

Hope for Tropical Biodiversity through True Bioliteracy

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ABSTRACT

For tropical wild biodiversity to survive, it must occupy a large terrain, be permanently endowed, and be integrated with its local, national, and international society. Among other things, integration will be enormously facilitated by giving bioilliterate humanity—all seven billion of us—the ability to read wild biodiversity anywhere any time for the personal cost of a pocket comb. That is true universal bioliteracy. DNA barcoding is the technology for this, and a personal or an institutional decision to sustain its cheap cost will cut the Gordian knot.

Key words: conservation; DNA barcoding; taxonomy.

IN CONTRAST WITH THE HOPE OF GETTING ANTHROPOGENIC CLIMATE CHANGE UNDER CONTROL, or even dampening it, there is still most decidedly an opportunity and hope for the conservation of tropical wild biodiversity, at least that which still survives as viable populations.

A major cause for hope is that we do not have to try to save *every bit* of it, nor even have an omnipresent, as well as global, solution in order to save a huge part of it. Biodiversity does not flow like CO₂. Stop trying to save all wild nature all the time, everywhere. Triage does have its place, especially when we are both the enemy and the partner. We have the luxury that by focusing on sociologically and ecologically workable lumps, and by purchasing or otherwise securing them from the marketplace, *right now*, where they are, there is still time for a major peace treaty with wild tropical nature. Yes, it will be flawed, but it will be vastly better than the pale shadow of nature that clings to subsistence agroscares, industrial agroscares, and urban sprawl. But, wild nature is melting like a snowdrift in a March warm wind, quickly turning into brown slush, even if still cold. We need to pick the low-hanging fruits, grow larger and more experienced at conserving, cooking, and eating them, and later reach for the higher branches.

Why am I restating the obvious? Because now the whole world can listen (thank you Google). There is still time for large lumps of wild tropical biodiversity to be recognized and saved. The solutions are also recognizable and applicable. While globalization is just as much the problem as is the frontier farmer with nine children, they are also both part of the solution. Globalization allows all of us to listen and participate. The occupant of the land is the caretaker.

LARGE, ENDOWED, AND INTEGRATED

Another reason for hope is that saving various sizes of lumps of tropical biodiversity is within the grasp of each of us, as individuals and as groups. Buy it off the marketplace. The aggregate of those lumps can be several large semi-wholes, especially if the aggregation is socially integrated locally and nationally. Humanity is not going

to give the planet back to the wild. The wild can only hope for a network or leopard spots of large lumps, not a continent(s). Large they have to be, to biologically survive, to minimize the island effect, to withstand the siege of the adjacent agroscape, and to absorb the footprints of us users, all of us.

What else besides large? Wild nature needs to be permanently endowed. In other words, it has to do the strategizing and negotiating required to be a partner to humans. The nondamaging bio-developers of the wild (*e.g.*, Janzen 1999, 2000) need job security and operations budgets to cover their mission of wildland survival into perpetuity through integration with society. This cannot be achieved through beggar status. The wildland lumps must pay their bills. No society will long tolerate a parasitic nonintegrated, yet adequately large wildland. Whether it will die by a thousand cuts or one legislated bullet, the free rider will die.

What else besides large and permanently endowed? The conserved wildland must be heavily integrated with the society in which it is imbedded. To be integrated means anything to everything, including being able to read its biodiversity and its other moods. One shirt does not fit all. Wildland integration will be very different in Canada, California, and Costa Rica. This is because the shirt is social and the body it wraps is place-based biodiversity, with all its scars, warts, and silky smooth niceness.

TO WHOM AM I TALKING?

Tropical conservation has been understandably focused on 'protect it'. That is the conservation emotion, the conservation industry. That industry is in part why tropical conservation still has something to work with. But it has been a mix of one-night stands and success through agricultural inviability of the frontier. And then we walk away to the next seductive issue. Marriage is long overdue. We have far too long deluded ourselves into thinking that saving it was enough. But if it is just saved, it is dead.

'Just save it' is an academic protocol. Think it, publish it, put it in your curriculum vitae. From then on, it is the journal and the library's responsibility. We move on to the next puzzle. Conservation is long overdue for creative, understanding, and mission-oriented

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resident engineers and administrators, appropriate annual budgets, and appropriate annual yields. 'Park guard' is not an adequate staff for a park any more than it is for a bank. Conservation through nondamaging biodevelopment is only attained with a secure endowment, payment for services, and a market for its offerings. This structure is well known. It is that of a large, good, long-standing university. It has security and buildings, but it has so much more than that necessary platform.

Yes, there will always be an agroscape, hopefully self-funded for its environmental health. That is one of the human gardens, no matter how sustainable. The urban ecosystem is another. Let humanity have *those* huge gardens. The *quid pro quo* we seek is that humans let wildness have its large garden in return (Janzen 1999, 2000). We do not lament the absence of serious wild biodiversity in the shopping mall, rice field, and football pitch. Some whole countries, some whole regions, some whole places, and some bits of places are missing wild biodiversity and always will be. Fine, back off, those of us who really appreciate wild nature. We all have to eat, generate electricity, and drive on highways. We have to seek a negotiated deal that lets us appreciate ferns, elephants, and butterflies while humanity gets on with its sustenance.

READ IT

So where is deep hope for wild biodiversity? Marry it to society. This is the UN year of that wedding. Marriage means give the power to all seven billion of us to read wild biodiversity, *now* (Janzen 2004; see also <http://www.youtube.com/watch?v=iOs6rI2Dtbs>).

Imagine what it would do to human–biodiversity interactions if everyone of any age anywhere anytime for any reason could know what species of thing they have just eaten, has just bitten them or their crop plant, has just stimulated their pleasure and curiosity centers, has just brought out their game warden role (Janzen *et al.* 2005, 2009; Holloway 2006; Stoeckle & Hebert 2008; see also <http://www.barcoding.si.edu/>, http://www.bolinfonet.org/conferences/assets/files/BOLI_Brochure_Final.pdf, <http://www.boldsystems.org/views/login.php>, and <http://www.ibolproject.org/>).

But humanity is bioilliterate. Yes, there is a high priest for the name and natural history of some species. That person, however, is almost never standing by your side. But with Google, can you get it? No, there is no hole in your computer or handheld into which to insert the biobit to link through Google. Who is going to give you that name in the dark, the rain, the backyard, or the rain forest? True bioliteracy is being able to link what humanity knows to the biodiversity in hand, eye, or mouth, and build on it. What is the cost to let all seven billion of us read wild biodiversity, *now*? The barcorder in the back pocket (Stoeckle & Hebert 2008) is a U.S.\$50 million check and a 2-yr effort. This is not much for a moon shot for the survival of wild biodiversity through letting everyone read it.

But the throwaway cheap back pocket barcorder has to include a chip or be wireless connected to the growing libraries (Janzen *et al.* 2005, 2009) of identification sequences—the DNA barcodes—of the world's biodiversity. This is the databank with which the mystery biobit will be compared. Back-of-the-napkin calculation says

U.S.\$4 billion and 20 yr to do the world's 20 million species of things large enough to perceive. There are already 500,000 barcodes in the library. It does not have to be 'done' to be used, any more than does a public library.

Who will fill that barcode library? The biodiversity priests and acolytes will. There are many of them, easily 100,000-strong across the globe. There are an amazing number of people who 'know' and handle a subset of the world's biodiversity: taxonomists, parataxonomists, hobbyists, government agencies, teachers, owners, nature lovers, biodiversity prospectors, game wardens, environment monitors, conservationists, etc. They will be pleased to submit an 'identified' bit of each species that they know or encounter, so as to have its DNA barcode in the barcode public library, so long as they do not have to pay the cost of putting it there. We can start with an average of ten barcodes per species, at perhaps U.S.\$20 per barcode.

Every time a chip of leaf or a bit of insect goes into your back pocket barcorder, two things need to happen. First, a feedback system says 'we think this is *Aus bus*' and 'thank you for another biogeocode for the location of *Aus bus*'. Or it says 'this is not in the barcode library, please gather some information about the origin of this DNA barcode, and perhaps collect a sample or image'. And the barcode library grows yet even more as DNA barcoding exposes species hidden inside of scientific names. These are species not readily visible to 1.5 m-tall diurnal mammals. What we thought we knew, we find we really do not know. There are three species of orca (Morin *et al.* 2010), six species of giraffe (Brown *et al.* 2007), ten species of *Astraptles fulgerator* butterfly (Hebert *et al.* 2004), and 37 species of *Apanteles leucostigmus* wasp (Smith *et al.* 2008).

Second, each time that barcorder gets used, a penny has to drop into a bucket to fund those few who are so fascinated by wild biodiversity that they will spend their lives organizing, synthesizing, and reporting information about wild biodiversity. The process is combining Google, Encyclopedia of Life, and Geographic Positioning Systems for wild biodiversity, using our curiosity and biodiversity's traits as universal locators.

Where has the roadblock been? Yesterday the pieces were science fiction. Yesterday, the priests and acolytes of taxonomic biodiversity were sequestered in their monasteries. Today, the reality is a laboratory, robot, and technician at the end of a courier's delivery, with output measurable in hours. Without action, tomorrow we will all lament the absent barcorder.

The real roadblock is the apparent absence of a single human, or aggregation of humans, who simply decides, OK, let us allow humanity to become bioliterate for the cost of a few days of the war in Iraq. Write that check. The team is standing ready at the starting gate, fidgeting with anticipation. I am not talking academic curiosity looking for one more way to achieve job security through a fatter bio and another grant. This is a mission with a quite different payout. Just imagine a world in which we are all—school kid, soldier, farmer, lawyer, entrepreneur—actually able to *know and access* what it is in hand, mouth, or eye, for free and right now. We have the option to have all seven billion members of humanity on the same team for the first time in human history.

Asking the bioilliterate to save any serious portion of extant wild tropical biodiversity is like asking an illiterate city to die of the

cold when they have a huge building full of thin sheets of firewood, known as the Library of Congress, at hand. I used to say, while gazing at a tropical forest with more species than all of North America in it, 'If you cannot read it, it is just firewood'. Now I rephrase this as 'If you cannot read it, it is just biofuel'. That is what the U.S.\$100 barrel of oil gave us.

Let us save the human–biodiversity relationship. For this to occur, the wild biodiversity side of the equation has to survive. Photographs and mausoleums full of cadavers on pins have their place, and the occasional tree and bird in the agroscape is pleasant. But they just cannot compare with the great biodiversity fullness in which we evolved for 6 million years.

Why save it? Because we humans are a walking pile of sensors, be it carbon or be it silicon, or both. To strip us of the stimulators of those sensors is far worse than burning all the books and databases on earth. It is, and it is like, taking away our color vision, memory, smell, and taste. It is our consignment to the white box of the featureless world. You feel that we can live by bread alone? An amazingly large part of that bread production depends on the wild things and their aggregations.

We are busily asking what we, as individuals, can do to bring the temperature and climate of our sick Earth back to normal. What can you, a shareholder right along with me and the person standing next to you, do for Corporation Wild Biodiversity, *right now*? Pitch in, tag along, join up. There are at least 500 people and institutions on this planet who could, with 5 percent of their net worth, truly save for humanity forever the great bulk of tropical biodiversity. Do they really know this? I do not think so. Put this opportunity on their desks.

In the spirit of full disclosure, I am a shareholder in this corporation. It is my wild biodiversity heritage that is being eaten off the earth, just as it is yours.

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