Ireland. Its name comes from Cúl Riabhach, which can be rendered in English along the lines of The Grey Corner. Thickly hedged stone-lined boreens connect the old farmhouses to one another and to the nearby villages and the outside world. Down one of these little roads is my mother’s family’s farm. The farmhouse stands on the banks of a stream called the Annamullaghaun, which means Mill River. The name acknowledges the farmhouse, which was once a small mill. The house has stood there in one form or another for four hundred years.

I had come for a visit with my Uncle Tony and my Aunt Angela, and my cousins Christine, Philip, Douglas, and the rest. It was my intention to make sense of some of my notes and then start out on a long walk. In one of my notebooks I’d jotted down a passage from the Old Testament’s Book of Hosea: *Therefore shall the land mourn, and everyone that dwelleth therein shall languish with the beasts of the field and with the fowls of heaven; yea, the fishes of the sea also shall be taken away.* There was also an article out of *The Guardian* that I’d scribbled on. It was from the May 23, 2000 edition, under the headline “The Way We’ll Live in 2032”: “The destruction of 70 per cent of the natural world in 30 years, mass extinction of species, and the collapse of human society in many countries is forecast in a bleak report by 1,100 scientists published yesterday.”

But a single narrative is not so easily imposed on the land. Each townland is its own piece of quilt. Within each townland there are fields. Each field accounts for itself in its own way, with its own

stories.

From the farmhouse at Coolreagh, you can walk over a small stone bridge that crosses the Annamullaghaun beside the farm, and you will find yourself standing in the townland of Caherhurl beside a field called the Castle Field, which takes its name from a craggy and vine-covered rock in the middle of it, the remnant of a stone fort built by local tribesmen loyal to Brian Boru, the great warrior chief who defeated the Vikings at Clontarf in 1014. In the Castle Field you will notice the ground beginning to rise gently, and if you walk that way, up Blackguard's Hill, you'll find yourself heading through Ballyvaughan, into the Slieve Bernagh mountains.

If you walk in the other direction, northward, you will eventually find yourself in the townland of Fossamore, and the ground begins to rise there, too, into the Slieve Aughty mountains. It's wilder up that way. Above Fossamore is Powlagower, the Goat's Hole, and Tabernagat, the Well of the Cats. There is the Sruthánalunacht, the Stream of New Milk, which once ran white with milk but long ago turned to water, they say, when a woman washed her feet in it. There are people who live at Cloonusker who say that at the end of the world, the final battle of the last war will be fought up there above Gortaderra, in a place called the Valley of the Black Pig, and on that last day of battle the Stream of New Milk will turn to blood.

The story the old people at Cloonusker tell is the same event foretold by Hosea, in his way, and is also the future imagined by those eleven hundred scientists, in their way, in that article in *The Guardian*. William Butler Yeats was haunted by these things, and just as the world was carrying the great weight of dread and foreboding in his apocalyptic poem, "The Valley of the Black Pig," so it was when I began writing this book. But what I should also report here, straight away, is that by the end of my travels, after a fairly thorough reconnaissance of the extinction at work in the world, I returned with absolutely no evidence that any of this is what humanity really wants. This is rather good news, I think. I can also confidently report that the roads and boreens that wind their way through the Eastern Clare hills do not lead inevitably northward beyond Fossamore into the Valley of the Black Pig.

Hosea's prophecy did not come to pass, the Israelites did not perish, and that *Guardian* article about the destruction of 70 percent of the natural world and the collapse of human societies within thirty years did not describe one inescapable fate. It was about a United Nations Environment Programme (UNEP) *Global Outlook* report that actually found four roads through the hills.

Only two of those roads lead into the Valley of the Black Pig. One of them, which the report calls a "security first" approach, traverses a desperate countryside of inequality and conflict, protest and reaction. The powerful and the wealthy end up gating themselves into enclaves, leaving the masses poor to survive as best they can in the collapsing environment outside the walls. The other road takes a more circuitous route, but it ends up in the same place. The UNEP scientists call this road a "market first" approach, because it requires us to put our faith solely in market forces, further globalization and greater trade liberalization. We count on corporate ingenuity to resolve social and "environmental" problems, and leave it to ethical investors and consumer groups to keep global capitalism honest. The state ends up with no capacity to regulate human affairs or protect those valu-

that humanity cherishes.

The other two roads lead to a different sort of countryside altogether. A “policy first” approach leaves public governments in charge of identifying social and environmental goals. We put our trust in coordinated responses to environmental disruption and poverty, factor environmental and social costs into our public policy, and allow for local and regional innovation. On the “sustainability first” road, a wholly new paradigm emerges. New institutions make room for radical changes in the way people interact with one another and with the living, breathing world. Corporations are held to account. Citizens and stakeholder groups participate directly in decision making. We all muddle through. And we live in hope.

The closer you look behind all those cringe-making global headlines, what you see is that practical solutions have already been found for almost all those dreadful problems the headlines describe. In many ways, the world is becoming a better place. The world is taking on another two hundred thousand people every day, but humanity’s total numbers are projected to level off at around 10 billion before the year 2100. The last, critical redoubts of 43.8 percent of the world’s vascular plants and more than one third of the world’s animals, birds, reptiles, and amphibians take up only about 1 percent of the earth’s surface. If we take “wilderness” to mean tracts of land of at least ten thousand square kilometers with, say, at least 70 percent of the native ecosystems intact, then almost half the planet is still like that.

This book does not forecast what the future has in store for us. Fortune-telling has always been a dodgy enterprise. I grew up in a world crippled with the fear of nuclear apocalypse. Then the Berlin Wall fell. Then, just as the great gulf between capitalism and communism was finally breached, two passenger planes were plunged into those two great towers in New York, and the world was divided against itself again. No one foresaw the epochal changes to practically every aspect of our lives that occurred, almost overnight, as a consequence of computers and the Internet. The exponential growth in information-technology capacity is moving from a curving line on a graph to a line that goes straight up, and no one knows where it’s going. By the beginning of this century, the People’s Republic of China had emerged as a great state-capitalist powerhouse with an economy so dynamic that it threatened to eclipse the United States, and the Muslim population of Western Europe was roughly the same as the population of Syria. No one foretold these things.

Even the meaning of the word *extinct* is blurring. Nature has always existed as much within the human imagination as anywhere else, but rapid advances in the genetic sciences, transgenic manipulation, and biotechnology are changing everything. They are throwing open the final border between wild and domesticated animals and plants, humans and animals, “wilderness” and zoos, and humans and machines. The emerging fields of robotics and nanotechnology will lead us all to hell or to heaven—nobody seems to know which.

There are even people up in County Leitrim who make a convincing case that the people of Cloonusker haven’t read St. Columba’s prophecies correctly at all, and the real Valley of the Black Pig isn’t that place above Gortaderra. It’s actually up their way, they say, by Ballinamore.

For all these reasons, when I started out on that long walk from the farm at Coolreagh, I was not drawn helplessly along the roads that lead up beyond Fossamore. I walked in a different direction, and I ended up at the Temple of Kali, in Calcutta. But I'm getting ahead of myself.

I set out with my cousin Christine, turning east at the top of the road from the farm. We walked in the direction of Lough Derg, the great broadening of the Shannon River that so deeply cleaves the country, and we headed toward the village of Tuamgraney, the Tomb of Gráinne. Some people associate Tuamgraney with Grian, an old sun goddess. Another way of translating the name of the village is Altar of the Sun. The fields and the stones argue among themselves about which of the stories is right and best, but all the old stories appear to agree on one thing: Gráinne was a high-born woman who became inconsolable and drowned herself in a little lake up above Feakle after learning she had been conceived of a sunbeam and would never know the world of mortal men.

Being mere mortals, when we pull away at the vines of our limited understanding of the sum of all living things, we still find the moss-covered foundation of Aristotle's *scala naturae*, and the fading inscriptions chiselled by the seventeenth-century Lutheran medical student Carl von Linné (also known as Carolus Linnaeus), who gave us our system of taxonomic nomenclature, which he called the *systema naturae*. Nowadays, the whole edifice is crumbling. Entire families of species emerge from the mud, as though summoned by Zeus, or disappear forever, as though extinguished by the impact of a Cretaceous asteroid. Sometimes they vanish out of the known world, and sometimes they vanish owing to the mere publication of papers in such scholarly periodicals as the *Journal of Heredity*. But the world of mere mortals will never be made up of species that fit neatly into their own genus, family, order, class, phylum, kingdom, and domain. The mortal world is also made up of stories. That's the first thing you notice when you walk through the East Clare hills.

The little field beside the farmhouse at Coolreagh is Carrigrua, the Red Crag. Across the boreen from Carrigrua is the Big Hollow. Above the Big Hollow is Hogan's. Then there's the tillage field, the old milking shed, and beyond the tillage field is Flanagan's. Jack Brian's field is all covered with whitethorns and holly and blackthorns. It's also called the Fairy Field, because within it is a rath which is a ring fort, one of those circles of stones where people used to see faint lights dancing on certain nights of the year. The holy well at Tobar Coolan is for sore eyes, the one at Ballyquinbeg is for sore bones, and the well at Saint Senan's is for headaches, and there is blackberry and hazelnut and plum and wild apple among and between everything.

For all its splendid, flourishing, and elaborately interconnected profusions of life, the earth is also a tomb, and the dead breathe their stories out of the ground. But those very stories, all over the world, are vanishing just as certainly as all those birds, languages, turtles, songs, and apples. They are all vanishing just as quickly. This presents a problem in relying on such an old and "slow" technology as a book to write about all this. It's not the scale of the phenomenon. It's the pace.

When the Dalcassian tribesmen built that watchtower in the Castle Field by the farm at Coolreagh there were about 350 million people on earth. Ten centuries later, the human population had grown fourfold, to about 1.4 billion. A mere century after that, it had quadrupled again. The amount of

methane in the atmosphere has more than doubled from the time of the Dalcassians. The amount of carbon dioxide in the atmosphere has grown by one third from the time when the farmhouse was built. Global climate patterns are changing faster than in any period since the Ice Age began to warm eighteen thousand years ago. All of the warmest years since the time of Christ occurred after 1990, and suddenly we are taking all to ourselves almost 40 percent of the earth's primary productivity—the plants that we eat, the plants we feed to the animals we eat, and the forests we raze to build our cities and our homes.

The rate of extinctions in the realm of animals and plants is believed to have accelerated perhaps one thousand times the “normal” background rate. Things vanish from the world in an instant and they fall among the nettles and the sorrel of the older taxonomies. It's hard to keep up with everything we're losing. One creature I was going to write about in this book, for instance, was a bird known as the po'ouli—a gorgeous little Hawaiian honeycreeper, confined to the upper slopes of the Haleakala volcano. But I was too late. The last one known to exist died in a cage on November 2, 2004.

So, slowing down and going for a long walk was the method I chose, and down one of the roads I walked in the East Clare hills is the Raheen Wood, where there is a tree called the Brian Boru Oak. The story told there is that the great warrior Brian Boru himself planted the oak one thousand years ago. It is a giant of a thing, living and breathing and rising into the sky out of a tangle of ferns and woodrush. They say it is the oldest tree in Ireland. It is certainly the oldest tree that remains of the Sudaine forest, which once lay thick and heavy on the Slieve Aughty mountains above Coolreagh. The forest has come to abide only in small places like the Raheen Wood because herdsmen had cut away at it for fuel and pasture, then the British cut away at it for barrel staves and ship's masts, and then came Oliver Cromwell's terror, in the seventeenth century. The forests were felled to flush the wolves and also the bands of rebels always hiding within, with their pikes and their gibberish. The last wolf in Ireland was hunted down and killed in 1786. The rebels were put to the sword. The trees kept falling.

But by then, the Irish were growing potatoes, and potato-farming served the same function as the “green revolution” in the Third World during the mid-twentieth century. It increased crop yields without addressing the root causes of hunger, such as population growth, dispossession, and the various pathologies associated with vast inequities in wealth and power. The potato had come from the New World, and it was a miracle food, just as Monsanto corn was to American industrial farmers in the late twentieth century. Then, one evening in the autumn of 1845, a strange mist settled on an Irish potato field. By the morning, the field was as black and dead as though locusts had fallen upon it. Within the space of a week, all the potatoes in Ireland had gone rotten and putrid in the ground.

Along the way to Tuamgraney, my cousin Christine and I lingered awhile in a field called A Casaoireach. Down through the years, the local people had planted yew trees in the field to keep the cattle away from all the sorrow in it. Lately, they've been planting other kinds of things, more local, distinct, and endemic varieties. But you still make the sign of the cross when you walk past, because in the ground under the trees are the bones of at least twelve thousand people. There is a huge grun-

tureen in the field. It's a giant iron pot that came from the Scarriff workhouse, a place that contributed many corpses to the field. An Casaoireach can be roughly translated as "Throw Them Back." Most people just call it the Famine Field. It comes from the time of An Gorta Mór, the Great Hunger.

Within three years of the potato blight that came in 1845, it was as though the heart of Ireland had been struck by an asteroid. Refugees were streaming away in every direction. When it was all over more than a million people, perhaps as many as two million, had starved to death. By the end of the nineteenth century, Ireland had lost two thirds of its people, and only about 15 percent of those who remained were capable of speaking their own language.

The story of extinctions today is eerily similar to the story that was unfolding in the East Clare hills in the years before the Great Hunger. It is a story of imperial capitalism, deforestation, rapid human population growth, the rise of crop monoculture, enormous disparities in the distribution of wealth, a blind faith in free trade, and the obliteration of localized culture. It's a story that always seems to lead to a field where people make the sign of the cross when they pass.

But some things do not so easily pass away from the world. They move through the cartography of our deepest longings, beyond any explanation, and in all those things that we have ever killed or venerated or loved, there is something we cannot quite banish. Always, a voice. Hold fast, it says. Hold fast.

It's only a short walk from the Famine Field to the Altar of the Sun.

Just outside the village of Tuamgraney, there are two standing stones in what once was a field, or what might be a mound, in front of Alan Sparling's house. You're welcome, then, Alan said, and he shooed away his little dog. It's good for your health just to stand beside the stones, the people used to say. There are two others just like them over by Frank Hassett's gate. Or rather one, split in two, owing to someone swearing an oath on the stone and breaking the oath, many years ago.

It was here that Gráinne of the Bright Cheeks, daughter of a chief from the Slieve Aughty mountains, lived, died, and was buried. She threw herself into Lough Na Bó Girre, the Lake of the Sun, and her body floated down a little stream to the place that ended up being called Derrygraney, the Oath of Gráinne. When the people found her, they wept, and they put her in the ground.

In these ways, the fields and the stones have their own stories, and all of us, the living and the dead, the wild and the tamed, the fowls of heaven and the fishes of the sea, are a part of it now.

This is a book of those stories.

## Night of the Living Dead

*I was greatly disturbed at the apparition. I walked to the left along the slope, turning my head about and peering this way and that among the straight stems of the trees. Why should a man go on all-fours and drink with his lips? Presently I heard an animal wailing again, and taking it to be the puma, I turned about and walked in a direction diametrically opposite to the sound.*

—H.G. Wells, *The Island of Doctor Moreau*

The tiger lay in a clearing in the twilight, on the other side of a trickling stream, perhaps ten metres from where I stood. The cries of nightjars drifted through the trees and mingled with the thrumming of frogs and the chirping of crickets in the muggy jungle air. It was long past sunset. I'd just strolled half-kilometre down a jungle path and across a swaying footbridge over a ravine. Then I saw it. The man-eater of English schoolboy nightmares, the great Terror of Batavia.

The tiger turned its head abruptly and glared at me. Suddenly, the crickets fell silent, and the stream with its little waterfall fell silent, and it was suddenly empty of water. Maybe somebody somewhere, had thrown a switch by mistake. Whatever had happened, a light briefly flickered, illuminating the enclosure where I stood. I noticed a plaque—Malayan Tiger Viewing Shelter Adopted by Chemical Industries (Far East Ltd.). There was thick plate glass separating the tiger from the outside world. There was a sign that read, Please Don't Knock, and another that pleaded, No Flash Photography, Please.

As the light flickered on and off, my view of the tiger was obscured within the image of my own face on the glass wall. At that instant, the question posed by the Romantic poet William Blake—*Tyger! Tyger! burning bright / In the forests of the night, / What immortal hand or eye / Could frame thy fearful symmetry?*—seemed to have found something of an answer in the way the innovative modern poet E.E. Cummings described the experience of seeing such animals in captivity: It's not animals that we see. Instead, it is "a concatenation of differently functioning and variously labelled mirrors, all of which are *alive*.... No mere spectacle of monsters, however extraordinary, could so move us. The truth is not that we see monsters, but that we *are* monsters."

In the fearful symmetry of Singapore's Night Safari, an auxiliary function of the Singapore Zoological Gardens, there are no cages. There are 68 lush jungle hectares, surrounded by the calm waters of the Seletar Reservoir, and the most imaginative and elaborately cunning landscape architecture is put to the work of maintaining all the illusions necessary to the suspension of disbelief. The night air is fragrant with orange blossoms and pigeon orchids. A Gir lion prowls among gaharu trees. There are banded palm civets, giant ant-eaters and babirusas—the "deer pigs" of Sulawesi rainforest, and lesser mouse deer—the smallest of all hoofed creatures. Among the staghorn ferns and



meranti trees are rare sloth bears and Malayan tapirs, those odd little things that are distantly related to both horses and rhinos and have the same colour markings as pandas.

The place is like a seventeenth-century *Wunderkammer* of the rare, the peculiar, and the vanishing built on a massive scale. There is even an electric tram that you can take for an excursion through all. It takes about 45 minutes.

A few kilometres away, at Singapore's famous Jurong Bird Park, you can take a monorail that will deliver you at such outlandish simulated-reality settings as the world's biggest artificial waterfall. It tumbles down the face of a 33-metre cliff at the rate of 8300 litres of water per minute, becomes a stream meandering through the world's largest "walk-in" aviary, and then gets pumped back up to the top, where it starts all over again. There are black-capped lorries from New Guinea, African reed-throated bee-eaters, hyacinth macaws from Brazil, Bali mynahs, Humboldt penguins, and 500 parrots from more than 100 species, almost one-third of all the parrot species on earth. Jurong houses the world's largest collection of hornbills and toucans, including the southern pied hornbill, the black hornbill, and the Great Indian hornbill.

You can wander through a series of micro-habitats taken from African savannahs, semi-desert, and rainforests. More than 10,000 specimens of plants from 125 species create these illusions, aided wherever necessary by murals. You can walk across a swaying suspension bridge through an artificial jungle while more than 1000 Australian lorries flutter around you. There are ostriches, rheas, emus, and cassowaries. The naturalistic settings and stage-light manipulations even manage to fool the birds. In the World of Darkness birdhouse, the lighting system tricks the night herons and the snowy owls and other nocturnal birds into thinking day is night and night is day. You can visit during the daytime and stroll down what looks and feels just like a starlit jungle trail. A giant mango tree grows up out of the middle of everything, and you have to read the plaque at the base of it to know that it is really just a replica of an "actual tree" in Selangor, West Malaysia.

The designers and animators of the Night Safari and the Jurong Bird Park have succeeded in creating a spectacularly weird simulacrum of the real world. But certain things are not so easily concealed by all those ingenious sightline considerations, psychological barriers, hidden moats, floral assemblages, and ecologically correct reproductions of landscape. There is captivity, and there is freedom. There is also what we want to believe about nature and about ourselves in that great "concatenation of differently functioning and variously labelled mirrors."

Over the course of the twentieth century, the world's tiger population fell from roughly 100,000 to about 7000. The Malayan tiger lying in the clearing in the Night Safari is a member of a species reduced to perhaps a few hundred animals, cowering in the ruins of their ancient haunts on the Malay Peninsula. The last Caspian tiger was shot in Turkey in 1970. The last Javan tiger was spotted during the 1970s in Java's Meru Betiri National Park. The last sighting of a Bali tiger, and it was a questionable sighting, was in 1976.

Most of the world's remaining tigers are Bengal tigers that survive precariously within the shallow recesses of India's national parks and wildlife reserves. A few hundred Amur tigers remain, but most

of them are in zoos. There are still several hundred Indo-Chinese tigers, and perhaps 400 Sumatran tigers, but the South Chinese tiger, widely believed to be the ancestor of all tigers, has been reduced to fewer than 50 known animals, all of them in zoos. The South Chinese tiger numbered about 5000 recently as the 1950s, before the Chinese government embarked on a pest-eradication program. The last time one was seen in the wild was in 1979. It was killed.

The 1990s began with only 14,000 Sumatran orangutans in the world; the decade ended with about 7000. In 2004, the International Union for the Conservation of Nature (IUCN) reported that the population had been halved again. This left the species officially listed as critically endangered, with populations expected to keep dropping as a consequence of forest clear-cutting and hunting. At the Singapore Zoo, you can pay to have tea with a Sumatran orangutan, all by yourself, for the equivalent of \$95 U.S.

If you come to the zoo in the afternoon, you can watch pygmy hippos from behind the glass of an underwater viewing station. They loll and splash around in what for all the world appears to be a deep marsh somewhere in Sierra Leone, but nobody can say whether any pygmy hippos remain in Sierra Leone. There are only about 7000 left in all of West Africa, and most of them are confined to Liberia's Sapo National Forest, but their numbers are declining rapidly. Logging companies are turning their swamp forests into wastelands, and the hippos are being killed for food and by trophy hunters who want their teeth. With the collapse of order in that part of the world, the civil wars and insurrections, the hippos' prospects aren't good. A related group of pygmy hippos was once common in Nigeria; in 1969 they were found to be a distinct subspecies, but there have been no confirmed sightings since then.

Another resident of the Singapore Zoo is the douc langur, an extravagantly coloured little monkey that suffered enormously during the American defoliant-bombing of Vietnam. Douc langurs are found only in Vietnam and neighbouring Laos. They are being hunted for food, for the pet trade, and for the folk-medicine market. Their forests are falling to chainsaws. Another zoo inmate is the endangered and increasingly rare ruffed lemur from Madagascar. Known in its home range by a name that translates as "night-wandering ghost," the ruffed lemur is one of the world's most unobtrusive primates, quietly going about its nocturnal rounds, barking only to warn its comrades of danger. It is a key pollinator for several plant species because it has an inordinate desire for nectar, and tends to go from flower to flower, its nose covered in pollen. There are proboscis monkeys at the zoo, too. They're the weird-looking, big-nosed monkeys from Borneo. Their numbers are dropping sharply because of the spread of timber operations and the rise of oil-palm plantations. The lion that strolls among the gaharu trees is from a vanishing population: only 200 of those regal creatures remain in India's Gir forests.

The hyacinth macaws at Jurong are critically endangered, numbering fewer than 300 in their home forests in Brazil. The Bali mynahs at the bird park are among the rarest of the world's birds; only a few dozen persist on their home island, outnumbered more than ten to one by the Bali mynahs in the zoos and aviaries of the world. Humboldt penguins too are undergoing a precipitous decline in the

home waters, in the Pacific, partly because the fish they eat are being depleted by fishermen, in whose nets the penguins also often perish, and partly because their nesting sites are being mined for guanaco. Great Indian hornbills are disappearing, too, because the forests of India are disappearing, but also partly because the birds have long been a favourite of bird collectors. They're the largest of the world's hornbills, standing well more than a metre in height, and they're possessed of such endearing habits as offering their captors morsels of food. For decades, one of the London Zoo's most popular animals was Josephine, a Great Indian hornbill. She died in 1998, at the age of 52.

About 2000 animals from 250 species are held at the Singapore Zoo and the Night Safari, 900 birds from about 600 species at the Jurong Bird Park. These institutions are routinely and deservedly praised by the appropriate international bodies as well-managed and progressive places, but there are other words that might be used to describe them. Here are three: Hospice. Necropolis. Tomb.

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The Great Indian hornbill, the Bali mynah, the hyacinth macaw, the proboscis monkey, the ruffed lemur, the douc langur, the pygmy hippo, the Sumatran orangutan, and the Malayan tiger belong to a special class of rare and vanishing creatures of the wild world known as the "living dead." It's a term biologists have begun to use to describe those species that are not expected to escape extinction without significant human intervention, such as captive breeding. Among the world's endangered mammals, birds, and reptiles, already 1500 species are expected to be wholly dependent upon captive breeding by 2050.

Specifically, the term "living dead" is used to describe species that have been rendered incapable of independent survival because other species upon which they depend are disappearing or are already gone. The living dead include species that exist mainly in zoos, such as the Amur tiger, and those suffering "latent extinction," which appears to be the douc langur's condition, as it slowly withers away as a result of habitat loss. Not all the critically endangered species on earth are necessarily counted among the living dead. It's hard to say whether a species has crossed into that netherworld unless you have a pretty clear idea about its long-term prospects. A key factor to consider is the extinction debt racked up from habitat loss that has already occurred.

One grim example of the way extinction debt works its misery comes from a study published in the journal *Conservation Biology* in 1999. Its author, Guy Cowlshaw, of the London Zoological Society, looked at the extinction debt incurred from forest clearing in Benin, Burundi, Cameroon, the Ivory Coast, Kenya, and Nigeria. Cowlshaw determined that the impact of logging would likely result in the extinction of one-third of those forests' primate species. That was the outstanding debt, even if all logging and poaching stopped the moment that Cowlshaw published his findings. It might take a century for those primate species to limp along, slowly paying off the debt until reaching equilibrium with their very extinction. But the debt will be called, and it will be paid. The trees keep falling. West Africa is expected to lose 70 percent of its already diminished forests by 2040. East Africa's forest losses are projected to be as high as 95 percent.

Singapore itself provides a vivid example of the way extinction debt works, as well as a rare glimpse into the way the world's current extinction crisis might be expected to unfold in the coming years.

The island nation of Singapore is situated in the humid tropics, which is the epicentre of the planet's current crisis in the extinction of wild things. The tropics are playing a central role in the ongoing story of extinctions because tropical forests contain the world's deepest reservoirs of terrestrial species diversity, and it is in the tropics that forests and other "old-growth" ecosystems are disappearing the fastest.

It's mainly this vanishing of tropical habitat that results in estimates putting the current global extinction rate as high as a thousand times the "normal" background rate. Those estimates are extrapolated from the relationship between habitat size and species diversity and a calculation of what habitat loss will mean for species loss. Another method involves tracking the progression of species through their trajectories on the status lists maintained by the IUCN, the main international body that monitors the collapse of biological diversity. These methods may seem a bit speculative around the edges, but they tend to be confirmed by the hard data produced by specific analyses of trends in well-known families of birds, plants, and animals in well-defined locales. Singapore is precisely one such well-defined locale. And unlike much of the tropical world, Singapore is positively robust in empirical data related to biological diversity and its withering.

Avocational naturalists and birdwatchers have been going about their business in Singapore since the earliest times, compiling meticulous records of the local flora and fauna. The island already had its own formal naturalists' society in the 1950s. It has been a tireless little group, providing at least a marginally effective voice for conservation despite being often only barely tolerated by the authoritarian regime that has controlled the country since the 1960s. But Singapore's naturalist traditions reach all the way back to the founder of the former British colony, Sir Stamford Raffles. Although Raffles earned his reputation as a vigorous but fair colonial administrator and an able challenger of Dutch commercial interests in the East Indies, he was also an avid collector of animal and plant specimens. That is what they will tell you at Singapore's Raffles Museum of Biodiversity Research, where the Old Man's tradition has been kept alive in collections, which include 18,000 plant specimens (2000 strains of fungi, even) and the carefully preserved bits of 300,000 dead animals from more than 10,000 species. The place is a marvel.

Biologists Barry Brook, Navjot Sodhi, and Peter Ng, an Australian and two Singaporeans, reckon that by looking at what had happened to biological diversity in Singapore, they might get a better grasp of the real impact of habitat loss elsewhere in the tropics. Mindful that the island is especially bollixed from an ecological point of view, Brook, Sodhi, and Ng reckoned they might draw from Singapore's experience some well-informed projections about the fate of biological diversity in the years to come and test those global trends in extinction that are otherwise unavoidably inferred from statistical models or by extrapolation. The Singapore study was published in the journal *Nature* in 2003.

The study revealed that fully half of the island's species existed only as relics within the mere one-quarter of 1 percent of the land mass that had been protected as forest reserve. Many of those species carried on in the weird half-life of the extinction debt arising from past habitat loss, a debt conventionally paid with the eventual oblivion of species. Three such Singaporean animals found to be among the living dead were the white-bellied woodpecker, the banded leaf monkey, and the cream-coloured giant squirrel. There were only four of the woodpeckers left, fewer than 15 of the monkey and fewer than 10 giant squirrels. Singapore had lost at least 95 percent of its forest cover since Raffles's time. Documented and conservatively inferred extinctions had occurred among 80 percent of the island's fish species, almost 80 percent of its mammal species, more than 70 percent of its plant species, about 60 percent of its bird species, 70 percent of its once-abundant butterfly species, and 70 percent of its amphibians.

Brook, Sodhi, and Ng calibrated these rates of local-population losses against the patterns of deforestation throughout Southeast Asia, which are projected to result in the disappearance of 70 percent of the region's forests. They concluded that somewhere between 13 and 42 percent of all Southeast Asian species—mammals, birds, plants, amphibians, decapods, phasmids, butterflies, reptiles, the lot—were more or less done for. Furthermore, half of the region-wide extirpations that would follow from forest loss could be expected to result in global extinction. That's because so many of Southeast Asia's life forms are endemic, which is to say they occur only locally.

At the Singapore Zoo, oblivious to the world outside, the living dead carry on. The proboscis monkeys are producing offspring. The zoo boasts the highest numbers of orangutans bred in captivity at any one institution—21. Twenty-two Malayan tigers have been born at the Singapore Zoo since 1973, along with 28 chimpanzees and 3 douc langurs, those exceedingly rare monkeys from the defoliated mountains of Vietnam and Laos. Other captive-bred members of living-dead species at the zoo are golden lion tamarins and white rhinos. Fourteen pygmy hippos have been born there. Around the world, 178 pygmy hippos live in 74 collections, and most of those hippos were born in zoos, to zoo-born parents. At the Jurong Bird Park, meanwhile, captive-born offspring have been hatched among more than 100 bird species, including many endangered species. Jurong is the only institution in the world to have successfully hatched fledglings from the southern pied hornbill, the black hornbill, and the Great Indian hornbill.

Among the growing ranks of the living dead, the ancient paradigm of evolution, as Darwin described it, is over. If their kind are among us at all a century from now, they will be wholly different from the creatures humans first encountered. They will not be "wild" animals at all. They will be the functions of artificial selection. They will live on in zoos, and perhaps some large parks. They will live in a world populated by animals we have chosen, with traits we have chosen, and in numbers we have chosen. If they live on in wilderness at all, it will be a wilderness of our own making. They will live in a simulacrum of the real world, in places like the Jurong Bird Park or the Singapore Zoo and its adjacent Night Safari grounds.

Every year, the Singapore Zoo attracts 1.5 million visitors. Ah Meng, the Sumatran orangutan who

whom you can pay to take tea, received a special award from the Singapore Tourism Board in 1999. She had raised five of her own babies at the Singapore Zoo.

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She became a grandmother there.

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In Greek myth, the chimera was a grotesque fire-breathing animal with a lion's head, a goat's body, and a dragon's tail. The term has come to mean a fanciful creature made up of different animals, and Singapore actually has its own chimera. "The Merlion" is an absurd-looking creature with the head of a lion and the tail of a fish. According to the official story, the Merlion comes from a thirteenth-century Malay legend and Singapore chose to adopt it as its national symbol. In the real world, the capitalist-authoritarian regime of Lee Kuan Yew, the Singaporean Tito, invented the Merlion in the 1960s, around the time it was jailing newspaper editors and left-wing intellectuals and shuttering Nanyang University. You will read in countless travel articles that the Merlion chimera has been considered the island's guardian since ancient times. Actually, it wasn't until the 1990s that tourism bureaucrats put their final touches on the fabrication of the legend. In Singapore, you can't even use the symbol of the Merlion for anything without government approval.

Singapore lies just off the southern tip of the Malay Peninsula, a few sea miles from several small islands immediately adjacent to the coast of nearby Sumatra. For all its grasping materialism and stifling political culture, Singapore has remained secular, multicultural, and stable, and has avoided the violence and despotism that convulsed nearby Malaysia and Indonesia throughout the latter half of the twentieth century. But four million people are packed into a country smaller than the Canadian city of Edmonton. As the 2003 *Nature* study showed, Singapore has almost completely devoured what was a largely uninhabited tropical island when Stamford Raffles and the British East India Company arrived in 1819. But the government has not been satiated by the island's living things: it has been pulling down the mountains and bulldozing them into the sea to make more room for itself in the shallows of the Singapore Strait.

With its cheek-by-jowl high-rise office towers, its vulgar residential complexes, its surfeit of American fast food franchises, multinational corporation branch plants, and off-the-shelf urban architecture, Singapore has been subsumed within the dreary homogeneity descending upon the cultures of the world. By the end of the 1990s, most of Singapore's buildings were less than 30 years old. The city is a bit difficult to describe, in fact, because it is so much like everywhere else. Even its oldest and largest graveyard, the venerable Bidari Cemetery, was bulldozed to make more room for urban development. In 2004, William Lim, a leading authority on urban development and architecture in Southeast Asia, described Singapore as a place where urban planners have "systematically removed and destroyed unprotected city areas and historical sites that had acted as containers of history, values, and cultures."

During my time there, I found regular solace at the In The Name Of Allah The Most Gracious The Most Merciful Mohd Rajeen & Brothers Café, a happy little establishment in Arab Street. The Muslim

quarter is one of the few places left in Singapore that feels and behaves like a real place. Apart from a handful of neighbourhoods that have somehow retained the old Malay *kampong* village atmosphere, Little India and Chinatown are the only other significant districts where some authentic local sensibility can be found. The rest of the city has been adequately described by the celebrated Dutch architect Rem Koolhaas as a place devised by “pure intention: if there is chaos, it is authored chaos; if it is ugly, it is designed ugliness; if it is absurd, it is willed absurdity. Singapore represents a unique ecology of the contemporary.”

Singapore more or less straddles the intersection of the “security first” and “markets first” roads the UNEP scientists were talking about in the *Global Outlook* report I referred to in the Prologue. Its people, most of whom are ethnically Chinese, have suffered the country’s Orwellian conditions of official truth, reinvention, construction, demolition, and reconstruction with a remarkably jolly grace. They take what little comfort they can in the country’s strides toward liberty and democracy. In 2000, for instance, the government relaxed its laws against the importation of chewing gum, but the people still have to be careful about asking too loudly for much more. As Singaporean journalist Cherrilyn George reports in his brave book *Singapore, The Air-Conditioned Nation*, the September 1, 2000 inauguration of a speaker’s corner in Ho Lim Park marked the first time since the colonial era that Singaporeans were allowed to address their fellow citizens publicly without a government licence. Still, having sustained 40 years of single-party rule by the People’s Action Party (PAP) since independence, Singapore is burdened by press-freedom restrictions that led Reporters Without Borders to rate it only slightly above North Korea and Myanmar.

The rating upset Information Minister Lee Boon Yang, who explained that in Singapore journalists were expected as a matter of course to contribute to “nation building.” By this phrase, the minister was referring to the government’s obsessive preoccupation with deforestation, urban expansion, construction, population growth, the enforcement of official mythology, and the burial of history—in other words, all those things contributing to the extinction of animals throughout the tropics, and to the extinction of local cultures, distinct urban landscapes, and ways of life. Not satisfied with having the third-highest population density of any country after Hong Kong and Monaco, PAP officials unveiled a plan in 2004 to boost population growth rates by offering multichild families tax breaks, reduced maid fees, better maternity benefits, cheap mortgages, and hefty family-allowance packets.

The entire country, which has practically no natural resources of its own, is the product of the limited company, which evolved into the multinational corporation—a statutory chimera fused with the same legal rights that Western democracies found first only in living, breathing human beings. It is well represented by the Merlion, of which there are four officially recognized statues. One of them gazes out from an imposing waterfront commercial-entertainment-office complex at One Fullerton down at Collyer Quay. It magically spits water into the Singapore River. The most grotesque is the gigantic Merlion statue on the artificial island of Sentosa. You can even go inside it, where there are gurgling sound effects and murals depicting fanciful pirates. The Sentosa Merlion is 37 metres tall.

emits laser beams from its eyes and smoke from its arse.

By the first decade of the twenty-first century, there were many chimeras moving through the world. The final walls between nature and artifice and between captivity and freedom are being scaled and breached at every rampart. Less than a century after H.G. Wells wrote *The Island of Doctor Moreau*, transgenic laboratory chickens were trilling like quails and a Canadian company had spliced the genes of a spider into the genes of a goat in the hopes of processing from the goat's milk "biosteel" with the tensile strength and flexibility of a spider's web. A transgenic zebra fish, the "glofish," has been genetically engineered by a Texas company to glow fluorescent red in the darkne of an aquarium tank. In 2004, a California firm, saucily named Genetic Savings and Clone, went in the business of cloning pets at \$50,000 a clone.

Even that thick pane of glass between the tiger and the rest of us is starting to crack. Scientists have bred mice with human brain cells, pigs with human blood in their veins, and sheep with human cells growing in their hearts. In 1987, the U.S. Patent and Trademark Office, following upon a U.S. Supreme Court ruling, declared that man-made organisms could be patented. Canadian and European government agencies eventually followed the American lead. Stem-cell research has opened up a vast potential for eliminating diseases and genetic abnormalities, and there are few rules to go by.

As early as 1988, the University of Virginia's Joseph Fletcher, a founder of the field of study known as bioethics, spoke approvingly of genetic manipulation to create "parahumans" with the physical capacity to do dangerous and demeaning work without the burdensome encumbrance of human rights. In 1997, two Americans, biologist Stuart Newman and biotech critic Jeremy Rifkin, applied to patent a "humanzee," a speculative part human, part chimpanzee species. Their application was a provocative stunt intended to force debate, and Newman and Rifkin were turned down. But by November 2002, U.S. and Canadian scientists had gathered in a closed meeting in New York, co-sponsored by Rockefeller University and the New York Academy of Science, to discuss the feasibility of creating a human-mouse chimera. The discussion centred on the possibility of injecting human embryonic stem cells into an early mouse embryo, to test whether it was possible to create a "mouse" carrying the full complement of human genes.

Freeman Dyson, with the Institute for Advanced Study in Princeton, New Jersey, argues that we should all be pleased with the possibilities. "Now, after some three billion years, the Darwinian era is over," Dyson wrote in the Massachusetts Institute of Technology's online *Technology Review* magazine in March 2005. "Cultural evolution is running a thousand times faster than Darwinian evolution, taking us into a new era of cultural interdependence that we call globalization. And now, in the last 30 years, *Homo sapiens* has revived the ancient pre-Darwinian practice of horizontal gene transfer, moving genes easily from microbes to plants and animals, blurring the boundaries between species." Dyson is positively ecstatic about the prospects: "There will be do-it-yourself kits for gardeners, who will use gene transfer to breed new varieties of roses and orchids. Also, biotech games for children, played with real eggs and seeds rather than with images on a screen. Genetic engineering, once it gets into the hands of the general public, will give us an explosion of biodiversity."



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