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**A TAPESTRY OF BROWNS AND GREENS**

*--The tapestry of life's story is woven with the threads of life's ties, ever joining and breaking.*

Rabindranath Tagore, *Fireflies*

When I look closely at a hanging tapestry, I observe that the pathways of individual threads wend through warp and woof, each one unconnected to the other. Yet if I stand back and look at the whole tapestry, its intricate and beautiful patterns emerge. In a roomful of such carpets, I observe that those with the most compelling patterns are composed of individual threads that have the highest intensity and most contrasting of colors. When I reflect on the tapestry of my own half-century of life, I see that the threads that have provided the greatest amount of influence on how I understand nature and my place in it are those that came from the vividly mixed ethnic background of my Indian/Hindu and Brooklyn/Jewish parents, threads that set me somewhat apart from the mainstream culture of white middle class America in which I was raised. Being myself composed of different colored threads has allowed me to see the complexity of nature, and to communicate them to a wide range of audiences.

It was near midnight at 10105 Dickens Avenue in October of 1966. The sleeping bags of my sixth-grade girlfriends lay like spokes around the central coffee table. Martha Bunn, my best friend since we were seven years old, asked me: Nalini, what does it feel like to look so different from everyone else? I remember opening my eyes wide in the dark room at her question. I had no answer. Until then, I had not realized that I looked different from my white friends in the sleeping bags next to mine. But at that moment, I realized that my mixed heritage apparently did set me apart from others in my suburban Maryland neighborhood -- at least from their perspective. My father was a Hindu who emigrated from India in 1946 for his doctorate in pharmacology. My mother was raised as an Orthodox Jew by parents who had fled the pogroms of Russia in 1916, and who spoke Yiddish in their home in Brooklyn, New York. My parents met in graduate school, married, and moved to Bethesda, Maryland where my father spent his career doing cancer research at the National Institute of Health.

The five Nadkarni kids were varying shades of brown. I was the third child, and was the darkest of the five, the most Indian in my facial features and body look. In contrast to other immigrant Indian families in the area, who seemed to assimilate into western culture as quickly as possible, my parents made our home a "Little India". They gave us all Indian names, which had meanings in Sanskrit: Saroj, lotus flower; Susheela, well-behaved; Nalini, water lily; Vinay, gentleness; Mohan, charmer. Even our dog and cats had Indian names: Tipu, Manya, Nisha. At dinnertime, we sat on the kitchen floor and ate

Indian food with our fingers, my mom circling the six of us, doling out curry and vegetable *bhaji*. We slept on mattresses on the floor, just as my father had done in Thane, the small village of his birth.

Christmas morning brought neither a crèche nor presents from Santa, as it did for all of our school friends. Rather, the family gathered around our fireplace, bereft of Christmas regalia, while my parents read excerpts from writings of Jawaharlal Nehru and Mahatma Gandhi. Each month, we received a letter from my father's *bhataji*, or family priest, with a dozen Indian stamps pasted in the corner of the odd-sized envelopes. Even unopened, these were redolent of sandalwood paste and *prasad*, the sweet powder he would distribute to each of us at the small alter of Ganesha, the god of good fortune and remover of obstacles. The little ivory carving of our family deity resided on a bookshelf in the kitchen pantry, where we gathered if a family member were sick, or traveling, to give prayers for their health or safe journeys.

Our family found it very natural that that Ganesha sat right next to our Menorah, Haggadah, and Hebrew dictionary, objects that embodied my mother's religion. The image of our elephant-headed god was somehow not at all a strange bedfellow to these three representations of Judaism, a faith that forbids any representation of God. Our two religions lived side-by-side, just as my sisters and I slept comfortably together on our floor-level mattresses. Although my mother's heritage was not as apparent as the Indian elements, Jewish holidays and traditions had a presence in our home. At Passover, we welcomed packages of honey cake and Matzoh from my maternal grandmother, our Bubby, who practiced her Orthodox customs all her life. These represented her acceptance of the marriage of her daughter, who had committed the unthinkable action of marrying outside the faith. Out of deference to her own parents, my mother did not tell her mother that she was married until after I – the third child – was born, because of the shame it would bring to her family. Civil law at that time also worked against them. My parents were not able to legally marry in Washington D.C. – our nation's capital - because of the miscegenation laws that still ruled 17 states. These forbade my dark-skinned Indian father – who was classified as a Negro – from marrying my white mother. They had to take a bus to New York and marry there to have their union be legal.

That initial awakening at Martha Bunn's slumber party, reinforced by my family history and the way we lived made me aware that I was somehow different from others. But those deep cultural differences my family embodied did not create a conflict. Rather, it fostered something enriching, just as different-colored threads created the richness of Tagore's tapestry. I believe that it set the stage for the way I have come to view nature – not as consisting of monochromes, but rather as comprising many colors and textures, all necessary to creating a complex and resilient whole.

## **NATURE AS PROTECTED AND PROTECTOR**

My early experiences provided me with two seemingly contradictory roles of nature. The natural world both needed protection and provided protection. As children, we participated in caring for the nature in our own back yard. Although my father was stern and authoritarian, and I often feared his iron rule, he had a benevolent attitude toward nature. On weekends, he tended our two-acre lot of garden and trees. I remember the care he showed when we transplanted young saplings from one part of our yard to another, a near-reverent tenderness that I seldom saw in him. He made sure that the sphere of soil surrounding each tree's young roots was big enough to absorb the shock of being uprooted. He would unfailingly water it afterward, to welcome it to its new environment. I liked to pat the soil in the handprints that he had lain down. His big handprint surrounded my little one in the dark soil beside the slender brown trunk that upheld the pliant limbs, so like mine, ready to grow. I have wondered if he saw himself in those transplanted trees, a fellow migrant, from his small village in India to the culture of suburban America. Those actions gave me a strong ethic of protecting nature.

I learned also that the converse was true -- nature protected me. The elm tree that stood outside my childhood home and tapped companionably on my bedroom window kept me company on scary, windy nights, assuring me that my favorite playmates – the trees that lined our driveway – awaited me outside to join them when daytime returned. Tree climbing was a near-daily pleasure for me. When I got home from school, I exchanged a hello with my mom, and grabbed a snack and a book to read. I chose one of the eight maple trees that lined the driveway to climb for the afternoon. Those perches were refuges from the world of homework, chores, fights with siblings, and strict parental directives. I could look out across my home territory, check on the progress of squirrel nest constructions, and feel the strong limbs of the trees holding me up for as long as I wished. In my imagination, those treetop roosts became in turn a place to sequester Anne Frank, a sanctuary for injured birds, a refuge for wounded soldiers, and a rescue vessel in case of drastic emergency neighborhood flooding. It was my Ark. Those afternoons of arboreal repose germinated my sense that nature is a place of safety, a place that protected me and those I cared for.

## **NATURE AS AN OBJECT OF STUDY**

As with many children of immigrants, the strongest directive from both of our parents to the children was to behave properly: to be obedient, respectful, and studious. Scholastic achievement was of paramount importance. Education had been the key element for the success of both of my parents, and they believed deeply it would help us find our place in life. I felt I had to meet the highest standards of all of my siblings. In the tradition of India, girls marry and go off to the family of their husbands, which requires large dowries, rendering them more of a burden than a gift. It is the sons who bring home wives and care for them in their old age. As the third daughter in a family of two cultures that value sons over

daughters, I worked hard to gather straight A's, played on three varsity sports teams, joined the Latin Scrabble Club, and implemented my own private After School Shakespeare Reading Project. This emphasis on academics created another thread that I wove into my relationship with nature, the realm of the intellect and use of the scientific process to understand trees and forests.

In college, I pursued the study of biology. During my junior year, I discovered the world of forest ecology through the lectures of a behavioral ecologist, Dr. Jon Waage. When he wasn't teaching Brown University undergraduates, he carried out research on damselfly behavior. I was amazed to learn that he could make a living by sitting at stream edges to record the movements of these aquatic insects. He posed seemingly narrow questions that later turned out to relate to much broader issues about life and death, competition and mutualism, and the evolution of life on Earth. How does a female's wing size affect mate choice? How does mate choice affect population diversity? How does diversity affect resilience to community disturbance from human activities? Wrestling through the labyrinth of the scientific literature, I learned to trace citations to their sources and recognize the key players in a scientific discussion. Attending scientific meetings gave me a tribal sense of community as I listened to its elders and became initiated into its rituals.

Most of all, I enjoyed the challenge of untangling the endless puzzles I encountered in nature. Like veterinarians with their dogs and obstetricians with the unborn, ecologists must work with their subjects without the benefit of speech. I had to rely on my own observations and those of other scientists, to figure out how ecological systems worked. I entered graduate school in forest ecology at the University of Washington. During my first summer as a doctoral student, I took a graduate level field course in tropical biology in Costa Rica. Whenever we struck out on a rainforest trail, my eyes went upward to the plants and animals that I saw in the treetops, located far from the reach of those who were stuck walking on the dark, damp forest floor. At that time, in 1979, almost no one had studied – or even climbed into – the forest canopy. Many of these tropical trees have unnervingly long straight trunks with no branches for 100 feet, rendering my childhood tree-climbing skills useless. But my interest was piqued to explore and understand the treetops. I learned mountain-climbing techniques to climb trees from Don Perry, an early pioneer of forest canopy access, and was on my way to making a niche for myself in the barely existing – but emerging -- field of forest canopy studies.

It took some struggles with my graduate committee help them understand that climbing trees could be serious science, rather than “Tarzan and Jane stuff”, as they called it. Eventually, they helped me carve out a dissertation project, a comparative study of the biomass held within the epiphytes – the plants that grow perched on tree branches and trunks. My fieldwork took place in the spectacular temperate rainforest of the Olympic National Park and the tropical cloud forests of Costa Rica. Both forest types

support massive loads of epiphytes, though the types and species of plants are very different. For four years, I identified, marked, and tagged all the trees in study plots at both sites, and collected epiphyte samples to calculate their mass relative to the whole ecosystem.

In the more than 25 years that followed, I continued this academic approach to nature, collaborating with students and colleagues to produce over ninety scientific papers and three scholarly books about canopy ecology. We have learned that treetop versions of traditionally terrestrial invertebrates – beetles, ants, springtails and even earthworms – are found in this canopy-level soil, living out their entire life cycle high above the forest floor. We have measured the amounts of nitrogen that the epiphytes intercept and retain from rain, mist, and dust, which can be considerable. A study that involved perching on platforms in trees for six hours each day revealed that birds of the cloud forest use epiphytic flowers and fruits for over one-third of all of their foraging visits, which documented the importance of these plants to arboreal animals. In summary, these little-known and structurally small plants that live their lives high above the forest floor have tremendous ecological importance for the forest as a whole; they are critical threads in the integrity of the complex tapestry that of rainforest ecosystems.

### **LEARNING FROM MANY SOURCES**

During my academic appointments at the University of California Santa Barbara and The Evergreen State College in Olympia, Washington, I immersed myself in the academic approach to understanding nature. I received scientific grants, carried out fieldwork, gave talks at meetings, and published scientific papers, just as my peers did. However, I sensed that this world of the ivory towers was somehow incomplete, and was missing certain elements and dimensions. I also recognized that the growing distance between scientists and non-scientists, and the widening gaps between humans and nature were two grave societal problems that most scientists did not seem to address. As my career progressed, I found myself compelled to reach out to other sources of information outside of academia that seemed equally valid to those inside it – sources that went beyond the scientific aspects of nature, and involved recognizing and understanding the medical, political, recreational, aesthetic, and religious values of nature. During that stage of my work, I became open to the idea that other ways of knowing might help me better understand the complexities of nature.

In 2000, I set out to understand the multiple values of trees and to link these with public audiences outside of academia. I began with the value of health, our most basic need. My younger brother, a physician of internal medicine, invited me to speak to his medical students about the relationships between trees and health. In my lecture, I presented examples of how health practitioners use trees for medicinal products. For example, the bark of the Pacific Yew tree (*Taxus brevifolia*), which grows in the Pacific Northwest, contains taxol, a compound that has proven to be an enormously effective anti-cancer

compound. This recent discovery was preceded in history by numerous other tree-related medicines. As early as the 17<sup>th</sup> century, quinine was extracted from the South American cinchona tree (*Cinchona officinalis*) to effectively treat malaria in South America. In addition to the chemical compounds trees provide to keep humans healthy, they also function to reduce stress in psychological ways. In the early 1990s, Roger Ulrich published scientific studies showing that patients who had a view of a tree outside their window recovered more quickly and with fewer complications as patients sustaining the same operation who had views of concrete walls. These studies have, in recent years, been applied to hospital and designs, and several companies now provide artificial tree scenery consisting of backlit panels that can be hung on walls and ceilings of examining rooms and waiting areas. Thus, the many health values of trees can be woven into the tapestry that describes the total significance of trees.

Recreation values can connect nature and science to people. Several years ago, my students and I created a “TreeTop Barbie Doll”, which provides an alternative to the traditional “girly” dolls – one that embodies exploration, strength, and an image of a young woman interested in forest science. An illustrated booklet about canopy biota of the Pacific Northwest accompanies TreeTop Barbie to engage young girls in science as well as outfits. I also realized that skateboards – as well as many other sports such as hockey, pole-vaulting, golf, and riflery – depend on trees because the equipment they require is composed of wood. We designed tree art stickers that are affixed to skateboards to remind the youthful users that trees are connected to what provides their swoop-flying action in the bowls and curves of their local skateboard park.

Political values are another important thread for the tree value tapestry. To explore how decision-makers and scientists communicate about policy issues that concern forests, I created the “Legislature Aloft” project, in which I invited twelve state legislators and their aides to join my students and me in the canopy for an afternoon. We installed some temporary platforms in the treetops of a local park, and then taught the congresspeople to ascend to platforms with harnesses and climbing ropes. In the hours we spent aloft, we discussed forest management issues, government funding of science, the reasons for high biodiversity in the canopy, and the importance of non-vascular plants in forest nutrient cycles. The post-session evaluation documented that nearly all of the participants felt positive about the experience, and most stated that they would be willing to contact a forest ecologist in the future. I still communicate with a subset of these legislators, and these relationships have enhanced my ability to exchange information about forest ecosystems to the people who make decisions about them.

Urban youth are a segment of the population that are hard to reach when it comes to interesting them in nature. To connect young people from the inner city with science and fieldwork, I stretched far outside of academia and engaged a young rapper named C.A.U.T.I.O.N. to come out to the field with field

scientists – a marine biologist, a forest ecologist, and an entomologist -- along with 30 middle school children from Tacoma, Washington. Each day included field time – with the rapper singing about the trees, clams, and bugs we encountered – and sound studio time – when the students made up their own rap songs about their field experiences. At the end of the week, the kids had cut a CD, which they presented to their families and peers. Their insights also served to open my eyes to the many colors of nature that they saw with fresh eyes in the familiar (to me) forest of my own college campus.

The element of formal religion is a powerful force in our society, but one which generally has a low profile in academia. However, it seemed to me that places of worship might be excellent places to both teach and learn about aspects of nature. Members of congregations set aside time, dress carefully, and open their hearts and minds to consider matters such as living in an upright way, caring for fellow humans, and marking important moments of life with meaningful ceremonies. I hypothesized that communicating how people of different faiths describe trees in their own holy texts, and in their own places of worship – churches, synagogues, and temples - might inspire its followers to be better stewards of forest ecosystems. I also believed that I would learn from the congregation about their views of nature and trees. By generating discussion on their turf instead of mine, the people in the pews might be more receptive to ideas that trees are critical to human survival and well-being.

There were two critical part of this approach. First, I had to be open about learning from non-scientific sources. Second, I had to consider multiple religions without judgment, just as Ganesha and the Menorah sat side by side on my families home alter. Before taking the pulpit, I acquainted myself with the tone and practice of each group by attending their services as a guest. After several months of simply listening and observing services of different faiths, I offered clergy a sermon on trees and spirituality, not as a scholar of religious studies nor as a particularly religious person myself, but rather as a scientist interested in understanding trees with my intellect, and as a human being who cares about forests. The 22 congregations I addressed ranged from fundamentalist to progressive, and included Episcopalians, Baptists, Unitarians, Zen Buddhists, Jews (Conservative and Reform), Catholics, Methodists, and interfaith organizations. My source materials came from downloading and searching the Bible, the Talmud, the Qu'ran, as well as Hindu and Buddhist scriptures.

Because it is the dominant religion, I began with the Christian tradition and spoke in churches. I downloaded the Old Testament from the web and did a search for quotations that contained the words “tree” and forest”, which I categorized into ways trees are used or viewed (e.g., practical use, adornment for temples, analogies to God, location markers). I integrated these into three topics for my talks: a) trees as providers of the needs of followers; b) how trees connect humans to the divine; and 3) the ways humans incorporate trees into spiritual practices. Congregants listened attentively, participated in



discussions after the sermon, suggested texts and hymns that I had overlooked, and passed me on to other churches. Some continued conversations with me by telephone and email.

On one occasion, I spoke from the *bima* (meaning “high place”, the raised platform from which the holy scriptures, the Torah, is read) of the Jewish synagogue in Olympia, Washington. One of the things that struck me was how rarely I had been in a synagogue, and yet how comfortable I felt there. Something of my mother’s teachings about the holidays, coupled with the memory of those packages from my Bubby made me feel a connection to the sounds and smells of the synagogue. When I spoke to the congregants about links between trees, spirituality, and Judaism, I described my childhood tree-climbing activities, which led me to opine that Tu B’Shvat, the celebration for the New Year of the Trees, was the best holiday the Jews invented. Its beginnings were strictly secular. The Torah required farmers every year to give a tenth of all crops grown to the priests of the Holy Temple, and Tu B’Shvat marked the date when those taxes were tallied. Gradually, the holiday became a day of celebration of trees, and of Jews’ connections to nature. In Israel and other countries, the day is celebrated with tree-planting ceremonies or by giving money to plant trees. Through these actions, modern Jews affirm a future filled with fruit, shade, and beauty for their children. Sukkot, another Jewish holiday, involves the building of a little house in the backyard, made from tree branches and sticks, in which to eat, host guests, and reflect on the time when their ancestors used such shelters during their 40 years of wandering in the desert after the Exodus from Egypt. The action of building the structure connects them to their important past and their shared beliefs.

Just as easily, I was able to talk about the role of trees in Hindu religion in the places of worship I visited, drawing from the teachings of my father. He described the early inhabitants of India as perceiving a godly element at work in places of natural beauty, especially in trees. Centuries ago, many villages set apart sacred land for the “tree spirits,” or *vanadevatas*. Would-be parents propitiated the spirits by tying toy cradles to the branches of trees in sacred groves. Damage to the sacred grove, especially the felling of a tree, might invite the wrath of the local deity, causing disease, disaster, or the failure of crops. Through ebbs and flows of many political and religious systems, spiritual beliefs have been the prime force that preserved these groves into modern times. All of the more than 13,000 sacred groves in India have a residing deity. The value of sacred groves now stretches far beyond the spiritual. They also protect plant and animal species that are valuable for food, medicine, and spiritual uses. In many areas, they are the last remaining threads of native, wild biological diversity in a country of one billion people.

Over the past 10 years of this type of outreach to non-traditional audiences, I have learned much more about trees than what came from ecology lectures and the tomes that fill the library stacks. Science is a domineering force if you choose to take it on, often leaving little room for the dream works of a Mary Oliver or the quiet prayers of a Buddhist monk. But I have come to decide that there is room for more than simply doing another experiment, getting another grant, writing another scientific paper, testing another hypothesis to the 0.05 level of significance. The insights that came from these “other” sources, have, for me, coalesced around the reflection that there is a valuable affinity between trees and people, the word affinity from the Latin word *affinis*, which indicates a relation by marriage. Although we are not of the same family, we can consider ourselves as being married into each others’ families, with the challenges, responsibilities, and benefits that come with being so linked.

### **TREES AND AND MY OWN SPIRITUALITY**

Although the opportunities I have been offered have been numerous and positive, there have been times in my adult life when I have encountered dark colors. Some of the murky times may have been a consequence of my mixed background. Did they stem from struggles to prove myself to my parents and the bigger world? Did I need to show myself and others that a small brown woman is as worthy – or more than worthy - of opportunities as a large white person? Whatever the cause, there have been times when I have misplaced my sense of self, when I have not heard my own voice, when I have nearly drowned in a place of no light.

During those times, I found spiritual solace and guidance by looking to trees and other representatives of nature as examples. One of the most basic way to gain – or regain – my sense of self was through meditation and conscious breathing, and this, I realized, is also linked to trees. Drawing from my Latin Scrabble Club days, I know the word spirit is derived from the Latin word, *spirare*, to breathe, the same root for spirituality, inspire, and expire. Although trees do not have lungs or gills as animals do, they breathe. Day and night, plants respire, taking in oxygen and releasing carbon dioxide, which provides energy for growth and reproduction. They also carry out photosynthesis, a process that harvests energy from sunlight and converts it into sugars, exuding oxygen, and continually replenish our oxygen supply. Because of the complementary way in which these gases are exchanged, every leaf becomes a connector among living things. Knowing this, in those dark times, I could merely look out at the maple tree in our back yard and be reminded that I am connected to other living things.

Many humans have a sense of spirituality, an awareness that we are linked to something larger than ourselves. Cosmologists have conceptualized the *axis mundi*, or the central universal pivot of the entire cosmos, portrayed as the imaginary line that links heaven to earth. Trees have also been used as symbols that confer wisdom or immortality to humans. In the Old Testament, the Tree of Life and the Tree of the

Knowledge of Good and Evil are introduced in the very first book of the Bible. In India and Britain, the only remaining specimens of certain species are rooted in sacred groves or churchyards, as they were protected because they symbolized eternal life, provided a conduit to communicate with gods, or were deities themselves. Buddha achieved enlightenment as he sat under the spreading limbs of the Bodhi tree, breathing in and breathing out in silence, as does a tree.

Although their trunks, branches, and leaves are apparent to all who look their way, the roots of trees lie underground and out of sight. Roots of real trees provide both support and their mechanism for gathering water and nutrients. Roots symbolize many things that relate to the spiritual realm — invisible systems and networks that sustain us, our families, friends, and institutions we need to live. The roots of some trees can biologically graft on to the root systems of neighboring trees to exchange water and nutrients within the soil, just as we grasp hands to share comfort or help those around us. No person is truly unattached. But the belowground world can also represent the elements that we hide from ourselves and others — our troubles, ill-health, addictions, and weaknesses. At times, we also conceal our greatest hopes and desires, our deepest personal truths, our untapped abilities, and those things that are most sacred to our spirits. To be truthful — full of *troth*, the Old English word for tree — we must recognize that these hidden parts are important parts of ourselves, and not something to discount.

On one Sunday when I was visiting churches on my trees and spirituality project, I arrived a bit late to the Westwood Baptist Church in Olympia, and slipped into the back pew to listen. The pastor was speaking on the need for all of us to seek and find an entity that will protect us, who will hold us in his arms to help us feel secure when we are frightened, and safe when there is danger around us. The priest spoke of being held by limbs that would support us forever, never tiring, never resting, helping us to find quiet and calm in our lives. I was amazed and pleased that the pastor would include a description of trees and their spiritual benefit to humans in his sermon. I recalled a line from a William Stafford poem: “I rock high in the oak – secure, big branches – at home while darkness comes.” It was only at the end of his sermon that I realized he was talking not about trees at all, but about Jesus. I realized that he and his flock view Jesus the way I view trees, as entities who hold us in their strong limbs, providing a safe refuge whenever we many need it.

### **PROTECTING TREES - REDUX**

I found that my evolving and expanding relationship with nature has also given me a voice, a voice that speaks for the protection of nature in all the ways that I can. As third daughter in my Indian/Jewish household, I had almost no voice at all. But now, having spent time in tall treetops in remote field sites, and interacted with a wide range of humans who value and understand trees in a wide range of ways, I have developed my own ways to help solve the growing distance between humans and nature, which is

both a cause and a consequence of the severe environmental problems we carry forward into the next century.

This distance between humans and nature is particularly apparent in certain segments of society, and I describe here one project – involving prisons and prisoners – that has addressed the closing of that gap. Prisons epitomize perhaps the most severe endpoint of built environments without nature. Whether consciously or unconsciously, criminal justice administrators keep representatives of nature away from inmates. In 2004, I initiated a project to both resolve a pressing environmental issue in the Pacific Northwest – harvesting mosses for the horticulture trade – and bringing together nature with humans who have been denied contact with it. In retrospect, I see that this project has reflected my multiethnic background and the ability it gave me to see multiple sides of an issue and value people from diverse backgrounds.

The environmental issue of unsustainable moss-collecting motivated me to begin. The collection of moss from forests in the Pacific Northwest is a growing industry for the horticultural and florist trade. Since 2000, the moss industry has grown rapidly, reaching an economic value of over \$260 million in 2005. This has raised concern among ecologists, because canopy-dwelling mosses fill important ecosystem roles, but are very slow to regenerate. Mosses capture and retain atmospheric nutrients, provide habitats for arboreal invertebrates, and supply foraging locales for arboreal vertebrates. Recent research has shown that moss communities take decades to re-grow after disturbance, so stripping mosses from trees is not sustainable. This prompted me to learn how to “farm” them in non-forest conditions so that collecting pressure on natural habitats would eventually be reduced. However, methods for moss growing in greenhouses have not been developed and require research on which species and with what methods this can be done. Horticultural therapists have ascertained that contact with growing plants can be beneficial for incarcerated persons. And mosses lend themselves well to the prison environment because their small stature requires the use of no sharp implements and because they are hardy and resilient.

In 2004, I initiated the “Moss in Prisons” at Cedar Creek Correctional Center, a local prison, to help resolve this issue. I worked with minimum-security prisoners to explore ways to best cultivate moss and measure its rates of growth. Moss taken from the wild as served as “seed material”, and the prisoners and I together established different ways of growing them: e.g., in mesh bags, on pieces of Big-leaf Maple wood, on open flats. Our moss-growing team comprised a warden, two of my students, an adult volunteer, and six inmates who rotated in as their fellow prisoners’ sentences ran out. Our questions were basic: which species should we use? How much water and nutrients do mosses need? Should solutions be delivered as droplets or as mist? Prisoners were responsible for observing and recording the vigor of

moss samples, drying, and weighing biomass of samples. We gave each inmate a notebook and pencil to write observations. The prisoners quickly learned to identify common moss species, using their scientific names (only a few mosses have common names). They devised their own ways to grow mosses (e.g., hanging clumps of moss in mesh bags); contrived ways to deliver water with first aid tubing and hardware clamps; and learned how and why to retrieve randomized subsets of mosses to air-dry for our moss growth measurements. My students and I regularly reviewed the growth rate data with the prisoners. After 18 months, we wanted to share the excitement of knowing which mosses grew fastest, and which watering treatment was most effective.

The results of the project were dramatic in many realms. The corrections center staff and I were astonished at the energy, interest, and patience the participants exhibited. Several of the inmates became motivated to find training in the horticulture and nursery field after they were released. As an outgrowth of this project, I was allowed to launch an in-prison lecture series called “Sustainable Living – Sustainable Lives.” Visiting lecturers from regional universities and government environmental agencies delivered talks on sustainability, natural history, and ecology to inmates and prison staff. The Superintendent introduced me to staff at other state prisons to replicate these programs. The questionnaires that we circulated before and after each of the sustainability lectures contained such statements as: “I understood everything the teacher said;” “Bring someone who can talk about soils next time;” and “How come the mosses don’t fall off the trees?” Participating researchers gained a sense of satisfaction and accomplishment in communicating to an audience that appeared to be outside the possible interest level of their research topic, but proved to be attentive and aware of its importance. This experience was valuable for me, not only as a scientist who got the answers to the questions on moss horticulture that I sought, but also because the collective work of my students, the inmates, and me were being used to protect the mosses – and the trees that support them. In addition, it reinforced the concept that all voices, all approaches, and all types of people can contribute to keeping the great tapestry of nature intact.

## **REFLECTIONS**

I can look back on my life and explore how my attitudes and actions about nature have flowed. In my childhood, I saw trees as my protectors, my refuge from the at times confusing and chaotic atmosphere of our family. Following my parents’ expectations and my own proclivity to participate in the intellectual world, I jumped into academia and became part of that tribe; approaching the mysteries of nature as puzzles to decipher with statistics. Frustrated at not being able to disseminate what I had learned from nature to non-scientists, I explored partnerships that would link my values of trees and natures to the values of others. I moved into the worlds of spirituality, and realized that at times, understanding comes

from being open to things I cannot measure. Finally, and in a continuing way, I have moved towards forest conservation, becoming the protector of trees and nature.

What has fueled this journey, which has taken me from the ivory tower of academia to the watchtowers of prison yards? I believe that having a hybrid background allowed me to “see” nature and my connections to it in complex ways, a gift and consequence of my brown skin and my mixed upbringing. It has compelled me to look outside my own discipline to fully understand what I am curious about. The strong colors of the Indian culture of my father and the vibrant hues of the urban Jewish culture of my mother mixed but did not merge. They coexisted, retaining their own purity, and complemented rather than conflicted with each other. This allowed me to see multiplicity in everything around me: the subtle differences between species niches in forest canopies; the multiple values that trees provide humans; and the many valid ways that people come to understand nature and the world. I see nature itself as a precious and multicolored tapestry.. That perception has also made me mindful about protecting its intricate patterns from raveling, fading, vanishing.

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