

Native Science

**Natural Laws
of Interdependence**

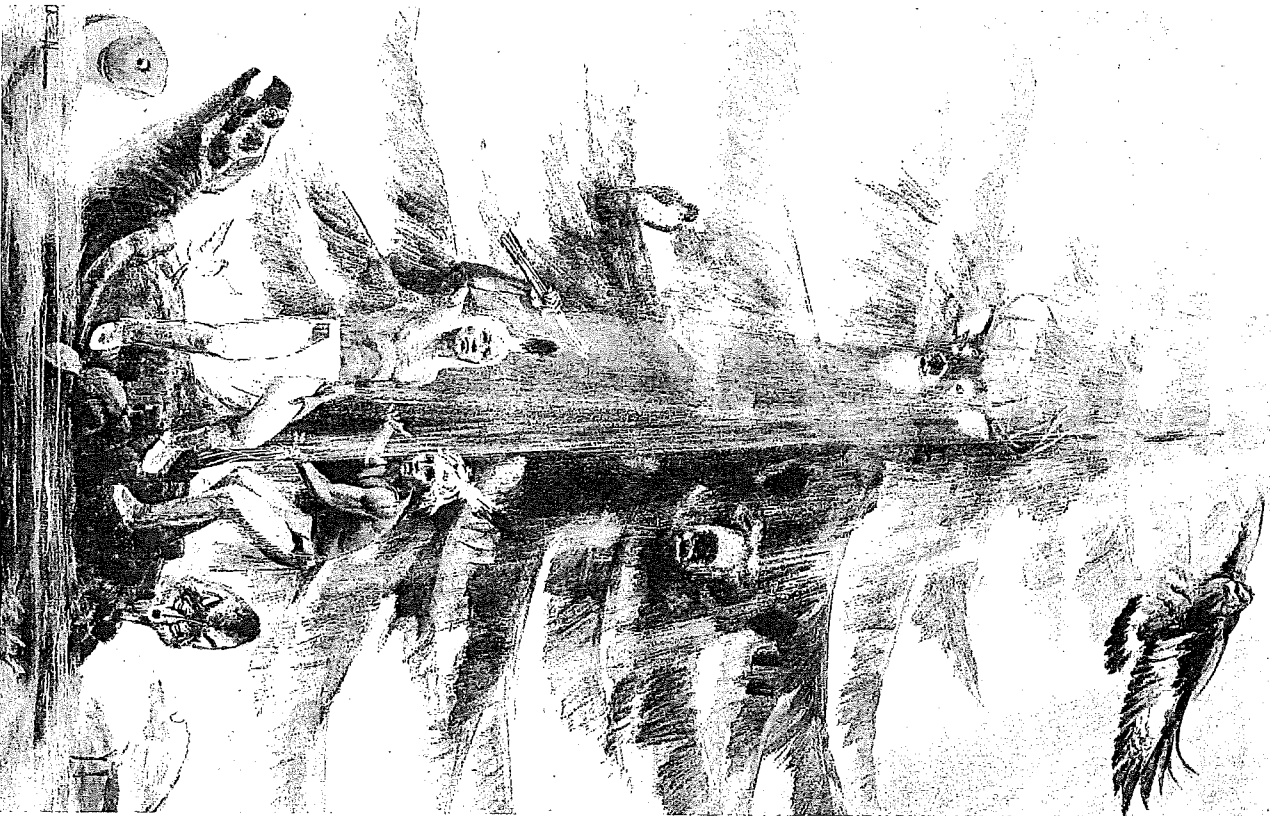
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“Tree of Peace.” Painting © Chief Oren Lyons.

CHAPTER TWO

Philosophy of Native Science

“Living the earth and facing the sun”

All is beautiful,
All is beautiful,
All is beautiful, indeed.
Now the Mother Earth
And the Father Sky,
Meeting, joining one another
Helpmates ever, they.
All is beautiful,
All is beautiful,
All is beautiful, indeed.

—Navajo

Eco-Philosophy

The sacred tree of life, as an analogy for the evolving process of Native science and quest for knowledge, presents a cosmological and structural symbol for Native science that embodies its life- and nature-centered orientations. Native science is in every sense an expression of the evolutionary interrelationship of Native people with nature. The tree presents an archetype of life, learning, and development that begins with the sprouting of a seedling from a seed embedded in fertile ground, then moves to the various stages of growth and development through all seasons of life and its trials and tribulations until it begins to form seeds of its own. The tree is natural analogy for a living philosophy. Each species of tree is of a particular "tribe" originating and rooted in the soil of a particular place, living and growing into its own particular form and completing itself in the distinct way of its species, yet having its own unique and one-of-a-kind expression of life. The leaves, fruits, and seeds of each tree are really the outward expression of its life and its "reeness." Each of these is an expression of the philosophy, art, and soul of the tree and of Native cultures.

The sacred tree is a symbolic metaphor of ecological philosophy represented in many aspects of myth and ceremony throughout Native America. Native stories often refer to the Tree of Life as the life-giving principle of the Earth that nourishes and connects all life. It is a symbol of the core orientations of the Native philosophies of holding life sacred and rootedness to the Earth. It is a living symbol and source of that divine energy of life expressed in language, song, dance, art, and science. The roots, trunk, branches, and leaves of this sacred tree may be seen as symbolic expressions of the various dimensions of Native science. The thousands of expressions of Native science are symbolic leaves of this great Tree of Life. Native science expresses the hope that this great tree will continue to flourish in the hearts of all humankind.

Cosmology is the contextual foundation for philosophy, a grand guiding story, by nature speculative, in that it tries to explain the universe, its origin, characteristics, and essential nature. A cosmology gives rise to philosophy, values, and action, which in turn form the foundation of a society's guiding institutions.

In the West, techno values of power, control, and efficiency are championed by institutions and organizations, and the modern hero is a practical, action-oriented, business-minded individualist, whether he or she wears a three-piece suit or faded jeans, who symbolizes the technological civilization and the cosmology on which it is based. Just as the Faustian person did, modern business acts on its sense of entitlement no matter what the expense. Actions have literally no frames of reference other than individual gratification and institutional profit and include the plunder of the natural world as a means to self-serving ends. Consequently, our applied technology, science, and economics have trivialized our lives and sterilized our spiritual sense of being.

An immature cosmology spawns immature individual values and institutions. But the immature Faustian individual is experiencing final self-indulgence. The era of the "ecological individual" is by necessity dawning. As our society's cosmology has misfired, resulting in environmental destruction, so have its philosophies, values, actions, and guiding institutions. The creation of an ecological cosmology with its philosophy for the individual must now be sought through education and in our political and economic systems. According to Henryk Skolimowsky (1992:3), "Eco-philosophy . . . is like a tree. Out of the roots of eco-cosmology grow the trunk and branches of eco-philosophy. . . . The tree is crowned with ecological consciousness, which in subtle ways feeds back into its roots. Thus the cycle is complete and self-renewing within itself."

Skolimowski was one of the first to articulate an eco-philosophy for the transformation of thought needed for a new ecological consciousness. In his 1981 study, *Eco-philosophy: Designing New Tactics for Living*, he states that because current political systems threaten to rob us of our highest values and because the current basis for action is no longer deeply rooted in life-serving purposes or reverence for nature, we need a new philosophy to inform and guide us. Skolimowski writes of the loss of soul in modern philosophy, bereft of a language that cannot speak of love, soul, or spirit, and advocates the recycling of minds toward the realization of a living philosophy.

Because the current worldview causes escalation of our destructive relationship with the environment at every level of life, human meaning atrophies. The emerging environmental cosmology will be in conflict with the popular mechanistic view. This "cosmic" conflict can be seen in the energy underlying philosophical, political, religious, and economic debates all over the world.

A modern "ecosophy" would be about the rediscovery of meaning as it relates to our universe. It would require not only a different way of thinking, but also a different way of knowing and living. Such an ecosophy would rebuild a unitary view of the cosmos in which everything is interdependent and moved by creative energy, one that views the Earth and the universe with reverence and explores our essential relationships and responsibilities therein. It would be, essentially, the philosophy Indigenous people have lived by for generations, writ large.

"We must not presume," wrote Skolimowski, "that the present day, scientific explanation of the structure of the universe is the only legitimate explanation, and that scientific cosmology is the only legitimate cosmology" (1992:9). Spurred by the development of quantum physics with its view of the universe as one indivisible whole, some Western scientists have begun to change their orientation from conviction of an absolute to one of relative truth among many truths and possible orientations and cosmologies. In truth, any story of the cosmos has to be metaphysical because every method of research stems from a cultural orientation, a paradigm of thinking that has a history in a particular tradition. There can be no such thing as a fully objective story of the universe. The cosmology of the Hopi is as valid and internally consistent as that of Western science.

Skolimowski (1992:16-27) contends that the emerging eco-cosmology and the philosophies that it gives rise to must rest on seven *internalized* orientations:

- The new cosmology must reflect realization that the fate of the Earth is now intimately intertwined with the fate of the human species. We are the universe and the universe is us.

- Evolution is a continuum of creative becoming, and humans are the result of this process as well as its facilitators.
- With our creative evolution of mind, we are reflections and participants of a greater universal whole. We are the Earth being conscious of itself.
- Humans are but one manifestation of an implicate universal order. All parts of this order interpenetrate one another. They are holistically codependent—"we are all related."
- Hope for human meaning and destiny underpins the motivation for human attempts to realize themselves and to affirm a future with compassion, courage, solidarity, and action.
- We continue to engender and cultivate reverence for life as a way of action and to acknowledge the beauty of life and the miracle of which it is an expression.
- In understanding the evolution and application of ecological ethics, we revere all living things, taking responsibility for our relationship to the Earth, for doing more with less, and for pursuing wisdom and self-actualization rather than all-consuming materialism.

Application of the above orientations will lead to an eco-philosophy that includes life orientation in contrast to language orientation; commitment to nature and values as opposed to detachment and objectivity; focus on spiritual vitality in contrast to academic spiritualism; an attempt to gain comprehensive understanding rather than piecemeal analysis; a pursuit of wisdom rather than the accumulation of data; a reorientation of economics toward a holistic quality of life rather than an increase in the GNP; a political orientation that truly focuses upon the greater good rather than on financially endowed special interests; and cultivation of social and individual responsibility rather than individualistic autonomy. Such an eco-philosophy honors cultural cosmologies as well as develops a deep inner consciousness of health as the foundation for outer transformation of self, community, and society. "Eco-philosophy signals the beginning of a new epistemology: pluralistic, life-rooted,

cosmos oriented in contradistinction to the present one which is matter-rooted and mechanism oriented" (Skolimowski 1992:55).

These orientations form a distinctly different conceptual framework, a kind of philosophical foundation needed to repair the damage of the former cosmology and to create an eco-consciousness that will engender new mythologies we can live by and a transformative worldview. A worldview is a set of assumptions and beliefs that form the basis of a people's comprehension of the world. The stories, symbols, analogies, and metaphors that express a worldview in coded form are called mythology. Worldviews are conveyed via mythology in informal, formal, unconscious, and conscious ways through family, community, art, media, economic, spiritual, governmental, and educational institutions.

It is especially with regard to educational institutions and the entire process of modern education that the creation of eco-philosophy faces its greatest challenge. Mainstream educational institutions are heavily invested in the maintenance and perpetuation of the old cosmology. Education is what molds and conditions people to "fit" into a society. Essentially, modern education conditions a person to be oriented to consumerism, competition, rationalism, detachment, individualism, and narcissism. Education supports the "consciousness" that has led to the ecological crisis and dilemma we face today. Solving the ecological crisis through contemporary educational structures would be next to impossible.

The emphasis of education must be turned toward conditioning for what Skolimowski calls the "ecological person," a contemporary version of the Indigenous man and woman. Ancient axioms of Indigenous education such as finding face, finding heart, becoming a complete man or woman in right relationship to one's self, family, community, and the natural world resound in the following perspective Skolimowski developed in 1992. He postulates an interactive relationship between cosmology, philosophy, values, and action. Education as an institution falls in the realm of "action," the action by which we transfer the cosmology, philosophy, and values to each other and subsequent generations, and which therefore plays a profound role in how

eco-philosophy might take hold. Education is a major part of the problem as well as major part of the solution.

Eco-philosophy is another chapter in our continuous dialogue with the ever-changing universe. In changing ourselves and our relationships, we are changing and co-creating the universe. Out of the lethargic trance of technological inertia, we are emerging with a heightened awareness of our destiny, which is to build a responsible world by assuming our own responsibility, to infuse the world with meaning and compassion (p. 61). The ecological person can be defined as a bundle of sensitivities, which are in the process of continuous refinement toward the enhancement and enlargement of life (p. 120). The ecological person realizes that she or he is the creature of evolution (and as such is a celebration of life), and that he is supported by the whole heritage of life: life unfolding, developing, and emerging into new forms. Human superiority is only an expression of the superiority of life, which is itself capable of self-consciousness and of writing poetry through us' (p. 122).

The ecological person is not a miraculous being, but one who perceives that lasting solutions cannot be instant solutions. The first step in the work is one of inner reconstruction, so that we achieve some balance, some harmony within, some clarity of vision, the sense of our place in the larger universe, that we acquire, in short, wisdom (p. 137). The ecological person is a web of dreams of a rather superior kind, which we can make a reality—if we act on it (p. 138).

Eco-philosophy seeks to reintegrate values with a worldview, in a direct and ecologically informed way that mirrors the level of integration once achieved by Indigenous peoples. Just as new forms of life are evolutionary—created out of older forms—so new forms of knowledge and systems of learning must be created out of the most promising spiritual and cultural heritages of the past. Much of our collective heritage is worth saving; there is much that is superior, creative, wise, and already ecologically sophisticated. An eco-education would draw from the knowledge, understanding, and creative thinking of past and present in order to prepare for a sustainable future. These sources are multidimensional, multicultural, and multisituational.

Tenets of Native Philosophy

Native philosophy has always been broad-based. It is not based on rational thought alone but incorporates to the fullest degree all aspects of interactions of "human in and of nature," that is, the knowledge and truth gained from interaction of body, mind, soul, and spirit with all aspects of nature. In process, reflection, and practice, Native science embodies the natural system characteristics of diversity, optimization, cooperation, self-regulation, change, creativity, connectiveness, and niche. As Robert Yazzie, chief justice of the Navajo Nation (1996), explains:

Navajo philosophy is not a philosophy in the Western sense of the word; it is the lived practices of cultural forms that embody the Navajo understanding of their connectivity in the worlds of spirits of nature, humans, animals, plants, minerals, and other natural phenomena. However, explained in terms of Western thought it may be viewed as the practice of an epistemology in which the mind embodies itself in a particular relationship with all other aspects of the world. For me as a Navajo, these other aspects are my relations. I have a duty toward them as they have a duty as a relative toward me.

Unfortunately, many people today have grown up with the Western culturally conditioned notion that only one science and one philosophy exist. But philosophies are culturally relative, founded on the worldview of the culture from which they come and which they were created to serve. A list of the guiding thoughts of Native science might include the following:

- Native science integrates a spiritual orientation.
- Dynamic multidimensional harmony is a perpetual state of the universe.
- All human knowledge is related to the creation of the world and the emergence of humans; therefore, human knowledge is based on human cosmology.

- Humanity has an important role in the perpetuation of the natural processes of the world.
- Every "thing" is animate and has spirit.
- There is significance to each natural place because each place reflects the whole order of nature.
- The history of relationship must be respected with regard to places, plants, animals, and natural phenomena.
- Technology should be appropriate and reflect balanced relationships to the natural world.
- There are basic relationships, patterns, and cycles in the world that need to be understood; this is the proper role of mathematics.
- There are stages of initiation to knowledge.
- Elders are relied upon as the keepers of essential knowledge.
- Acting in the world must be sanctioned through ritual and ceremony.
- Properly fashioned artifacts contain the energy of the thoughts, materials, and contexts in which they are fashioned and therefore become symbols of those thoughts, entities, or processes.
- Dreams are consider gateways to creative possibilities if used wisely and practically.

Native science operates according to cognitive and linguistic "maps" that chart both collective and individual wisdom. How something is related and the nature of causality in a given natural context are foci of deep reflection. The ways in which aspects of nature are transformed through time and space and the nature of proper orientation to "sacred space" demand the observation of subtle details that are the foundation of knowledge. Ritual and ceremony can be personal or communal "technologies" for accessing knowledge, and symbols are used to remember key understandings of the natural world. Native science is a process for understanding in all aspects of Native tradition.

The "coming to know" of Native science revolves around the natural creative process of human learning. Intervention in a natural process is taken on only with great care and much consideration. Continual

emphasis is placed on "being of nature" or working with its natural flow; listening and looking closely are consistently practiced. Teachers act always as facilitators.

Knowledge is presented in "high contexts," in which many levels of information are shared at many levels of communication. True knowing is based on experiencing nature directly. "Doing" and playing are integral parts of Native learning; apprenticeship is a form of directed learning. Meditation or silence and reflection also play a role in internalizing the lessons of nature.

Elders provide guidance and facilitate learning, often through story along with artifacts and manifestations of traditions, but it is the individual's responsibility to learn. An individual's dreams and visions properly prepared for and properly received may bring true knowing. Even the "trickster" (chaos) may facilitate creative understanding, and this role in whatever form it is played is highly respected.

Process of Native Science

The perspective of Native science goes beyond objective measurement, honoring the primacy of direct experience, interconnectedness, relationship, holism, quality, and value. Its definition is based on its own merits, conceptual framework, and practice and orientation in the tribal contexts in which it is expressed. Concerned with the processes and energies within the universe, it continually deals in systems of relationships and their application to the life of the community. Science cannot divide its application into departments; it is integrated into the whole of life and being and provides a basic schema and basis for action.

For instance, the traditional Yupiaq people based their philosophy and lifeways on maintaining and sustaining relationships among human, natural, and spiritual worlds. The balance of nature, or ecological perspective, was of utmost importance to the Yupiaq. To understand the Yupiaq worldview it is necessary to understand the multiple meaning of a word that epitomizes Yupiaq philosophy. This word is "ella," which is a base word that can be modified to change its meaning by adding a suffix or suffixes. Examples include "Qail' ella auqa?" (How

is the weather?); "Qail' ellan auqa?" (How are you feeling?); "Ellapak nunii" (The world's land); "Ellagpim yua" (Spirit of the Universe); "Ellapak" (Universe); and "Ella amiglituq" (The sky is cloudy). Variations of this one root word can be made to refer to weather, awareness, world, creative force or god, universe, and the sky. The key word here is awareness or consciousness. Consciousness is the highest attainment of the human being; the human being must be able to make sense out of values and traditions as juxtaposed with the "objects" of the universe. As a manifestation of their "ella," the Yupiaq developed a body of values and traditions that would enable them to maintain and sustain their ecological worldview (Kawagley 1994:15).

Native science stems from a deeply held philosophy of proper relationship with the natural world that is transferred through direct experience with a landscape, and through social and ceremonial situations that help members of a tribe learn the key relationships through participation and their "ella," as the Yupiaq would say. Methodological elements and tools of Native science that have traditionally facilitated such learning included:

Observation. Careful observations of plants, animals, weather, celestial events, healing processes, the structures of natural entities, and the ecologies of nature.

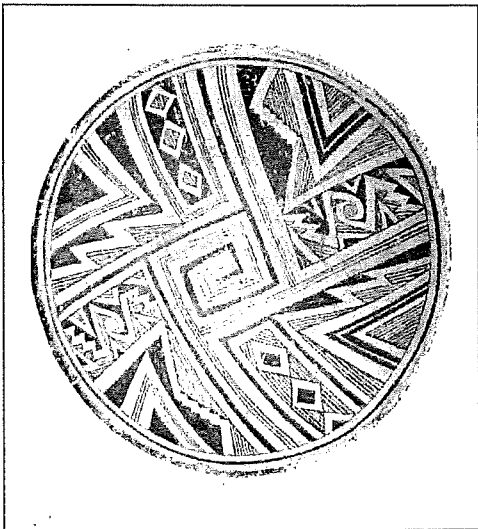
Experiment. In Native science, there is no deliberate attempt to distort a natural event beyond observation. Native peoples have traditionally applied practical experimentation at all times to find efficient ways to live in their various environments, and ingenious and ecologically appropriate technologies were developed.

Meaning and understanding. These were the priorities of Native science, rather than a need to predict and control. Meaningful relationship and an understanding of one's responsibilities to those entities in nature that people depended on were the reasons for a Native science, which invited a desired result through entering into specific relationships with the energies of the natural world.

Objectivity. Native science reflects the understanding that objectivity is founded on subjectivity. There is a stress on direct subjective

experience, predicated on a personal and collective closeness to nature, which will lead to an understanding of the subtle qualities of nature.

Unity. Native science stresses order and harmony but also acknowledges and honors diversity and chaos as creators of reality. "Relationships and renewable alliances take the place of fixed laws, and Indigenous science accepts the possibility that chance and the unexpected can enter and disturb any scheme. Thus, the circle is left open and chance as represented by the clown, the trickster, and gambling games, occupies an important role" (Peat 1994:257).



This plate is representative of ancient Anasazi design motifs that symbolize the four directions and other elements of nature (chaos), along with the fundamental order of the universe in the center. Photograph © Marcia Keegan.

Models. Native science also has models. Teaching revolves around high context models in which information is communicated at many levels, and which are highly representational and elicit higher order thinking and understanding. An example of such a ritual process model is the Plains Sun Dance, which may include symbols such as the circle, numbers, geometric shapes, special objects, art forms, songs, dances, stories, proverbs, or metaphors, all of which unify experience with meaning and facilitate the mind's conscious process of connecting with

the energies and animating power of nature. Native symbols go beyond simple archetypes when they represent the universe itself, as with a ceremonial structure such as the Navajo hogan.

Causality. Native science reflects a belief in causes that affect and go beyond the physical, principles such as synchronicity and the action of natural energies and entities. Other such principles include the transformation of energy to other forms and resonance with the order of the universe, as reflected in the adage, "as above so below."

Instrumentation. Native science relies on preparation of the mind, body, and spirit of each person as the primary vehicle of "coming to know." The mind and body can be used for careful, disciplined, and repeatable experimentation and observation. Knowledge is gathered through the body, mind, and heart in altered states of being, in songs and dance, in meditation and reflection, and in dreams and visions.

Appropriate technology. Because social value is gained by honoring mutual reciprocal relationships, spin-offs of Native science in technology are carefully applied. Adoption of technology is conservative and based on intrinsic need, and care is taken to ensure that technologies adopted and applied do not disrupt a particular ecology. Such care is grounded in the belief that it is possible to live well through adhering to a cosmology and philosophy honoring balance, harmony, and ecologically sustainable relationships.

Spirit. Native science incorporates spiritual process: no division exists between science and spirituality. Every act, element, plant, animal, and natural process is considered to have a moving spirit with which humans continually communicate.

Interpretation. Native science bases its interpretation of natural phenomena on context. Therefore, meaning is based the context of the events and reflection of Native philosophy.

Explanation. Native science works with a multiplicity of metaphoric stories, symbols, and images to explain events in nature.

Authority. Native science gains its authority partly through the society, elders, direct experience, and dream or vision, and on the sanctity of the relationship established over time with particular environments.

“Authority, if we are to use that word at all in the context of Native science, resides in individuals and their direct experience rather than some social establishment” (Peat 1994:265).

Place. Particular places are endowed with special energy that may be used but must be protected. This sentiment extends from the notion of sacred space and the understanding that the Earth itself is sacred. The role of people is to respect and maintain the inherent order and harmony of the land.

Initiation. There are both formal and informal pathways to certain levels of Native science. For instance, in the Midewiwin Society of the Ojibwe, there are four stages of initiation, each involving extensive training, learning of songs, ceremonies, stories, interpretation of special scrolls, and petroglyphs (Peat 1994:267-68).

Cosmology. All philosophies are founded on an elemental idea of how the universe was created along with humankind’s emergence into the world, and Native science is connected to the origins and migrations of people through the American landscape and to notions of time-space, sacred cycles, astronomy, art, myth, ritual, and dance. Cosmology is reflected in the cycles of community celebrations, rites of renewal, and stories, and serves the important function of validating Native peoples’ way of life, core values, and social ecology.

Representations. Signs and formulas of thought appear in many forms, records in stone, clay, birch bark, hides, structures, and hundreds of other forms. These representations record key thoughts, understandings, and stories important to remembering aspects of Native science.

Humans. People play a key role in facilitating knowledge about the natural world in conscious thinking and tool making. Given this role, humans have special responsibilities to the natural world and to other living things. Native science is the study of learning and carrying out these responsibilities. Native science is about stewardship and the practice of deep ecology.

Ceremony. Ceremony is both a context for transferring knowledge and a way to remember the responsibility we have to our relationships with life. Native ceremony is associated with maintaining and restoring

balance, renewal, cultivating relationship, and creative participation with nature.

Elders. Elders are respected as carriers of Native knowledge, wisdom, and experience. Therefore, they are utilized as the first line of teachers, facilitators, and guides in the learning of Native science.

Life energy. Life energy is acknowledged throughout the expressions of knowledge, understanding, and application. All things have life force. There is a natural energy that moves all things that must be understood and respected.

Dreams and visions. Dreams and visions are a natural means for accessing knowledge and establishing relationship to the world. They are encouraged and facilitated.

Paths. Predetermined systematic activities of learning are viewed as ways to search for and find knowledge. All of nature has these inherent patterns of trajectories, “right paths,” which reflect the unfolding of natural pathways through which it may be understood. The “Good Red Road,” “Dream-Time Path,” “Earth Walk,” and “Pipe Way” are some of the ways Native peoples have referred to the directed path in the quest for knowledge, meaning, and understanding.

Native Science Practice

Native science practice attempts to connect the “in-scape”—our human intelligence, a microcosm of the intelligence of the Earth and the universe—with the heart and mind. Art and language, through story, song, and symbolic dance are used simultaneously to explore relationships to the in-scape and the land.

Exploring the in-scape may be considered a “first step” in Native science practice. This is another way of saying that the practice of Native science begins with setting forth specific intentions to seek knowledge from participation with the natural world and then exploring intuition and creative imagination. These are foundations of the metaphoric mind—the mind without or before words—a natural tendency all people intuitively exhibit when confronted with new learning and knowledge. Native science builds on and encourages this creative and instinctual way

of learning. In traditional Native societies, exploring the in-scape is something that children are encouraged to do and continue to do throughout their lives.

The ability to transform and metamorphose, to think metaphorically, comes with practice, and the development of meaning and understanding comes with increasing knowledge. Language is more than a code; it is a way of participating with each other and the natural world. At one level language is a symbolic code for representing the world that we perceive with our senses. At the deeper psychological level, language is sensuous, evocative, filled with emotion, meaning, and spirit. Meanings are not solely connected to intellectual definition but to the life of the body and spirit of the speaker. In its holistic and natural sense, language is animate and animating, it expresses our living spirit through sound and the emotion with which we speak. In the Native perspective, language exemplifies our communion with nature rather than our separation from it.

The world of nature is in constant flux; therefore, Native science does not attempt to categorize firmly within the domains of ideas, concepts, or laws formed only through an analysis bent on a specific discovery, as is the case with Western scientific analysis. Rather, Native science attempts to understand the nature or essence of things. This does not mean that Native science excludes rational thought, but rather that it includes heart and being with rational perception to move beyond the surface understanding of a thing to a relationship that includes all aspects of one's self.

In Native science, sanction of knowledge through appropriate ritual and tribal society acknowledgment is important, because knowledge of the natural world and how best to relate to it is not just a matter of individual understanding but is gained and shared for the benefit and perpetuation of the community. An example is the undertaking of a pledge to Sun Dance in Plains Indian traditions. Commitment to gain and share knowledge is an important aspect of Native science since deep knowledge of nature brings with it responsibilities in its application and sharing. It is a "given" in Native traditions that deep knowledge is not easily gained and requires time and dedication to attain. Sanction and commitment are also connected to ethics, or the care and attitude in which important knowledge

is gained and shared. In this way, sanction and commitment act as foundational safeguards for both individual and tribe and form a kind of check and balance for important knowledge.

The maintenance of dynamic balance and harmony with all relationships to nature is the foundational paradigm of Native science. Reality is based on mutual reciprocity, the rule of "paying back" what has been received from nature. The world operates on a constant flow of give-and-take relationships. In traditional Native hunting, when a hunter takes a deer, an offering is made and thanks given to the spirit family of the deer and, in some traditions, to the "mother of game" who is another mythic manifestation of the Earth Mother. Hunting rituals are performed before, during and after traditional Native hunting to acknowledge the transformation of the deer's life, spirit, and flesh into that of the human. The Native hunter and community know well that this gift from Nature and the game spirits will have to be "paid back" at some time in the future by humans in the universal cycle of death, birth, and rebirth.

This transformation of energy is also exemplified in the continual transformation of energy to matter and back again. Electrons continually borrow energy from the universe to transform themselves into different kinds of atoms. However, what has been borrowed from the universe must eventually be paid back, and this happens when an electron "dies" back to the field of energy from which it came to provide energy for the creation of new electrons and atoms.

Native science applies the principle that we humans bring our reality into being; hence, the focus of Native traditions on prayer to bring about and perpetuate life. It must be emphasized that what we think and believe and how we act in the world impacts on literally everything. We bring our reality into being by our thoughts, actions and intentions. Native science is about creating the inner sensibilities of humans, or the inner ear, which hears the subtle voice of nature. The structures and symbols of Native science serve as bridges between realities. In archaic Plains Indian traditions, the medicine wheel was a structure that brought inner and outer realities of nature together. Many Native symbols are representations of the non-human realities of nature, such as the "abiding stone" or dream time.

In Australia the Aboriginal peoples speak of The Dreaming, a reality in which the Ancestors walked on the land and special resting points created certain features. Some Ancestors turned into rocks. But this does not mean that the Ancestors stopped Being and metamorphosed into animate rock. Rather, the Ancestor still exists, for Dream Time is different from our linear arrow of time, in which the past is gone forever. Dream Time coexists and interpenetrates the here and now—the Ancestor and the rock enfold one another (Peat 1994:287).

Native practices and ceremonies that specifically help people to remember and act on their responsibilities to the natural world and help perpetuate the harmony of the universe include world renewal ceremonies such as the Yurok White Deer Skin Dance, ceremonial complexes such as the various forms of Plains Indian Sun Dance, and seasonal ceremonies such as the various Green Corn Dances among Southeast Indian tribes. Native science applies the principle of being true to all of one's relationships, which means keeping true to all our primal responsibilities, compacts, and alliances with the natural world. All of these reflections of relationships require our constant attention and participation.

GUIDING STORIES

Native science is a story, an explanation of the ways of nature and sources of life, embedded in the guiding stories of a people and the language and way of life that convey their stories. Indigenous people are people of place, and the nature of place is embedded in their language. The physical, cognitive, and emotional orientation of a people is a kind of map they carry in their heads and transfer from generation to generation. This map is multidimensional and reflects the spiritual as well as the mythic geography of a people.

Knowing the origins of their people, their place, and the all-important things the place contains is considered essential orientation for a tribal person. A people's origin story maps and integrates the key rela-

tionships with all aspects of the landscape. Hence, the origin stories of a people are presented via symbolic language, story, art, song, and ritual.

Essential elements of stories are passed on through societies, art forms, ceremonial complexes, forms of technology, and the everyday activities of life and work. The adoption or adaptation of knowledge usually has a lineage in the origin story of a people. For example, in many Indigenous stories of emergence and migration, the places a people stopped and where important events happened are mentioned. These are actual places marked and named in the map that Native people carry in their stories and in their minds. In brief, Native stories relate the evolution of the people through time, space, and place.

When the Western scientific story meets that of Native origins, a clash of paradigms occurs, because cultural stories of origin are creative interpretations of the experience of a people in participation with places. Literal fact is woven with metaphorical meaning. The ethnocentric notion that only the Western scientific story is accurate prevents any dialogue regarding the participatory meaning of Native origin stories and their orientation to a people's homeland.

GUIDING THOUGHTS

The guiding thoughts of Native science are simple yet profound, and subtle yet encompassing. Everything is considered to be "alive" or animate and imbued with "spirit" or energy. A stone has its own form of animation and unique energy. Everything is related, that is, connected in dynamic, interactive, and mutually reciprocal relationships. All things, events, and forms of energy unfold and infold themselves in a contextual field of the micro and macro universe.

In the practice of Native science, the more humans know about themselves—that is, their connections with everything around them—the greater the celebration of life, the greater the comfort of knowing, and the greater the joy of being. This relationship to space and time, and between living and nonliving things, is not just physical, but psychological and spiritual, in that it involves dreams, visions, knowing, and understanding beyond the simple objectified knowledge of something. In other

words, it is inclusive of all the ways that humans are capable of knowing and understanding the world.

Native people were interested in finding the proper, ethical, and moral paths upon which human beings should walk. As co-creators with nature, everything we do and experience has importance to the rest of the world. We can not mis-experience anything, we can only mis-interpret what we experience. The information gained through experience is considered in interpreting relationship with the natural world, thereby pointing to the kind of "story" that might contain and convey that information. Concerned about the ethical aspects of knowledge, environmental observation, and understanding received from visions, ceremonies, and spirits, Native scientific philosophy reflects an inclusive and moral universe. No body of knowledge exists for its own sake outside the moral framework of understanding.

The tribal universe is a circle of learning, life, and relationship that is inclusive of all-important information needed to make life decisions. The Plains Indian medicine wheel is an example of the circle of learning by orienting to perceived qualities of the sacred directions these people recognized.

The Lakota wheel is probably best known as the medicine wheel. The four directions, each one symbolizing the relationship of certain qualities to the whole, make up the wheel. . . . [E]ach direction is represented by a word that stands for the quality of that direction. In this wheel, each direction is also represented by an animal. East is illumination, and it is signified by the eagle. South, or innocence, is represented by the mouse. West is introspection and has the bear as its symbol, and north, which is wisdom, is depicted by the buffalo. . . . The Lakota used this wheel to teach people how to bring balance into their lives. They believed that people were born with a certain energy. . . . [A] person's task, then, would be to . . . balance with the qualities of the other three directions (Nelson 1994:18).

The following could be described as foundational premises or realities of the Native worldview, and consequently, of Native science as well. *Natural democracy must prevail.* The Earth is alive and nurtures all things of her body and all have intelligence and a right to exist. This is the essence of the Native concept of "natural democracy." Democracy, or the concept that all are equal and have a say in how their lives will be lived or affected, is a principle of social ecology.

Everything is related. This premise is based on acute observation of the entire web of life in order to gain insight into the relationships among all living things. Such observation was used in making a living that was inobtrusive and life enhancing.

All relationships have a natural history. People have a history in a place and a history of relationship to each other. People have a history with regard to plants, animals, nature, and all things in nature.

Native science orients itself to a "space and a place." Native peoples' places are sacred and bounded, and their science is used to understand, explain, and honor the life they are tied to in the greater circle of physical life. Sacred sites are mapped in the space of tribal memory to acknowledge forces that keep things in order and moving. The people learn to respect the life in the places they live, and thereby to preserve and perpetuate the ecology.

Everything has a time and an evolutionary path. This is the understanding of natural evolution through cycles. "In some undetermined manner, the universe had a direction to it: every entity had a part to play in the creation of the future, and human beings had a special vocation in that they initiated, at the proper time, new relationships and new events" (Peat 1994:43).

NATIVE SCIENCE PARADIGM

What is the Native science paradigm? Western scientists believe that science is a Western invention, but as discussed previously, Western science has its own specific history and is a particular kind of expression of Western culture. Given this cultural disposition, card-carrying Western scientists believe that non-Western societies relate to nature only

in ways categorized anthropologically as folk tales or cultural technology, and that these ways are not science in their experience of the term.

The word "science" has only recently been used to depict systems of knowledge that refer to the multidimensional world of nature and people's ways or traditions of relationship with the world. Use of "science" by Native peoples contains this type of understanding. This use to describe the experience and traditions of Native peoples remains controversial given the biases and scientism of some Western scientists.

In the introduction to the winter 1996 issue of *ReVision*, Jürgen Kremer writes, "Indigenous consciousness defines itself in the experience of personality, the ego as agent, separate and simultaneously connected and previous to other egos, to the land, the seasonal cycles, to spirit, the world of transcendence, dreams and ancestry." Therein lies the difference between Western and Indigenous paradigms. The issue is a matter of perspective. Indigenous consciousness has always included, along with the practical relationships of the natural world, aspects such as the direct relationship of communities of people with the spirit of the place in which they have lived and the places they have come to know and understand.

Herbert Read, pioneer arts educator, wrote, "Science is the explanation, and art is the expression of the same reality" (1945:7). That definition has important ramifications for Native science. Within Indigenous consciousness, science is also an art form, which incorporates both an objective explanation of how things happen in the natural world and a way of "looking." The idea that science and art are two sides of the same coin is what Indigenous people have always tried to convey, and this is also in the margin of Western philosophical thinking, as philosophers, artists, humanists, and religious leaders insist that science is a part of the greater whole of human expression.

In Western society, conflict about the definition of science has been underway since the time of Galileo when science was separated from religion. Religion became the antithesis of science—although some would describe science as a kind of religion. These controversies continue to characterize Western philosophical traditions.

Theoretical physicists F. David Peat and David Bohm have proposed an alternative view of science, a view that is based on the realities quantum physics implies and that is inclusive of the central views of Native science. Like other creative scientists, they have tried to make connections between their current work and past, present, and future ideas in order to build theories. Both participated in a consortium to which Indigenous people from all over the world were invited that met in Canada and Great Britain to discuss the philosophical impact of quantum theory. Peat in particular took an interest in a comparison between Native American ways of knowing and Western science, and used his understanding to develop a philosophy based on quantum relationships. The insights generated by these thinkers demonstrate parallels between new views of science and ways Indigenous people have always sought to understand their world.

Native science reflects a celebration of renewal. The ultimate aim is not explaining an objectified universe, but rather learning about and understanding responsibilities and relationships and celebrating those that humans establish with the world. Native science is also about mutual reciprocity, which simply means a give-and-take relationship with the natural world, and which presupposes a responsibility to care for, sustain, and respect the rights of other living things, plants, animals, and the place in which one lives.

This is reflective of one of the oldest ecological principles practiced by Indigenous people all over the world, past and present. If you depend upon a place for your life and livelihood, you have to take care of that place or suffer the consequences, a lesson learned and relearned by many generations over time. As a result of those hard-earned lessons, ecological principles have been incorporated as metaphysical as well as practical rules for human conduct. In addition to responsibility, there is also celebration of life, a key element in seeking to understand how to live a good life.

Native science mirrors and celebrates the cycles of time, space, and being, in individual action, community action, ritual and ceremonial activities, and direct relationships with the land. The ubiquitous use of the circle and directional orientations both underpins Native science and is its result.

Ultimately, science is storytelling for understanding of the natural world. Indigenous science is also a process of understanding, a way of coming to know rightful relationships to the natural world that yields life. For example, peyote is regarded as a sacramental plant used in pilgrimages or for seeking understanding. The Huichol use peyote "to find our lives," and theirs is a journey back through time, landscape, and relationships. The pilgrims take on the role of their ancestors so they become players in their own mythological history. They recount the journey of their first shaman Watakamé and the first people to go to the land of many colors of flowers called Wirikuta, a place of ultimate harmony and balance. The metaphor of the land where the Huichol originated is recounted in rituals and the oldest tales of human existence when humans, plants, animals, and natural phenomena could communicate.

Peyote for the Huichol and other Native peoples becomes the facilitator for the reenactment and reestablishment of conventions in this primal relationship. People can achieve this experience if the peyote is properly taken under the guidance of a shaman. Through these practices, Indigenous people reestablish primal connections and orientations that must be learned generation after generation. The purpose of ritual, myth, and story is to tell of important aspects of the continuity and flow of life, that is, a particular people's life and history.

"Coming-to-know" is the best translation for education in Native traditions. There is no word for education, or science, or art in most Indigenous languages. But, a coming-to-know, a coming-to-understand, metaphorically entails a journey, a process, a quest for knowledge and understanding. There is then a visionary tradition involved with these understandings that encompasses harmony, compassion, hunting, planting, technology, spirit, song, dance, color, number, cycle, balance, death, and renewal.

This is where a great deal of misunderstanding between Western objectified science and Indigenous traditions of knowledge has occurred. Knowledge among Indigenous people is acquired in a completely different way, but the coming-to-know process is nevertheless extremely systematic. For example, certain processes must occur in

a particular order, which in its way is similar to the precise ways that an experiment is executed within the Western scientific method. Coming-to-know is the goal of Indigenous science, a different goal from that of Western science.

Like Western science, Indigenous science is sequential and builds on previous knowledge. But in Native traditions, guides or teachers—individuals who have gone that way before—are necessary. Building on prior learning and traditions is never a direct or linear path. Instead, Indigenous science pursues a rather meandering path around things and over obstacles, a roundabout way. In the Western mind-set, getting from point A to B is a linear process, and in the Indigenous mind-set, arrival at B occurs through fields of relationships and establishment of a sense of meaning, a sense of territory, a sense of breadth of the context. The psychologies of thinking and approach differ.

A parallel in Western thought is the artist, as artists also do this kind of meandering. The value of the effort, the coming to know, is found in the journey, in addition to or rather than, the end result. Consequently, this is why Western artistic traditions find greater affinity with Indigenous thinking than does the scientific mind-set. There is a kind of natural connection between these processes, an intersection.

Traditionally, Indigenous peoples understood that compacts must be made between sources of life, the land, their place, and with the natural entities there. The key relationships they established are reflected in ceremonies. Fishing peoples in the Northwest established compacts with the animals they fished, and because they were also forest people, they made compacts with the trees and the entities of the natural processes of the forest. Compacts differ among desert peoples, plains peoples, coastal peoples, people living near volcanoes, and so on.

Ceremonies and rituals choreograph situations to bring people in contact with those compacts, the entities involved in relationships. The ceremonies themselves become ways of coming to know, of understanding. As compacts are never static and a cyclic process exists even in their making and evolution, there are traditions of communal and environmental renewal. Native science involves this making of

compacts and their continual renewal through the year, and through generations and broader time cycles. These guiding orientations of Native science hold promise for the forging of a new philosophy of nature that is so desperately needed to address the post-modern crisis of environmental perception.

Meanings and Possibilities

The story of Native relationships to the natural world is more than can be told in one story and more than a footnote to environmentalism. Rather, it is a story of complex human relationships in complex interaction with nature. In the final analysis, Native science as the outward expression of Native relationship to the natural world is a philosophical *ideal*. It is an ideal conveyed through Native cosmologies, community, relationships to plants, animals, landscape, and the cosmos. It is an ideal that must be sought. It is an ideal that must be remembered and re-remembered through art, ceremony, story, ways of community, and personal experience. We human beings are forgetful creatures, and we need cosmology, philosophy, and lived experience at a personal and communal level to remember our life-sustaining relationships. For traditional Native cultures the practice of Native science, along with its cosmological and philosophical orientations, provided the context for such remembering.

In their striving toward this ideal Native people have not been perfect in their personification or realization of it. As would be true of any other people, Native people are human and express all the diversity of human nature, including the saintly and the not so saintly, the pious and the not so pious, the wise and the not so wise. Despite such imperfection, Native people strive for a cultural ideal predicated upon dynamic relationship with nature based on participation. Striving for such an ideal is little different from, say, a medical doctor striving to be true to the Hippocratic oath, or a lawyer striving to be true to a standard of justice, or a teacher who strives to fulfill the highest standards of his or her profession. The point is that Native science is predicated on a cultural ideal centered on nature and which posits establishing an ongoing and dynamic relationship based on traditions of holistic participation.

It is the philosophical ideal that a society attempts to emulate that forms the focal point for its creative evolution and development. This philosophy stems from the worldview of culture that guides its prevailing thoughts and behaviors toward the environment. Native science and the worldviews and philosophies from which it is derived provide models, lessons, meanings, and possibilities for what it means to participate with rather than attempting to dominate nature. Yet, when detractors say that Native people have no science, that they do not "walk their talk," that they are environmentalist by convenience, that they are not acting Native enough or the opposite, that they are environmental "saints," and so on, they echo a stereotype that has been evolving for the past five hundred years and are denying the complex, dynamic, and diverse history and contemporary reality of Native cultures. They continue to reflect and perpetuate a stereotype that serves no one.

Native cultures traditionally engaged nature in order to survive. Their collective historical and cultural experience with the natural world is profound and sophisticated. But, it is also evolving as we now collectively face a global crisis of relationship with the natural world and with each other. The philosophical ideal of ethical *participation* with nature may be the only ideal what will afford all of us a sustainable future as we enter the first years of the twenty-first century.