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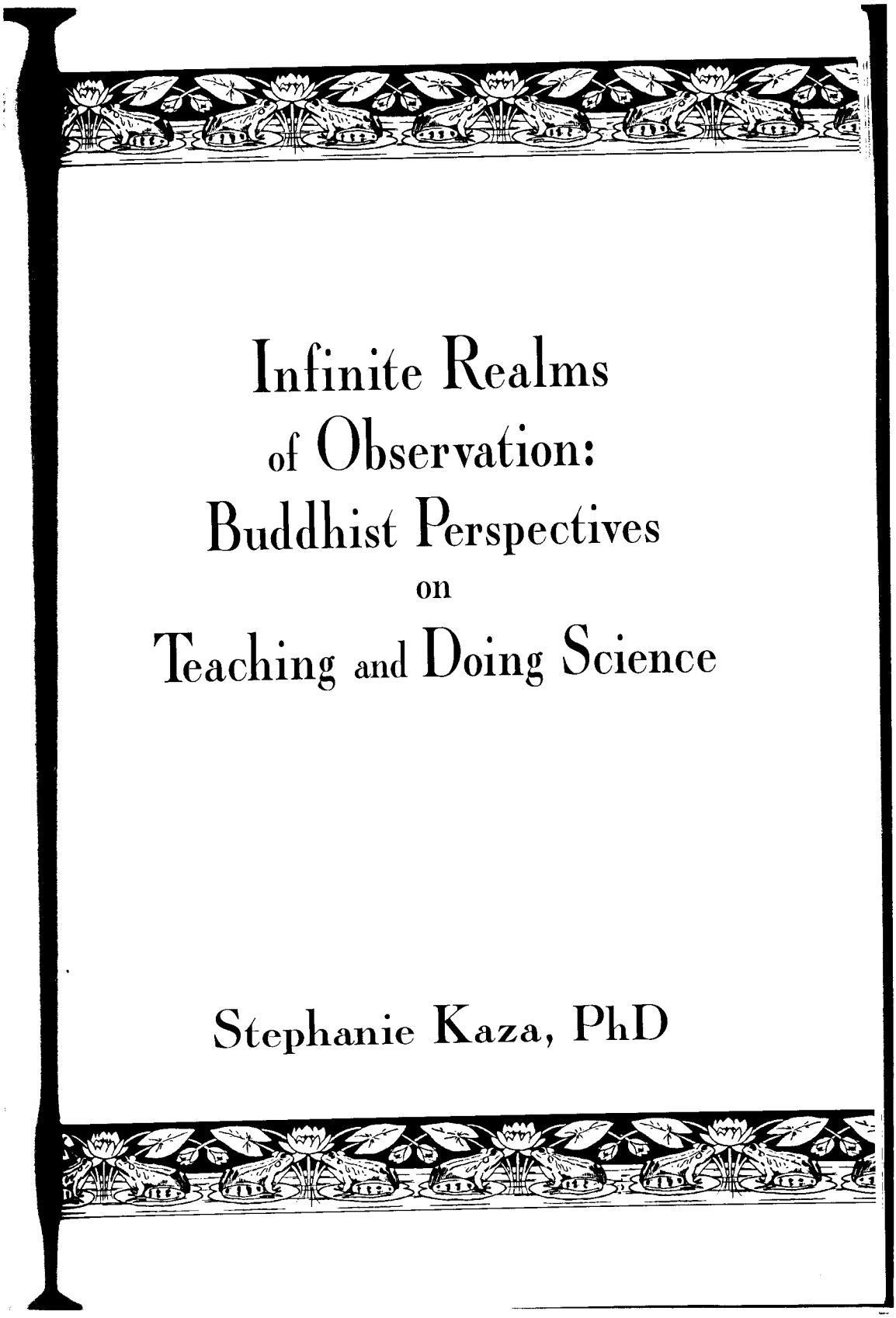

Infinite Realms of Observation: Buddhist Perspectives on Teaching and Doing Science

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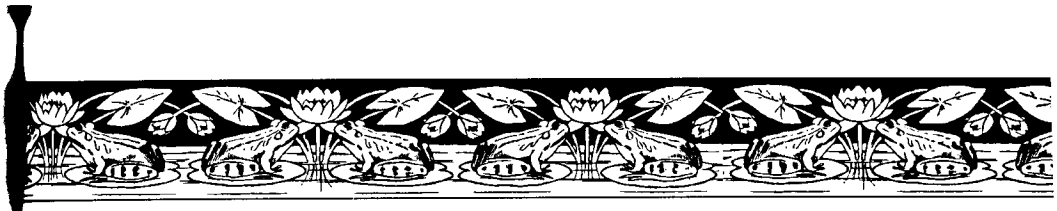

When I began my studies at Oberlin College, I felt sure I would concentrate on the sciences. I had taken high school physics, chemistry, math, biology, and was fascinated by dissection; I thought I would become a surgeon. Yet after a year and a half exposure to a liberal arts curriculum, I went into traumatic paralysis trying to choose a major. I considered chemistry and math but also was intrigued by religion and psychology. Every week I flipflopped, suffering under the pressure to choose a single perspective. The crisis lasted an entire semester, establishing a dilemma which would haunt me through graduate school and on into professional life. Eventually I majored in biology, out of sheer love for the beauty and complexity of life forms.

In my first ecology course I was introduced to a relational view, epitomized by ecosystem studies. Seeing organisms in context seemed much more complete and satisfying than observing them as autonomous entities. By the 1970s, ecological problems were surfacing at a despair-inducing rate, and I found myself mesmerized, like many others, by the plight of marine mammals. I took on the messy tuna-dolphin controversy as my doctoral research and quickly realized neither biology nor ecology were enough to explain the situation. To analyze the dynamics of the controversy I also needed fisheries anthropology, marine mammal law, environmental ethics, and marine economics. Despite the urgings of my graduate committee to choose a single discipline focus, I turned to a systems approach of resource use analysis which synthesized many perspectives, each shedding light on the others.

But I was a little ahead of my time for most academic programs. So I shared my insights with others through science education, serving as education director for Point Reyes Bird Observatory and then the U.C. Berkeley Botanical Garden. In the meantime I had taken up the study and practice of Zen Buddhism. I learned to meditate, I studied Zen texts, and I lived for three years at Green Gulch Zen Center in northern California. I came to see how all thinking is conditioned by previous experience and values. Now even a systems approach to organisms and

habitats was not enough. I needed to understand how powerfully human attitudes towards nature affect the shape of the landscape.

I took my curiosity to Starr King divinity school in Berkeley where I studied ethics and theology. My Buddhist perspective was accepted as compatible with the Unitarian-Univeralist curriculum, particularly since I was interested in spiritually-based social change. Here I gained considerable vocabulary in understanding human values and social systems. I sensed I was getting close to some of what underlies scientific process and decision-making. But where could I combine my love for ethics, religion, and ecology? To my great fortune, I was invited to explore these issues through my teaching and writing as a member of the faculty of the School of Natural Resources at the University of Vermont. In dialogue with colleagues and students I continue to ask serious questions about the roles of science and religion in shaping social values.

In this article, I reflect on four principles of Buddhist practice and philosophy, illustrating their relationship to science education and environmental policy. I draw on my own personal experience in a number of diverse settings, showing one person's exploration of the overlap between the worlds of science and religion. My primary science orientation has come to emphasize the fields of natural history, conservation biology, and restoration ecology. My primary religious orientation is Soto Zen Buddhism, a tradition in the Mahayana school developed by 13th century Japanese teacher Eihei Dogen and carried to me through Shunryu Suzuki Roshi and Kobun Chino Otogawa.

THE MIND OF ATTENTION

At the heart of good science training is cultivating a disciplined mind with astute capacities for observing the world outside the self. At the heart of Zen training is cultivating an attentive mind with astute capacities for self-observation (Aitken, 1984). The two naturally complement and support each other. In the scientific tradition, paying attention is central to understanding natural phenomena through careful observation. In the Buddhist tradition, paying attention is seen as a prerequisite for developing awareness of one's thoughts and actions. This, in turn, is necessary to break through the limited views of the self and perceive the nondual nature of the world. In both traditions, those who practice with rigor for a period of time become more capable of clear perceiving and also more humble about what they cannot perceive.

Field biology is based fundamentally on careful observation of the landscape, with particular attention to pattern. The experienced ornithologist, familiar with the birds in a particular region, can describe the cycles of breeding, migration, and mortality as well as the general distribution of species by habitat type. This knowledge is not based in written reports or books but rather in personal experience of a specific place with its specific birds. At Point Reyes Bird Observatory, where I served as education director, the scientific staff has been monitoring landbirds, shorebirds, and seabirds of central coastal California for 25 years. They have censused Bolinas Lagoon every month and know to the week when the western sandpipers will arrive and depart. They have banded all the wrentits and song sparrows in the coastal scrub and have tracked them from season to season. Every Christmas PRBO ornithologists and volunteer birdwatchers conduct a systematic bird count with other Audubon groups. Over the years they know more or less what birds to expect where—scaups and surf scoters at Drake's Bay, merlins and peregrine falcons at Bolinas Lagoon, ruby-crowned kinglets on Inverness Ridge (Evens, 1988). The cumulative on-the-ground knowledge of the over 150 bird species of the Point Reyes-West Marin area forms a basis for understanding the intricate patterns of these birds' lives. When counts are unusually low or rare species appear, these variations are noted against the backdrop of a broad picture.

A good field biologist pays attention at many different levels. To understand shorebird feeding patterns, one must be able to recognize individual species. To understand gull dominance hierarchies, one must be able to recognize individual birds. To understand life expectancies and causes of mortality, one must be able to monitor many individual birds of a species over their entire lives as well as track the health of the habitats they depend on. Further the biologist must be part of a community of attention that is observing the birds from various vantage points to put together composite pictures of their lives.

I believe in some ways, my mind was prepared for the rigors of Zen training by my experience as a naturalist in the field. I was taught to make careful notes of my observations in the Joseph Grinnell tradition and to scrutinize plant parts for field identification using Munz's *California Flora*. I trained myself to identify birds by their songs and trees by their silhouettes. I walked at night to develop sensory acuteness with my feet and ears. I cultivated a sense of place and pattern, first in

the Santa Cruz hills and coast, and then in Marin County. The captivating joy of being with elegant columbines and silent owls quite easily and naturally taught me to pay attention. The reward was in the surprise of glimpsing the richness of the myriad lives all around me.

Zen training, however, is far more demanding than field biology. The realms of observation are infinite—from personal mental and physical habits to the nature of group dynamics, from family history to global consumption and production patterns. The point of mindfulness practice is to raise one's awareness of the *many* causative factors involved in any action and to develop the capacity to discriminate between them. Mindfulness is the heart of Buddhist meditation.

In the classic text, "Sutra on the Four Establishments of Mindfulness," the Buddha offers methods for cultivating mindfulness in four arenas: the body, the feelings, the mind, and the objects of mind (translation and commentary by Nhat Hanh, 1990). Each of these influences the way one perceives the natural world. To practice mindfulness of the body, one pays attention to the breath, the positions of the body, the actions of the body, the various body parts (one's stomach, liver, heart, etc.), and the eventual decomposition of the body as corpse. The last practice is a drill in impermanence, lest the observer assume a constancy in his or her perceptual faculties. Breath, posture, physical well-being all affect how alert one is to shape, pattern, and detail. Astute field observers, for example, develop a sixth sense for subtle cues in color or motion which can vary in accuracy depending on personal well-being or centeredness.

Mindfulness of feelings involves self-observation of pleasant, painful, and neutral feelings as they arrive and pass through the mind. These include feelings of discomfort or satisfaction with a physiological basis and feelings such as emotions and moods which may have a psychological basis. As in all mindfulness practice, the material for observation is endless. One practices identifying the feelings and sitting quietly and attentively as they arise, not shutting them out of the mind but learning to pay attention and not dwell on any particular mood as permanent. Almost all people, field biologists included, can recognize "gut level" feelings about different environments. One person may be terrified of the open spaces of the desert, another may be claustrophobic in the dark depths of a rainforest. The degree to which one is preoccupied with one's comfort or discomfort can distract from the capacity to

observe the natural world with equanimity and full attention. Some of these feelings lie at the root of certain stereotypes which can prejudice people against the biological richness of a place. Because wetlands, for example, are squishy and unstable at low tide, walking with uncertain footing can be unpleasant; coping with muddy clothes may be a bother. Concern for one's own personal well-being can interfere with seeing a place for what it is.

Mindfulness of the mind and objects of mind are equally challenging practices. The Zen practicioner learns to recognize the Three Poisons—greed, hatred, and delusion—in their various manifestations as well as degrees of concentration, confusion, and habitual mental formations. One studies the five streams of form, feelings, perceptions, mental formations, and consciousness to see how the self is not permanent or autonomous but rather a temporary pattern in time and space (Nhat Hanh, 1990). It is in this realm of practice that one can observe how ideas and past experiences in nature shape how one perceives the natural world. Like a well trained scientist, the Buddhist student must go beyond oversimplified ideas to examine closely what actually exists. This is how John Muir challenged the reigning theories about the formation of Yosemite Valley by paying careful attention to boulder distribution, scree slopes, and hanging waterfalls. Against all criticism he suggested the evidence pointed to glacial carving and retreat.

In this time of environmental crisis and tremendous loss of biodiversity, many unexamined assumptions are driving human actions. Some cultural values are transmitted unconsciously from generation to generation—fear of snakes, hatred of wolves, eradication of weeds. Others such as those affiliated with consumerism take root very quickly in the media-saturated environment of today's world (Kanner and Gomes, 1995). I find now that my work lies more in developing social awareness of these hindrances than in carrying out biological field projects. I rely largely on my Zen training in mindfulness to illuminate values and attitudes behind environmental controversy or policy-making.

Looking back over twenty-five years of science and environmental education, I find that the main thing I have taught is how to pay attention. Whether it is paying attention to the plants themselves or to one's impact on the wilderness or one's prejudices towards certain landscapes—all of it is about looking closely and developing awareness. In many different circumstances I have seen people of all ages suddenly fall

in love with a tree or bird, simply because they are paying attention and enjoying the fullness of that experience. I am convinced that this experience is at the heart of feeling concern for the well-being of a landscape or organism. When one perceives clearly, if even for a moment, the rich complexity and vitality of another being, one tastes the desire for its life to continue to unfold. This connection was obvious on whalewatching trips I led in Baja California. The crew would lower small motorboats into the lagoon and we would set off in search of sounding gray whales. The more curious females, sometimes with their calves, would approach and allow us to get quite close. Not infrequently the ardent whalewatchers could reach over the side and actually touch an impressive 50 foot giant! When they reboarded the ship raving about their encounters, it was as if they would never be the same again. I called this a "born again" nature conversion—the powerful remembering of what it is like to be completely attentive in the presence of another being (Kaza, 1983).

When I was education director at the U.C. Berkeley Botanical Garden, we used the practice of paying attention as a natural springboard for ethical response. We developed two programs based on conservation concerns—one on tropical forests, the other on California habitats. Both programs engaged participants in observing the features of plants native to each region. To illustrate the important role of pollinators in tropical ecosystems, we drew people's attention to flower shapes and insect foraging patterns. To demonstrate biogeographical distribution patterns, we pointed to the endemic natives of the California serpentine soils. Each program offered numerous opportunities to make direct contact with other life forms and to consider the threats facing these ecosystems. It was obvious to visitors that the chance of deeper engagement with the fascinating organisms would be much more limited in the future if habitat loss proceeded unchecked. We also participated in raising awareness about the role and presence of Strawberry Creek as a central feature of the Berkeley campus. Through an interpretive brochure, we traced the watercourse from the Garden to the Bay, showing how the creek had been altered and contained and where restoration efforts had slowed erosion and improved aquatic habitat. We wanted people to notice the creek and join in the effort to keep it vital and alive rather than forgotten and polluted.

Much of science today is taught through books, movies, or com-

puters. All of these provide secondary interpretations, shaped by a team of editorial writers or photographers. From my Zen perspective, each of these are one or more steps removed from the commanding experience of paying attention directly to the organism or landscape and feeling the sensory impact of its presence. I personally take a strong stand on learning in the field and leaving the Discovery channel turned off. I am concerned that the heavy emphasis on text or screen-based learning builds cognitive skills but not necessarily perceptual skills (Bowers, 1995) . Movies too often convey a misleadingly condensed picture of a species or habitat. At the northern elephant seal breeding territory of Ano Nuevo State Reserve, I was astonished that visitors expected the behemoth seals to fight, mate, nurse, and squawk all in the half hour that they saw them. These are animals that sleep 20 hours a day if there is no disturbance. I finally realized that many people had seen nature specials on the elephant seals and were expecting their experience in nature to conform to the television!

Movies and computers both carry the disadvantage of absorbing one's attention visually by constant motion and change on the screen. They can perpetuate a kind of addiction to fast-paced peripheral change which is not at all characteristic of the natural world. Young people today are very prone to boredom because they are so used to highly distracting forms of entertainment and learning. They do not have much patience for the slow pace of the natural world. Observing a sleeping seal or a stalking heron takes time and a willingness to pay attention without the constant charge of adrenaline. Young people on extended field study programs can sometimes take several weeks to slow down enough to arrive and be able to actually see what is around them.

Paying attention directly with the body and mind offers a kind of intimacy that is not available through the screen or on paper. One tastes with one's own perceptual faculties the complex patterns of life as they have evolved over millions of years. Each direct encounter builds a richness of relationship that cannot be taken from the experiencer. As a Zen practitioner I have come to value this richness of relationship and intimacy as core to understanding my place in the world. I sometimes fear that science as a discipline removes people from the opportunity for relationship more often than it encourages it. I find I am drawn most to those fields of science which engage the full body-mind attention in relation to the natural world—field geology, field botany, conservation biol-

ogy, restoration ecology. These seem to me to be the most supportive in cultivating what I understand to be the Buddhist approach to an attentive mind.

NO SEPARATE SELF

In Zen training the teachings and practices on the nature of the self challenge traditional western understandings in a radical way. European philosophy and Judeo-Christian ethical perspectives center on the notion of the individual as autonomous, impelled by will, and self-determined. Buddhist philosophy is built on the understanding and experience that the self is dependent on other phenomena and does *not* exist as an autonomous unit. The Buddha taught that an individual is nothing more than the five aggregates which comprise his or her temporary life shape: form, feelings, perceptions, thoughts, and consciousness. These accumulated patterns are like five dynamic streams passing through a point in time and space. Buddhist meditation instructions provide methods for observing these five streams and penetrating the delusion of a separate self. In this penetration, one tastes the profound nondualistic nature of reality. Temporarily freed of the delusion of an absolute self, one experiences the vast realm of causes and conditions that determine the many forms and events of the universe (Hongzhii, 1991). In this sense, one is not separate from the mountain, the waterfall, the bobcat. The experience of unity with the natural world generates a dramatic shift in orientation to the Other, whether in human or nonhuman form. No longer can it be seen as opposite, separate, or dualistically exclusive.

The Zen experience of nonduality challenges one of the most fundamental assumptions underlying western scientific method: that observer and observed exist independently and do not influence each other. It is in this context that I first began to question deeply some of the conclusions of manipulative studies of animals taken out of context. How could laboratory conditions ever duplicate the wild complexity of a natural habitat? How could Skinnerian behavior models fully explain an animal's response to food, light conditions, and other stimuli? The laboratory model assumes the animal's surroundings are more or less constant. In fact, every animal is responding continously to changing conditions with a variety of adaptive behaviors. Some of these are easy to observe on a gross scale—Yosemite bears learning to climb food hang-

ing ropes or peregrine falcons nesting under high rise building overhangs. Other behaviors are inaccessible or only partially observable, since it is impossible to follow any organism in the wild through its entire life day and night.

The Zen perspective also led me to question how scientists could perform experiments on plants and animals which obviously caused suffering without acknowledging some concern for their subjects (Jordan, 1991). My high school biology students brought this to my attention rather forcefully during the standard frog dissection lab. For the first part of the lab, the students recorded their observations of behavioral patterns of the lively frogs hopping around in an aquarium. The next day they were to pithe the frogs and observe the internal anatomy, complete with beating heart and still reflexive muscles. Several students refused to pithe their frogs. In fact, they taunted me in the halls, calling me a "murderer"! They preferred their frogs alive rather than dead, and thought the frogs probably felt the same way. I ended up pithing a number of frogs for those who were afraid they would bungle it. As for the outright rebels, I asked them to write statements of conscientious objection to articulate their moral feelings. It was a turning point for me. My students convinced me that such death and cruelty were not necessary for their learning, and in fact, were detrimental to cultivating any sense of compassion, moral responsiblity, or oneness with these animals.

As my Zen training intensified, I came to see that no artifical barrier between self and other was tenable. This meant I could not kill a mosquito, eat meat, cut firewood, or till soil without recognizing the full existence of other life forms as inseparable from my own. This did not mean I did not engage in these activities; it just meant I was no longer protected from my own suffering by the delusion of dualistic thinking. In part, this was responsible for my turning away from the "hardcore" aspects of manipulative biology. Field observation with minimal impact was acceptable, but more disturbance than that raised real questions. My religious training concerned itself with cultivating moral integrity based on nondualistic understanding of the self and other. How could I follow the prescribed methods of science if it meant going against my own moral integrity?

Some people who have had similar concerns have taken these to the animal rights movement, insisting on humane treatment of laboratory animals (Singer, 1990). While this has not been my path, I have been

glad that the conversation has been raised and that universities now require more careful oversight of experiments involving live animals. For my part of the dialogue I have explored the conscious and unconscious barriers to nondualistic experience of the natural world that permeate everyday life in western culture. Among these are stereotyping, preferences, value judgments, and backgrounding (Kaza, 1995). My Zen training has been invaluable in its rigorous practices which illuminate inaccurate or delusional mental conditioning and holding to a self as separate and autonomous. Yet I am impressed that western social attitudes towards the natural world as alien other or objectified resource are so entrenched they are even present at western Buddhist retreat centers.

My primary work with the principle of "no separate self" is a collection of essays exploring "conversations" with trees (Kaza, 1993). In this writing I wanted to go beyond the usual barriers of difference to find some truthful meeting between person and tree. The work exposed many of the common mental habits which block nondualistic experience with the nonhuman world. While pattern recognition is helpful for spotting protected sites or food, stereotyping can distort or mislead. Though all blue oaks do have similar branching patterns and acorns, the distinct place, history, and context of each oak create quite different experiences between tree and person and for the tree itself. In the essays I wrote, a young Douglas fir forest gave me a sense of hope for the resilience of natural ecosystems; an old growth stand revealed the history of fear of forests as dangerous realms to be tamed and cleared. People also use stereotypes to lump species together, as in "the drooping majestic oak," thereby overlooking the ecological distinctions of distribution, genetic plasticity, and vulnerability to disease. In seeking out meritorious individuals for stories, I saw I wanted companions of stature to fit my own stereotyped images of the "big, old, and generous" tree.

Personal or cultural preference for certain trees or forests can also prevent full recognition of less preferred species. I found the rolling open bay-madrone woodlands of California to be much more alluring than the close-pressed thorny chaparral of the scrub oak. Often these preferences are based on the cultural value judgments of "good" or "bad." "Good" trees are those which provide slow-burning firewood, cool shade cover, or harvestable timber. "Bad" trees are harmful, messy or unpredictable, dropping leaves and limbs which clutter one's yard or damage one's home. Depending on one's perspective, a "good" tree can

be seen as "bad" or "useless" and thereby justify the taking of its life. In Thailand, I was aghast to see beautiful slow-growing teak forests being cleared to plant foreign but fast-growing eucalyptus and pine as preferred trees for the paper industry (Carrere and Lohmann, 1996).

For many people, trees are background scenery, a wash of green behind something else more important. The Other, in this case, then appears inessential or not worth noticing in any detail. This is demonstrated in the extreme in advertisements for cars which use the romantic image of a generic background forest to offset the shiny magnetism of a new expensive car. Hidden in the process of backgrounding is the denial of one's dependency on that very wash of green (Plumwood, 1993). In Maine the maintenance of such background scenery has been reduced to a narrow strip of trees along the wild and scenic rivers. Behind this is a moonscape of slash and broken soil, the paltry remains of a spruce forest, now gobbled up for paper production (Lansky, 1992).

One extreme form of dualism which I feel has limited scientific analysis significantly is the emphasis on a reductionist approach. One organism or one chromosome is examined in great detail, generating explanations based primarily on the reduced part in isolation. This focus on the object independent of context conveys a dualistic split which does not reflect reality. Nuclear physicists have found this kind of isolation impossible, for nuclear particle behavior is strongly affected by the context of how particles are observed. Biologists who work with whole systems gain greater insight into organisms as part of larger patterns (Capra, 1996). This analysis is certainly more complex, but from a Buddhist perspective it avoids the fundamental error of isolating one element from the rest as a separate existence.

In this area my Buddhist training has determined the kind of science I am willing to engage in. I can no longer handle plants and animals as inanimate objects entirely separate from my own existence. I far prefer to engage in scientific inquiry that is based on the assumption that we are all codependently existing and mutually affecting each other in many ways. This does not have to compromise the rigor of the investigation or analysis, but it does mean letting go of some of the habits of mind that perpetuate a human-centered perspective of the natural world.

THE LAW OF INTERDEPENDENCE

Ecology as a science has made its mark on the world by lifting up the central governing aspect of ecological systems: interdependence. Ecologists study biological relationships between flowers and pollinators, soils and trees, birds and food sources. Each small puzzle clue reveals a complex world in which organisms rely on each other in myriad ways. The nature of the relationships in total is what makes up a functioning ecosystem. Conservation biologists study what happens when relationships are damaged or destroyed within the system due to habitat loss, invasive species, or disturbance. Ecology has provided a rallying cry for environmentalists who intuitively sense that a systems approach is more inclusive and accurate in dealing with the natural world.

Buddhist philosophy likewise takes interdependence as its central tenet. A beautiful image of this comes from the Chinese Hua-Yen school of Buddhism (Cook, 1977). Imagine a fishnet shaped set of threads which stretch in all dimensions to the infinite corners of the world. At each crossing point in the net is a jewel with an infinite number of facets, each of which reflects all the other jewels in the web. This is Indra's Net, a metaphor for a universe in which all beings and events are interrelating and co-determining each other's existence. The core dynamic of the web is what flashes between the facets. It is the Buddhist student's task to understand the nature of these mutually causal relations from the particular perspective she holds in her position in the web. The Law of Interdependence is another way of stating that there is no separate self or independent existence, for each being and phenomena reflect all others.

The implications of interdependence for environmental work are profound. On the discouraging side one can imagine an infinite number of relationships, each endangered in some way by toxic wastes, urban sprawl, or ozone thinning. Ecological research has revealed important patterns of interdependence which are threatened by certain human activities. On the encouraging side, however, every action in the web counts. With conscious choice, people can become a positive, restorative force protecting seed stock or buffering creek erosion.

Buddhism has provided a philosophical grounding that perfectly complements and includes the ecological perspective of my science training. I no longer struggle with the Judeo-Christian biases of heaven vs.

earth or humans vs. nature. These oppositional categories never made intuitive sense to me and were not something I could find in my own personal experience with the natural world. Buddhism most explicitly includes *all* beings in the web of interdependence without claiming a hierarchical dominionistic role for human beings (Hunt-Badiner, 1990). This lines up with my understanding of evolution—that many beings evolved sophisticated relationships long before humans appeared, relationships that we were dependent on for our own evolution and existence. Doing science and practicing religion complement each other drawing on interdependence as the fundamental orientation to existence.

Buddhism, however, takes interdependence a step farther than ecology. This central law is also stated as co-dependent arising, or mutual causality, and part of this realm is the human mind. Thus human thoughts, habits, attitudes, values, and perceptions serve as agents in causing or influencing the behavior of other beings and events. For example, the perception of certain plants as "weeds" promotes the need for weed "killers" and thus an entire industry of chemical pesticides and the human health fallout from that. Or the perception that predators are "voracious" produces an aggressive campaign to eradicate wolves, coyotes, bobcats, and mountain lions in the west in the early twentieth century (Lopez, 1978).

My first glimpse of the usefulness of a Buddhist perspective in environmental problem analysis was in my doctoral research on the tuna-dolphin controversy (Kaza, 1979). I began with a thorough investigation of the biology of tuna schools and dolphin affiliations with these schools. This explained why it was effective for fishermen to throw large nets around dolphin groups to capture a tuna school. But it did not explain why the incidental killing of dolphins was so upsetting to the American public. For this I had to consider the aesthetic, kinesthetic, and emotional relationship between people and dolphins. To sort out the polarized finger-pointing between fishermen and environmentalists, I had to look at the role of stereotyping, the differences in short and long-term perspectives on ocean harvesting, and the economic and class distinctions between the two groups. It quickly became clear that the driving force behind the controversy was the conflict in values between the various parties.

Over time as I have studied one environmental problem after another, I realized that the tools of biology were inadequate to address

the many complex factors of causality at work in each situation. For me, taking a Buddhist philosophical perspective had little to do with adding a religious overlay to what I could see. Rather, it meant bringing a commitment based in my spiritual practice, to look into every aspect of the problem and see what the primary determining causes were. Recently I evaluated the ethical tensions in the northern forest debate affecting the hardwood ecosystems of New York, Vermont, Maine, and the rest of New England (Kaza, 1994). Taking a neutral Indra's web perspective allowed me to look at the concerns of environmentalists and rural property owners, both caught in the rapidly advancing clearcutting machinery of corporate business.

This work introduced elements of class relations which I had not considered before. It became apparent that Indra's Web includes not only individual mental habits and values, but also underlying patterns of cultural relations with the environment. At about that time I became involved in helping students plan a student-taught course titled "Environmental Justice" which focused directly on these issues. The topics included discrimination in toxic waste dump siting, women's health issues and environmental hazards, people of color environmental groups, and prejudice in federal resource agencies. In another course I investigated patterns of domination which showed parallels between the treatment of women and the treatment of nature. Through the School of Natural Resources I helped with a new course on "Race and Culture in the Natural Resources," providing alternative perspectives to the traditional dominant views of the field. Engaging these perspectives offered a way to embrace a worldview based on interdependence.

What I see now is that cultural patterns of oppression play out through most realms of human endeavor, including science. Race, class, and gender bias can mutually reinforce each other in the justification for resource exploitation. For example, Perdue has many factory chicken farms in North Carolina where taxes and labor are inexpensive and environmental regulation lax. Most of the workers are lower class African-American women who stand all day in ice and blood and often become crippled with arthritis very early in their lives. Perdue makes a grand profit, but chickens and factory workers suffer.

I find my Buddhist orientation toward mutual causality best represented by the emerging fields of social anthropology or human ecology. I believe an interdisciplinary approach to environmental problems pro-

vides the strongest analysis and most astute insight into the various causes and conditions creating any particular situation. I have by now outgrown the limitations of any single discipline of science. It has become painfully clear to me that only a systems approach can account for the magnitude and entrenched nature of some of the most destructive patterns on the planet. In this I am completely aligned with my Buddhist training and I count it as an advantage (Macy, 1991).

The Path of Compassion

Zen teachers speak of two pillars of practice which complement and guide each other. One is the path of wisdom, assisted by the realized spiritual being Manjusri who fiercely cuts through delusion in pursuit of truth. The other is the path of compassion, guided by Avalokitesvara, the bodhisattva or awakened being who hears the suffering of the world. In the Chinese tradition this realization of perfection is depicted in feminine form as Kuan Yin. Manjusri helps cultivate insight understanding based on experiential knowledge of the law of dependent coarising. Avalokitesvara helps open the heart to respond to the pain and difficulties of all beings (Aitken, 1984).

In the world of science I find great encouragement for cutting through delusion in search of the truth. It is to me the most beautiful aspect about doing science. I admire the fire of passion burning in the eyes of those who are committed to this truth-seeking. Science teaches the art of asking questions and posing ideas that can be tested or investigated to see if they hold up to the test of on-the-ground data. I have always appreciated the collegiality among scientists in reviewing each other's work and offering critiques where appropriate. This sense of a community engaged in truth-seeking presents a powerful force for good in the larger society. However, as an idealist, I have been frustrated and disappointed by the degree to which competition and power relations have corrupted this fundamental truth-seeking in some aspects of science.

From my perspective as a Buddhist, what is missing from science training is the practice of compassion. The cultivation of compassion reinforces the insight of interdependence through a felt response to the plight of others. Compassion offers a direct experiential route to recognizing that the realities of birth, sickness, old age, and death will come to

all beings. The Buddhist sense of compassion is distinct from a western notion of empathy or even pity. Literally, the roots of the word compassion mean "to suffer with." The path of compassion invites one to suffer with the existence of suffering—poverty, violence, epidemics, natural disasters—the list is endless (Eppsteiner, 1985).

Some Western critics of Buddhism find the recognition of suffering depressing or gloomy. In contrast to the Christian traditions which hold up the joy of the heavenly reward, Buddhism is much more realistic and grounded. The practice of compassion is itself a joyful antidote to suffering. The first teaching of the Buddha directly addressed the existence of suffering in the Four Noble Truths as a path to enlightenment (Habito, 1993). The first truth is that suffering exists. It is important to recognize here that the Buddha did not emphasize individual suffering, i.e. your suffering or my suffering, but just the existence of suffering in general. If one is caught in the particular pain of one's own suffering, it becomes yet another form of self-centeredness, preventing one from seeing the interdependent whole. Scientists, for example, suffer from grant rejections and the exhaustion of competitive striving, often taking their losses personally rather than as an indication of an overstretched system.

The second Noble Truth is that the cause of suffering lies in grasping or clinging to the delusion of a separate self. This delusion manifests itself in attachment to personal desires and preferences, in protective defenses that promote the individual ego, and in the denial of the existence of others upon whom one depends. The cultivation of compassion helps to mitigate against this natural human tendency to be absorbed in one's own small world.

The Third Noble Truth is that there can be liberation from suffering, that right in the midst of delusion, one can find the spaciousness of enlightenment. The Fourth Noble Truth offers the Eight-fold Path as a method to achieve enlightenment and thereby be free of suffering. One of the eight is Right Livelihood, or choosing a vocation which cultivates compassion. I see now that I have chosen a life of teaching because of my desire to cultivate compassion for myself and in my students. While it is true that some scientists make a point to speak out about the results of their research and engage public concern (Rachel Carson, Paul Ehrlich, Michael Soule, among others), many do not. There seems to be a vague assumption that anything to do with ethics or moral response is taught in other departments.

From a Buddhist perspective, this is not adequate. Doing scientific work without compassion too easily leads to objectification of research subjects, whether plants, animals, people, or landscapes. In some cases, experimental actions which induce suffering are rationalized as necessary. Witness the horrendous liberties taken in testing the first nuclear bombs. No warnings were given; no protective measures were taken for the nearby populace, and now the many resulting cases of leukemia and other cancers are coming to light. This, in my mind, is unconscious and unconscienable science, a not unexpected result of a training which omits compassion. Similar arguments are being advanced today on behalf of genetic engineering experiments. Release of genetically modified organisms is said to be necessary in order to advance to the next phase of production. In the haste for scientific and technological reward, very little attention is given to the possible suffering of other lives.

I find myself most at home in the field of Environmental Studies, where all the teaching—in economics, ethics, policy, and ecology—is motivated by a genuine concern for the well-being of the earth and its life forms. Compassion is a natural motivator for learning; our students want to know how to protect and sustain the life of beloved places. They want to understand the impacts on the southern countries of rapacious consumption in the North. They want to be engaged in campus ecology issues, to move institutional policy towards environmentally aware choices.

One of the most difficult things for young people and many others as well, is to accept the grief, rage, fear, and sorrow they experience in waking up to the state of the environment (Macy, 1983). In my own teaching I try to work with these states of mind as natural responses to the suffering of other beings. I do not want to protect students from their feelings, for I sense that this receptive place is where compassion arises. I want to offer practices that will help sustain students under the pressures of increasing environmental deterioration. I do not want them to drop out and give up because of an overwhelming sense of discouragement. They must function in a world in which many people in power are operating in almost total denial about the state of the environment. The practice of compassion keeps the heart open and willing to work with others.

I recently was asked to consult with the U.S. Forest Service on a project which promotes compassion in its own way. Staff of the south-

west regional office were facing conflicts generated from native American spiritual use of the public forest lands. Rather than avoid the complex issues of multiple use, the Forest Service convened a gathering to investigate the role of spiritual and religious values in public lands management. Discussion ranged widely and many different points of view were represented. We were not aiming to solve specific conflicts, but to broaden the conversation beyond its previously limited resource-oriented base. I prepared research on the world's major religions and their attitudes and practices towards the natural world. Others developed commentary on sense of place, native American perspectives, types of research needed, and the role of federal management agencies. The gatherings, and the book which resulted (Driver et al, 1996), served to stimulate new depths of understanding in territory which is rife with moral dilemmas.

It has occurred to me that it would be illuminating to revise the standard scientific environmental impact statement format to describe a project in terms of the suffering it would cause. One could list the organisms and ecosystems that would suffer and how they would suffer in particular—death, disturbance, loss of reproductive faculties, population reduction, etc. One could then parallel this list with an analysis of the human parties that would suffer and what form their suffering would take. This could include economic impact but also psychological and spiritual impact. Suffering takes many forms but only a few of these are recorded on environmental impact statements. A more complete accounting would satisfy my Buddhist interest in considering compassion for all beings.

BRINGING SCIENCE TO THE TEMPLE

In reviewing my own journey through the two worlds of science and Buddhism, especially as they intersect in environmental studies, I have found more opportunities to explore the influence of Buddhism on science than vice versa. I carry a Buddhist perspective with me to the various realms of environmental policy and ethics I encounter and use this perspective to find ways to broaden the conversation. I prefer to translate this perspective into modes appropriate for each situation, what Buddhists would call using *upaya* or skillful means. I never introduce Buddhist concepts with an eye to converting or convincing anyone

that these are the right or best approaches. But I take my commitment to the practice seriously and call upon it where it can be helpful. In this regard, I am one of a growing number of people practicing "socially-engaged Buddhism"—taking the practice off the meditation cushion and into the street to make some difference in the world (Kraft, 1994).

In contrast, it seems a greater challenge to me to bring a scientific perspective to the Buddhist community. My experience in this area is limited primarily to my home temple in northern California, Green Gulch Zen Center, where I lived for three years. In addition to the Zen practice area the center includes a 12 acre organic farm and flower garden. In the neighboring valley lies Muir Woods, the last remaining fragment of old growth redwoods close to San Francisco. Because the center is still young, less than 25 years old, it has been concerned primarily with establishing the meditation practice and hosting the community of interested practitioners. Stewardship for the land has rested primarily in the hands and minds of the head gardener and farm manager.

Since Buddhism takes a fundamentally nonviolent approach to other forms of life, the place has benefitted from a certain degree of benign neglect outside the intensively cared for farm and garden fields. Sparrows and finches have settled the brushy areas in great numbers and frogs have taken over the zendo pond. A pair of great horned owls have kept company in the valley for more than ten years, and red foxes and raccoons regularly patrol the large compost piles. The path of noninterference has allowed the land to recover from thirty years of cattle grazing and pesticide spraying on the hillsides to promote pasturage. To the extent that science has played a role in managing the Green Gulch lands, it has been in the development of beautiful organic agricultural soil. Through careful attention to cover crops, compost building, and soil amendments, the farm and garden staff have built a rich moist dark soil which supports squash, beets, potatoes, chard, kale, and ten kinds of lettuce.

Over the years there have been various efforts to take responsibility for managing the noncultivated areas of the valley. The most consistently successful work has been tree-planting: first to provide windbreaks and reduce soil erosion in the fields, then to begin to recover some of the forested areas which were depleted after the great San Francisco earthquake. Arbor Days have been conducted annually since 1975 with great enthusiasm but relatively little ecological guidance.

During my active years there we produced a set of recommendations for returning the valley to environmental health. These included removing non-native plants, establishing oak and redwood groves, opening the creek channel, and protecting bird nesting and watering spots. From a naturalist's perspective, it was easy to see how with a few gestures in the right places, Green Gulch would become a rich haven of biodiversity along the northern California coast.

But these things take time and commitment from more than one or two staff members. The most positive encouragement has come from staff at nearby Muir Woods who are promoting native plant propagation and restoration projects. Working together as good neighbors, the head gardener at Green Gulch and the head ranger at Muir Woods have helped each other move forward with habitat restoration. Beyond those at Green Gulch with a specific interest in environmental matters, however, the institution as a whole has not been very receptive to ecological advice nor committed to long-range planning in this arena.

I include this piece of the Buddhism-science dialogue in my life to show there is still plenty of opportunity for good work here. Though Buddhist philosophy and practice are most compatible with an ecological perspective, it is not necessarily true that all Buddhists are ecologically informed or committed. In fact, very few are. As in many communities or church groups, a few people will take the initiative to influence others to act in an ecologically responsible way. How many scientists bring the gift of their knowledge to their churches or temples? This process is still just beginning in the American Buddhist community, but I have great hopes that it will yet flower in the centers with direct responsibility for the land.

I believe that engaging in ecological restoration can generate personal and community spiritual restoration. The more opportunities we create for this, the more we can actually find practical and meaningful ways to live in nonviolent and conscious relationship with the land. This is my great motivation in exploring the relationship of science and Buddhism. The outcomes of such exploration may have very significant consequence for the health of human life and the land. It is my hope that the work we do together across these fields of endeavor will serve to relieve the suffering and promote the well-being of the world's myriad beings and places.

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