

Teaching Tomorrow's Conservation Leaders: Lessons from Aldo Leopold

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Let me begin by saying thank-you to the Brandwein Institute for the opportunity to be here with you all today. I am honored to be invited, and to be in the company of those distinguished scholars, scientists, educators, and artists who have preceded me. As I have learned about the Institute and its programs, I have been inspired by the wisdom, creativity, and commitment of the Brandwein community. Your work is so important, and I welcome this chance to contribute to it.

My plan today is straightforward. I'll begin with some introductory remarks and then provide a brief overview of Aldo Leopold's life and work. The heart of my talk will be an exploration of several core themes in Leopold's approach to education that seem to be essential to the task of teaching tomorrow's leaders. I will conclude with a few thoughts to launch us into conversation.

True Confessions

At the outset, I must share with you a couple ironic observations and personal confessions. As I am among science teachers, the first involves my own experience as a student. I am having some flashbacks here to my youth. I attended high school not far from here, in the suburbs of Chicago. I was a good student, did well enough in my advanced science classes. But I also know that I did not do as well as I might have. And now I know why. I recall vividly my experience in freshman biology. Our textbook followed what was then, and perhaps may still be, the standard progression in biology instruction, from the scientific method and basic organic chemistry to cells to genes to microorganisms, plants, and animals, to heredity and evolution. And our course through the year followed the same progression. But all year long my eyes were riveted on the photos and material in Chapter 37: "A World of Ecosystems"—mountains and rivers and deserts and forests, food chains and predation and plant communities!

I couldn't wait. Eagerly, all year long, I anticipated getting to that part of the course that made my heart beat and my spirit soar. You can guess where this is going.... And you can imagine how deflated I was when our teacher announced, sometime in late spring, that because we were running behind schedule, we would have to skip Chapter 37. Oh, the frustration! Even more, in my memory I hear a somewhat dismissive tone in my teachers' voice, as if to say, "It's ok; that stuff is really not all that important anyway."

Perhaps it was that disappointment that led me down the wayward path toward becoming, alas, an English and History major! In college—also here in Chicago, at DePaul University—I took the required science courses, but little more. I had to come back to science through the back door: through Henry David Thoreau's botany, through Lewis Mumford's history of technology, through Thomas Kuhn's shifting paradigms—and through Aldo Leopold's land ethic. I share this admission because it frames one of the points of my presentation today:

that science became a vital interest of mine again once I became as interested in its *context* as I was in its *content*. I came to appreciate not only what science reveals about the workings of our brains and bodies, our world and universe, but the ways in which that knowledge shapes our relationships with the world, and with each other. And that, I would later come to see, is a very Leopoldian way of understanding the role of science.

My second confession involves a contradiction in my title today. For years I have explicitly avoided answering questions that begin “What would Aldo Leopold think about....” For a long while, I explained why: that it was difficult to know for sure what Leopold would have thought on any given topic; that he was always an original, and often surprising, thinker; that he was always growing in his ideas and perspectives; and that question absolves us from thinking creatively ourselves about current difficult realities and tensions. More recently, though, I have taken to answering the “What would...” questions differently. Now I say: I cannot tell you exactly *what* Leopold would think about this or that topic or problem; but I can explain *how* I think he would have thought about it. And, after all, that is the important thing: the process of reasoning and connecting and contemplation that we bring to understanding our reality, and responding to it in a conscientious way.

It was that dimension of Leopold that inspired his own students, and that generations of readers have found in his writing, that attracted me as a scholar, and that informs the question of the day: How can Leopold’s work and words can help us to prepare future conservation leaders? It was his *way* of thinking that holds vital and necessary lessons for the future.

We live in what some are referring to as “the Age of Consequences.”¹ We all know the problems, the long list from climate change, biodiversity loss, and degraded soils and water, to emerging diseases, compromised food systems, and growing inequality. But now we recognize that our many social, political, economic, and environmental challenges are *interrelated, converging, cumulative, compounding, and synergistic*.²

Systems thinkers refer to these as *wicked problems*: problems difficult to solve definitively due to complex interdependencies, conflicting value systems and worldviews, incomplete data and high uncertainty, and a daunting array of cultural, economic, and political constraints.³ To solve such problems, solutions must address roots causes and not merely the varied symptoms. The solutions to one problem must, at minimum, not exacerbate other problems; rather, they must all contribute to solving the other, related problems. To arrive at such solutions, we need new ways of thinking, and hence of learning and teaching. And we need new kinds of *leadership*. This is what Aldo Leopold understood when he was addressing

¹ My colleague Courtney White has explored this concept in his book *The Age of Consequences: A Chronicle of Concern and Hope* (Berkeley, CA: Counterpoint, 2015).

² See Curt Meine, “The Courage to Connect,” *Journal of Soil and Water Conservation* 67,5 (Sept/Oct 2012): 120A-121A. <http://www.jsowonline.org/content/67/5/120A.full.pdf>

³ The foundational reference for the concept of “wicked problems” is: Horst Rittel and Melvin Webber, “Dilemmas in a General Theory of Planning,” *Policy Sciences*, Vol. 4 (Amsterdam: Elsevier Scientific Publishing Company, Inc., 1973), pp. 155–169. See also Jeffrey Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems* (Chichester, England: Wiley Publishing, 2006); Valerie Brown, John Alfred Harris, and Jacqueline Y. Russell, eds., *Tackling Wicked Problems through the Transdisciplinary Imagination* (London and Washington, D.C.: Earthscan, 2010).

and seeking solutions to wicked problems before we had a convenient 21st-century term for them.

Aldo Leopold: A Basic Biography

I am guessing that most of you here today have heard of Aldo Leopold, many of you have read his classic *A Sand County Almanac*⁴, and maybe even a few of you were inspired along your career path by his work and example. For all of us, let me provide a brief review of his life to provide context for what will follow.⁵

Leopold was born in 1887 in Burlington, Iowa, and began his lifelong interest in natural history and science in his boyhood haunts along the Mississippi River. After graduating from Yale University in 1907, he earned a master's degree from Yale's Forest School in 1909. As a member of the nation's first generation of trained foresters, he immediately Leopold joined the new U.S. Forest Service, where he became a leading innovator in soil conservation, range management, recreational planning, game management, and wilderness protection. His field work in these years provided the foundations for understanding landscape-scale ecosystem processes such as fire and soil erosion, leading in turn to new approaches to land management. Concerned by the accelerating fragmentation of the nation's wild lands, he led efforts that in 1924 resulted in the designation of the nation's first wilderness area within the Gila National Forest in New Mexico.

After leaving the Forest Service in 1928, Leopold devoted himself to the development of wildlife ecology and management as a distinct field, first as an independent researcher, then as professor at the University of Wisconsin. His fundamental contribution in these years was to apply concepts from the science of ecology to the conservation of wildlife populations and habitats. His text *Game Management*, published in 1933, was the first in the field. He became a founding father of the new field of wildlife ecology and later served as the president of the Ecological Society of America. Even while marking his mark in the conservation sciences, he was putting his ideas into practice, literally, on the ground, at the abandoned farm—"first worn out, then abandoned by our bigger-and-better society"⁶—that became the focus of his and his family's experiments in land restoration. For this occasion, it is especially important to note that the five Leopold siblings all became accomplished scientists and conservationists in their own right. Three were elected to the National Academy of Sciences, an achievement unique in the annals of American science.⁷

⁴ The original edition is: Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949).

⁵ This biographic sketch is drawn from Curt Meine, "Aldo Leopold," in Hugh Richard Slotten, ed., *Oxford Encyclopedia of the History of Science, Medicine, and Technology in America* (New York: Oxford University Press, 2014). For an overview of Leopold scholarship, see the on-line Oxford Bibliographies entry at <http://www.oxfordbibliographies.com/view/document/obo-9780199830060/obo-9780199830060-0037.xml>. See also the documentary film *Green Fire: Aldo Leopold and a Land Ethic for Our Time* (2011).

⁶ Aldo Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation* (New York: Library of America, 2013), p. 3. All subsequent citations of Leopold's writing refer to this edition, unless otherwise indicated.

⁷ See Luther J. Carter, "The Leopolds: A Family of Naturalists," *Science* 207 (180): 1051-1055.

Through his many nontechnical writings, including policy statements, editorials, and nature essays, Leopold defined a new approach to conservation, one that sought to blend elements of older utilitarian and preservationist traditions within a broader context of contemporary ecological understanding. He argued that successful conservation involved more than the simple economic goal of sustained yields of discrete resources and products; rather, conservation ought to promote *land health*—“the capacity for self-renewal” in “the soils, waters, plants, and animals that collectively comprise the land.”⁸ Concerned by the accelerated pace of technological change and its impact on biotic diversity and ecological processes, Leopold in the post-war years focused his writing on the ethical aspects of human-nature relationships.

In the final years of his life, Leopold compiled many of his essays into the collection published posthumously in 1949 as *A Sand County Almanac*. The book became, along with Rachel Carson's *Silent Spring* (1962), a basic text for the modern environmental movement. Especially influential was its capstone essay, “The Land Ethic,” in which Leopold argued for an expansion of the sphere of human ethical concern to include the natural world. Leopold's writings have become only more influential over the decades, providing important foundations for such emerging interdisciplinary fields as restoration ecology, conservation biology, environmental history, ecological economics, and environmental ethics.

Even this brief sketch helps us to see why Leopold's insights on science, education, and leadership made him a transformative figure in his own time, and why they remain relevant in ours. Leopold made his mark on conservation in a period of multiple social and environmental crises: widespread deforestation, wildlife depletion, overfishing, overgrazing, wetland drainage, flooding and soil erosion; his later years saw the Dust Bowl, Depression, and World War. He was early to appreciate that the science of ecology, then only emerging and maturing, was fundamental to conservation practice, policy, and philosophy. He lived through dramatic technological and industrial revolutions, and saw the changing role that science played—for ill and for good—in mediating our relationship with the natural world. And he understood that these were far more than merely technical issues and challenges; that they involve the very core of our humanity, our search for meaning, our ways of seeing the world, and our visions for the future.

Lessons for Leadership

Aldo Leopold was an educator himself, and by all accounts a highly effective and influential one. His writing in *A Sand County Almanac* endures, in part, because a gentle but deeply informed pedagogy infuses his prose, and entices the reader into a world vivid with drama, diversity, and beauty. In Leopold's example and in his writings, we find attributes that can inform our own efforts not only to prepare students for the uncertainties and complexities that lie ahead, but to encourage their inherent leadership skills.

The cultivation of curiosity and perception. We can begin with what I think we all know and appreciate: that it all begins with the fire of curiosity and the growth of perception. Keep

⁸ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 505.

that flame lit, and the rest takes care of itself; neglect it, or allow it to sputter out, and it becomes a long hard slog back to engagement. Aldo Leopold saw natural history, and the natural sciences, not as the domain of the professional researcher, but as the pathway to wonderment, open to all. And he saw such a perspective as fortification for the future.

This is fundamental, I think, as we aim to open students' eyes without weighing them down with all the problems of the world. "Prudence never kindled a fire in the human heart," Leopold wrote in 1939. "I have no hope for conservation born of fear. The 4-H boy who becomes curious about why red pines need more acid than white is closer to conservation than he who writes a prize essay on the dangers of timber famine."⁹ And key to this was the encouragement of our innate capacity for perception—for seeing into the world with creativity and sensitivity. *Perception* is a key word in the Leopold lexicon, the key to ecological insight. Yet he was quick to say that advanced training in ecology was not a requirement. "On the contrary," he wrote, "the Ph.D. may become as callous as an undertaker to the mysteries at which he officiates. Like all real treasures of the mind, perception can be split into infinitely small fractions without losing its quality. The weeds in a city lot convey the same lesson as the redwoods."¹⁰

It is hard to imagine true leadership that is not marked by native inquisitiveness and perception. When we block our view, we close ourselves to needs and possibilities. When we open our eyes to a living world suffused with mystery, beauty, and diversity, we prepare ourselves to live well with it, and within it.

The value of direct, personal, tangible experience. For Leopold, it was not enough to *know* the lessons of weeds and redwoods intellectually. For those lessons to lodge, and their impact to reverberate, they had to be personal and direct. Book-learning and classroom lectures have their necessary place, but perhaps we need to say it openly: *places* have their place! And education divorced from the reality of places—of landscapes and watersheds and bioregions and flyways—would sever the connection between abstract knowledge and living systems—and, worse yet, between ideology and consequence.

In "The Land Ethic" Leopold wrote: "Perhaps the most serious obstacle impeding the evolution of a land ethic is the fact that our educational and economic system is headed away from rather than toward, an intense consciousness of land."¹¹ He bemoaned "the eviction of outdoor studies from the schools" and the fact that "the living animal is virtually omitted from the present system of zoological education."¹² It is, of course, a situation that has become only more exacerbated over time, as Richard Louv¹³ and others have documented. Our digital devices, growing more powerful with every new product roll-out, increasingly rule our lives and mediate our experiences. They are, for all their power, just tools; depending on how they are used, they can dull or enrich our experience. No doubt, they do both. But what endures is the imprint on our consciousness of the personal.

⁹ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 428.

¹⁰ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 150.

¹¹ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 187.

¹² Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 413.

¹³ Richard Louv, *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder* (Chapel Hill, NC: Algonquin Books, 2008).

It is that authenticity that we know when we feel it, and see it, and hear it. It is that very personal truth, informing judgment and guiding our visions, that we recognize as a core attribute of leadership—and that, when it is lacking, leaves us vulnerable to manipulation and myopia.

The capacity for critical thinking and independent judgment. As our colleague David Orr has noted, “Leopold is most interesting to us as an educator not because he wrote long complex tomes on educational theory, but rather because he was a consummate student of the land who could change his mind as the evidence warranted.”¹⁴ In a key 1947 address, “The Ecological Conscience,” Leopold suggested that such a conscience “is an affair of the mind as well as the heart. It implies a capacity *to study and learn*, as well as to emote about the problems of conservation.”¹⁵

Leopold was one who always kept his mind and heart in communion, in close communication with each other. He recognized the special role of science in the lifelong conversation we have with ourselves and with each other. “Science,” he wrote “contributes moral as well as material blessings to the world. Its great moral contribution is objectivity, or the scientific point of view. This means doubting everything except facts; it means hewing to the facts, let the chips fall where they may.”¹⁶ He was one to challenge even his own most cherished values and beliefs—to test them, to reaffirm them, to change them if need be. The best known instance of this was the evolution of his attitude toward predators, described with poetic intensity in his famous essay “Thinking Like a Mountain.” “Only the mountain has lived long enough,” he wrote “to listen objectively to the howl of a wolf.”¹⁷ But we could aspire to think like mountains: to consider the long-term, the large-scale, the complex and evolving, at the intersection of self-interest and the common good. In a world of wicked problems, such perspective is essential to effective leadership.

The need to connect and integrate fields of knowledge. Wicked problems persist when, and because, we fail to see connections and relationships. Leadership in addressing such problems requires that we see, understand, and honor such connections—between people, between humans and nature, and between fields of knowledge. Aldo Leopold was a connector, an integrator, and exemplary interdisciplinarian. He was a pioneer in several fields of conservation science precisely because he saw the connections, and thought across disciplinary boundaries.

There are certain themes in Leopold’s work that require no explanation, just recitation. And so: “Perhaps the most important of these purposes is to teach the student how to put the sciences together in order to use them. All the sciences and arts are taught as if they were separate. They are separate only in the classroom. Step out on the campus and they are immediately fused. Land ecology is putting the sciences and arts together for the purpose of

¹⁴ David Orr, “What Is Education For?” in *The Essential Aldo Leopold*, Curt Meine and Richard L. Knight, eds. (Madison, WI: University of Wisconsin Press, 1999), p. 256.

¹⁵ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 528.

¹⁶ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 134.

¹⁷ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 114.

understanding our environment. ...With such a synthesis as a starting point, the tenets of conservation formulate themselves almost before the teacher can suggest them.”¹⁸

Leopold was not a free-floating generalist. He had “street cred”—and “field cred”—and “campus cred”—in a variety of disciplines. But he saw danger when reductionism in science was not coupled with integration, when connections were ignored or neglected. He called for “a reversal of specialization; instead of learning more and more about less and less, we must learn more and more about the whole biotic landscape.”¹⁹ He asked that science inform not just our intelligence, but our vision: to help us think expansively and imagine generously.

We all have watched, in recent years, as attention has come to focus on the importance of the STEM disciplines. We have also seen something of a counter-trend, as attention has also been given to sustainability as a coordinating and connecting concept across disciplines. By the 1930s, Leopold saw ecology—the science of connection and relationship—as fundamental to understanding how we might reconcile these varied needs. Musing to himself in 1935, he wrote: “One of the anomalies of modern ecology is that it is the creation of two groups, each of which seems barely aware of the existence of each other. The one studies the human community, almost as if it were a separate entity, and calls its findings sociology, economics, and history. The other studies the plant and animal community and comfortably relegates the hodge-podge of politics to ‘the liberal arts.’ The inevitable fusion of these two lines of thought will perhaps constitute the outstanding advance of the present century.”²⁰ And, shall we say, this century as well.

The need to communicate. For Aldo Leopold, conservation science was not work undertaken by isolated researchers apart from people or from public responsibilities. Its findings were not intended to be shared just with other researchers, or even with students. Leadership in science and conservation entailed a responsibility for communication. In Leopold’s case, this reflected especially his deep conviction that this new, still-emerging science of ecology was too fundamentally important to remain the domain of academic specialists. In an unpublished manuscript he wrote: “No ‘language’ adequate for portraying the land mechanism exists in any science or art, save only ecology. A language is imperative, for if we are to guide land-use we must talk sense to farmer and economist, pioneer and poet, stockman and philosopher, lumberjack and geographer, engineer and historian.”²¹

And so he did. The essays that eventually came together in *A Sand County Almanac* were born of the need to share the insights of his science with students, fellow scientists, fellow citizens, landowners, resource managers, economists, philosophers, policy-makers. This also reflected the culture of the institution that Leopold called home in these years: the University of Wisconsin. Its institutional creed—the Wisconsin Idea—demanded that knowledge be pursued not just for its own sake, but in service of the public interest.

And this in turn revealed the tight connection that Leopold saw between science and citizenship. “The citizen conservationist,” he wrote in these years, “needs an understanding of

¹⁸ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 467.

¹⁹ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 458.

²⁰ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 375.

²¹ Leopold, from “Biotic Land Use,” in *The Essential Aldo Leopold*, p. 275.

wildlife ecology... to enable him to function as a critic of sound policy.... The forces which threaten wildlife emanate from its environment, and their operation cannot be understood by a public versed only in names and habits of species. Such a public, as a critic of conservation policies, is equivalent to a person having a wide personal acquaintance, but no knowledge of business, as a critic of politics or economics. ...Ecology is the politics and economics of animals and plants."²² It seems almost hardly worth mentioning that we live in a time when the function of science in our democracy is being challenged, in ways that many of us find so unsettling. Let us not be shy about saying it: in a democracy, science is essential to informed citizenship. It is not all that we need, but without it, we are unable "to function as [critics] of sound policy."

Keeping the vital link: science and ethics. The same critical perspective and healthy skepticism that Leopold brought to his work *in* science he also employed in his thinking *about* science. Few (as we have seen) in our history have been so eloquent in defending the role of science and articulating its value to the human condition, to the individual's growth, and to a well functioning democracy and sustainable economy. But few could be as blunt as Leopold in pointing out the limitations of science and the dangers of science unmoored from ethics. He was especially concerned about the prospects for a world in which science and technology served short-term, merely material needs and interests. He wrote, in 1941, "If science cannot lead us to wisdom as well as power, it is surely no science at all."²³

World War II and its aftermath served only to heighten this concern. The war changed how science was done, how it was funded, how it was applied. Leopold lived just long enough to see these changes taking hold, and to express in increasingly direct terms his apprehension. In his essay "On a Monument to the Pigeon," a contemplation of lessons learned from the story of the extinct passenger pigeon, he writes: "Time was when the aim of science was to understand the world, and to learn how man may live in harmony with it. If I read Darwin right, he was more concerned with understanding than with power. But science, as now decanted for public consumption, is mainly a race for power. Science has no respect for the land as a community of organisms, no concept of man as a fellow passenger in the odyssey of evolution."²⁴

The fullest expression of his concern came, of course, in his summary statement of "The Land Ethic." Deeply grounded in science, Leopold's statement of the land ethic nonetheless highlighted the difference between "man the conqueror versus man the biotic citizen; science the sharpener of his sword versus science the searchlight on his universe; land the slave and the servant versus land the collective organism."²⁵ His science was not only connected to his ethical sensibility: it framed it and fed it: "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man,

²² Leopold, from "Teaching Wildlife Conservation in Public Schools," in *The Essential Aldo Leopold*, p. 260.

²³ Leopold, from "Ecology and Politics," in *The Essential Aldo Leopold*, p. 275.

²⁴ Leopold, from "On a Monument to the Pigeon" in *The Essential Aldo Leopold*, pp. 277-278.

²⁵ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, pp. 186-187.

nor for us to reap from it the esthetic harvest it is capable, under science, of contributing to culture.”²⁶

Leopold understood well that no one individual can presume to “write” an ethic. An ethic evolve[s], he observed, “in the minds of a thinking community.”²⁷ If there is a single lesson from Leopold’s work that I hope we can share with our students in the Age of Consequences, it is this: that they, regardless of background and belief system, with whatever talents and experience and wisdom they bring, take an active part in forging this ethic; that they become leaders in the thinking community and active agents of their own future, and the future of our shared place. And it is our job to give the tools and confidence to do so, and to encourage them in the literal sense: to instill courage.

I have condensed Leopold’s approach to education, science, and leadership down to these six themes, but I don’t want to leave the impression that this is an exclusive list. If I had another forty minutes, I might explore, for example, his thoughts on the relationship of science and economics, or the premium Leopold put on collaboration, in research and in applying knowledge; or the value and importance of teaching the history of science. But I think it is best to let Leopold speak for himself on one last point that we should always bring to our own teaching: the utter joy of learning. In a contemplation of “the role of wildlife in a liberal education,” he wrote that such education entails “not merely a dilute dosage of technical education. It calls for somewhat different teaching materials and sometimes even different teachers. The objective is to teach the student to see the land, to understand what he sees, and to *enjoy* what he understands.”²⁸

My own favorite expression of this came in one of his own lectures to his undergraduate students at the University of Wisconsin toward the end of his life. Who would not have appreciated a professor who paused halfway through the semester to say: “I am trying to teach you that this alphabet of ‘natural objects’ (soils and rivers, birds and beasts) spells out a story, which he who runs may read—if he knows how. Once you learn to read the land, I have no fear of what you will do to it, or with it. And I know many pleasant things it will do to you.”²⁹ If we are fortunate, we might have had such a teacher in our lives. If our students are fortunate, we can at least occasionally be such a teacher to them. And if our world is fortunate, they will infuse such joy, and curiosity, and critical thinking into their lives, their places, and their role as citizens. They will have become leaders without even realizing it.

Facing Forward

I said at the opening of my talk today that the wicked problems before us will require that we pursue and instill new ways of thinking, and that Aldo Leopold is among the teachers that we can look to for guidance and instruction in this epic task. But I want to amend that statement as I come toward my conclusion here. I want to say that in some respects we also need to reclaim old ways of thinking. In the search for elegant solutions to our complex

²⁶ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 4.

²⁷ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 188.

²⁸ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 467.

²⁹ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 523.

problems, as opposed to mere silver bullets, our ancestors were not dummies. Communities and cultures around the world formulated their own land wisdom long before Aldo Leopold crystallized it for us as *the land ethic*. From the Cree people of Hudson Bay:

There is medicine on the land, where beauty and strength can be found.
 Human life is one with Creation.
 Sacred and natural laws govern all of Creation.
 Knowledge comes from the Creator through the land.
 Life is tied to and connected to the land.³⁰

For the indigenous Hawai'ians, being *pono* means being in perfect alignment and balance with all things in life. It means one has the perfect relationship with the creative energy of the universe, however you might describe that energy... *Pono* means you are in complete harmony through your custodial relationship with the earth.³¹

These are just two examples. All cultures and communities, to endure, must come to such understanding.

And we can find contemporary expressions from so many diverse sources, resonating with Leopold, and converging around our global need to forge healthier human and human-nature relationships. In his Nobel Peace Prize lecture in 1964, Martin Luther King observed: "...Modern man suffers from a kind of poverty of the spirit, which stands in glaring contrast to his scientific and technological abundance. We've learned to fly the air like birds, we've learned to swim the seas like fish, and yet we haven't learned to walk the Earth as brothers and sisters."³²

My colleague Robin Kimmerer, Potawatomi botanist and a powerful voice of traditional ecological knowledge, writes: "Ecological restoration is an act of reciprocity and the Earth asks us to turn our gifts to healing the damage we have done. The Earth-shaping prowess that we thoughtlessly use to sicken the land can be used to heal it. It is not just the land that is broken, but our relationship with land. We can be medicine for the Earth, partners in renewal."³³

It may seem far afield to draw from such sources in this talk, but we can no longer afford to think so—as if we ever could. If we are to solve our wicked problems, we will need to draw upon every source of wisdom, every voice of reason and compassion, every connecting soul and bridging spirit that we can muster to the cause. We need to be the integrators, the communicators, and the instructors. This is what an evolving and vibrant land ethic allows us to do, and calls us to do. And it is what we can aspire to instill in our students.

³⁰ Micahel Gnarowski, ed., *I Dream of Yesterday and Tomorrow: A Celebration of the James Bay Cree* (Kemptonville, Ont.: Golden Dog Press and the Grand Council of the Cree, 2002), pp. 11-12. See Curt Meine, "This Place in Time," in *Conservation for a New Generation: Redefining Natural Resources Management*, Richard L. Knight and Courtney White, eds. (Washington, D.C. and Covelo, Calif.: Island Press, 2009), pp. 11-29.

³¹ See Malcolm Nāea Chun, *Pono: The Way of Living* (Honolulu: University of Hawaii, 2006).

³² Martin Luther King, https://www.youtube.com/watch?v=e-4aiJ9r_ro. This is a variation on King's text in his 1964 Nobel Peace Prize lecture in Oslo. See http://www.nobelprize.org/nobel_prizes/peace/laureates/1964/king-lecture.html.

³³ Robin Kimmerer, "Returning the Gift," Center for Humans and Nature website, <http://www.humansandnature.org/earth-ethic---robin-kimmerer-response-80.php>

There is another insight that has rolled around out there for some time, that you have perhaps heard, and variations of which are variously attributed to Albert Einstein, astronomer Clifford Stoll, and genre-bending musician Frank Zappa, and probably many others I don't about: "Data is not information, information is not knowledge, knowledge is not understanding, understanding is not wisdom." We are still coming to terms with this chain of distinctions. Aldo Leopold was not alone trying to keep the channels leading from data to wisdom open, fluid, and fresh. His example ought to encourage *us*.

Our students will inherit a world of wicked problems, mounting risks, and vast uncertainties. But it is also a world—it is always a world—of subtle beauties, large potentials, and creative opportunities. We can give them paralyzing angst on the one hand, or simplistic hope on the other. I don't think we want to give them either. We want to give them the skill, knowledge, and sensitivity to make that journey from data to wisdom, to gain confidence along the way, and to become the leaders we need them to be. We want them to think critically and to act resolutely. We want them to enjoy rich and meaningful lives in the process.

Amid the disorienting darkness of world war, Leopold wrote: "Conservation is our attempt to put human ecology on a permanent footing."³⁴ We are still striving toward that end. Let us do the necessary things that Leopold as an educator did, and what science teachers have the opportunity and privilege to do every single day: open eyes, feed curiosity, hone perceptions, provide information, make connections, ask questions, and instill trust.

Thank you for all your work in doing so, and thank you for inviting me to be with you here today.

³⁴ Leopold, *A Sand County Almanac & Other Writings on Ecology and Conservation*, p. 479.