

Of Moisture and Moss

On the lone mountain
I meet no one,
I hear only the echo.
At an angle the sun's rays
enter the depths of the wood,
And shine
upon the green moss. Wang Wei 752

My first impression is of impending doom in the old growth forest. I face the small yews and cedars coated with cattail moss, each tree with outstretched arms and a khaki gown with wide sleeves hanging. These ghostly figures, in oversized clothes of moss are the ghouls of the under-story. The hanging mosses in places here are so dense and bunched that they form monsters like great bears in the forest. Then I notice the lumps. The rocks and stumps and logs are thickly coated in greens and browns and yellows - a myriad of mosses that hide the angles and round the ridges. What else do these carpets cover? What else is hidden? Branches have fallen, the gaps filled with leaf litter, the whole mass coated with moss. Who lives in there? The still-bare broad-leaved maples are swaddled in yellow moss, their trunks and branches thick with it. The deep fissures in the bark of giant Douglas firs contain gray-green lichen, its little gray-green branchlets bearing red crests, and the thick ridges of bark sport a varied green sward of fine branching moss. The smoother bark of great hemlocks is coated with creeping mosses, green, yellow-green and khaki. Some small maples still in winter mode have rings of moss, lumps of it, hanging like mad hair. No tree escapes the moss. I walk the silent cushions of moss, all the hues of green and yellow and brown, my tread so soft that I feel I am spying on something. Emerging from this soft flooring are the long fronds of sword fern, dark leathery leaves of salal and Oregon grape. I see a red huckleberry bush, its networks of small green branches with little green leaves just emerging from red buds. A vine maple is a mesh of smooth green branches each ending in a pale emerald jewel; the tree is a sprinkle of buds waiting to leaf out, sparkling against the backdrop of trunks and moss, and dark needles of young hemlocks and yews. I chance on bright white trillium lilies and pink fairy slipper orchids that give spots of glory to this coated wilderness. Here in the Oregon cascades, the cool wet forest is transformed by moss.

After a while the feeling of gloom gives way to curiosity and I look at the moss. So many different kinds - fine smooth dark green swards, bunch grasses, pincushions, tiny fir trees, minute branching trees, trailing threads, long feathers, doubly pinnate leaves, small round leaves, rock moss, broom moss, step moss, tangle moss, rough moss, hair cap moss. I notice that they vary in where they grow. The spectacular Oregon beaked moss with its leaves divided and divided again is commonest where there is a lot of humus - bases of trees, old rotting stumps, leaf-littered mounds and much of the ground. It is cold to touch and I wonder at the undamaged perfection of its delicate feather form. No herbivores have eaten here. I notice a little round-leaved moss is mixed with liverworts on wet rocks. This would be a place to find those most primitive of moths, the Micropterygidae, whose larvae still feed on these ancient plant forms as they did 150 million years ago, before the rise of modern plants that other moths and butterflies use today. The cattails mosses have a predilection for those under-story trees - the yews, though they gather on the branches of

just about anything. I read that there are perhaps forty species of moss here, but more than their diversity is their superabundance. And I ponder this world of moss; so different from anything I had seen before. As a child living in Queensland I had loved moss but I knew only the fine emerald lumps that grew in tiny patches in the most hidden places. Before I was ten we went on family picnics to Gold Creek crossings in Brookfield, long before it became engulfed by the westward spread of Brisbane. Father and my brother Barton made the tea, hooking the billy can over a small fire, while mother and my sister Jennifer emptied the picnic basket and arranged the cakes on the picnic rug. Baby Adrian sprawled on his own small rug. I always went off on my own, played in the creek, turning stones, skipping the thin ones, and building dams. And under little shady banks I would find small patches of wonder green velvet moss to feel with my hand and in my head. Once I took some home and tried to keep it in a cave I dug on the slopes of my little garden. But it had no chance in that dry place with that chlorinated city water. Our house was built on tall wooden stumps and beside it an enormous tank stood on a stand on its own stumps. Rainwater from the roof collected in the tank and under it was a rough shower room just for cold rainwater showers. There, in the crack between the concrete floor and wooden planks of the walls grew pincushions of bright green moss. Mother said tank water was the best for washing our hair and I remember the pleasure of showers there on hot summer days, the water flowing over the moss, my toes touching the soft curves of it. It was my father's job to keep everything outside clean and tidy, and that included the tank shower and I pleaded with him not to clear away the moss that mother hated. He laughed and said, "I will leave it for you, my little moss fairy." I have seen mossy banks and moss-covered logs in tropical rainforests, and here and there by streams and shady ponds. I have seen plenty of moss. But this cool wet forest is the real world of moss. Here, one of the oldest plant lineages is in a land of massive plenty. Here, plant types that predate all the trees and shrubs and wildflowers, live in glorious luxuriance. Hundreds of millions of years ago they were among the earliest plants to live on land, and the mosses still need to live in moist environments. Their evolutionary age and dependence on water makes their predominance in this temperate rainforest unsurprising yet fascinating. It is an old growth forest for the foresters, and the zoologists study the rare spotted owls that live in trees that may have germinated several hundred years ago, but it is also an old growth forest for the antiquity of these bryophytes, the mosses that cover everything below the canopy. I look at the mosses with my magnifying glass. I know that some are male and some are female but within a species they all look much the same, though some do have a "fruiting body." Yet each is haploid – it has only one set of chromosomes. These plants will produce the male and female gametes, the sperm and ova. Now water is needed again, with splashings of water the sperm gets to its destiny unless it hitches a ride on a tiny moss mite, or there is enough moisture for the sperm to swim there. It will not be a problem in this wet forest, and the fertilized ova become microscopic diploid plants with their double sets of chromosomes inside the fruiting body of the female moss. This miniscule internal plant is the equivalent of the larger plants we see and know, the trees and shrubs and wildflowers. In these later evolutionary advances, the moss plant has become the ova and pollen, the miniscule internal plant with its double set of chromosomes has become the large plant with roots and stems and vessels and cellulose. Inside the moss's fruiting body, the tiny thing divides, eventually making spores, each with one set of chromosomes, each able to grow alone under moist conditions into a new moss plant. The dry facts about small wet plants didn't interest me much in botany class but now I am filled with admiration for these feats that must be so commonplace here. Dozens of species, millions upon millions of individuals all succeeding in this difficult life cycle without help from other organisms – the symbiotic bacteria and fungi, the pollinators and the seed dispersers so abundant among the

flowering plants. And here they are, blanketing everything below the high branches, an unparalleled richness of primitive life. I walk to a site where the decomposition of logs is to be studied for 200 years. I trudge through old snow and then find a trail that takes me among them. The heavy silence is broken only by the sound of running water. Everywhere the trickles collect into runnels and tiny waterfalls that in turn collect into little streams, and then into bigger ones and finally into the rushing waters of Outlook Creek. The sound is all around me. I hear no birds, but as I sit on an old mossy log one small squirrel sets up his long complaint at my presence as he runs up and down the huge trunk of a Douglas fir. I am otherwise alone. Apart from the squirrel and the water running I am aware of a deep silence that oddly changes time. I am simultaneously conscious of the present moment and of the ages – the hundreds of years needed for these trees to grow, the tens of thousands of years this forest has been here, the millions of years since these plants evolved, the hundreds of millions of years that mosses have lived on earth. Time seems slow here. Animal life is hidden. No crickets or cicadas sing, no wood butterflies drift, no cobwebs cross the path. And yet, in all that fallen timber, bacteria and fungi and other microorganisms are wreaking havoc on the cellulose, and no doubt there are insect larvae amongst them. My entomological experience imagines beetle larvae, maggots, wood roaches, centipedes, millipedes, mites. There is snow around some of the logs but it peters out a few inches from them. There is heat produced by all the organisms busy inside, wrecking the cellulose, breaking down everything to smaller molecules. Returning by a different route I look down into a moss-covered depression, a narrow stream rushing through, the beds of mosses meeting the running water. A mass of fallen branches on the right is covered also with moss, and on the left those ghostly arms of small trees that I can no longer identify droop their mosses and lichens over the water, while high above the monster firs and hemlocks create the ever-present gloom. I think of the only other rainforests I have known, tropical ones. How often I walked in Lamington National Park in Queensland when I was young and studied insects there. I remember a damp bank of moss where tiny caves were homes for glowworms that hung their silken sticky traps and lit their lamps at night to catch even smaller creatures. And the old logs did have moss, though it never struck me as a significant life form. I worked in African and Central American forests, where I had eyes mainly for the forest grasshoppers that I studied. And nowhere is there a memory of such lush wet coverings, these hanging cattails, these green mounds. I stop to take in the feel of this wild wilderness and remember a very different mossy place. It was in the tiny north-facing garden of a house in central London, where I lived in two first floor rooms with no curtains or heating or charm. Under the plane tree that dominated the garden grew fine moss and thin blades of grass. I walked on it every day as I chained up my bicycle, and I remember remembering the tropics and rainforests I had known and the few mossy childhood days. The moss stayed green year round in that shady English place, though patches of it went brown after a boozy party during which the crazy women who lived above me decided to lock themselves in the only lavatory. Here in this temperate forest at the end of a winter of record snow, fallen trees, broken branches and scraps of gray lichens litter the ground in places and all of it is damp from yesterday's rain and the weeks of melting snow. The mosses are coated with tiny drops of water, and among the soft moist green, thin brown stems rise, ending in tiny fruiting bodies. I get down on my knees to look closely and see that the little stems are in patches, that each little head has a wet sheen. When I rise and walk on my steps make no sound. The mosses are part of the silence here. I go on a cold cloudy afternoon to a place above Lookout Creek. I stood above the wild water, tumbling over rocks, rippling over hidden banks, rushing to get somewhere else. I am happy to hear the loud water music that drowns the possibility of bird song but also drowns an always sadness, and turns it to a mournful happiness that this life is

so short and yet so rich. Reefs of rounded stones and stacks of tree debris tell of even wilder waters that have rushed through here not long ago. On the opposite bank, across the gap of the creek, I can at last see the tops of some of the lichen covered giant Douglas firs and hemlocks that make up so much of this forest, many of them with the topmost branch dead. In front of them two huge old big leaf maples struggle to leaf out, their trunks and branches densely clothed in yellow moss, the angles lumpish with masses of it. A delicate alder's brown catkins show up against the green of cedar branches. The banks below with their bulging rocks are massed with brownish green – more moss in this mossy place.

After so much snow spring is late. The record is a littering of fallen trees, fallen branches, twiglets, Douglas fir sprigs, bits of hemlock branches, lots of torn lettuce lichens, matted strings of wiry hair lichens. They cover the rhododendrons not yet even thinking about flowering, the shiny leaves of salal and Oregon grape, the long fronds of sword ferns bent and broken from the snow, the moss covered logs and rocks, the cushioned mossy ground. Paths are all hidden with this years spring dementia - layers of materials on which new moss will grow. I stand watching the running water for some time. And I look around at the mayhem before noticing an enormous stump - so big, yet for the longest time I had not taken it in. This hidden stump speaks of a time when the trees here were even bigger, a time when the giants were logged. It is four feet high and out of it grows salal, ferns, mosses and ten or so hemlock seedlings less than six feet high. At the side of the engulfing mound of litter and moss rises a hemlock perhaps fifty feet high. Is it part of the original? A sprout from a living stump? Or are all these growths making use of the nutrients from the slowly decomposing mass. I pace around the circumference – sixty feet or so. Then I see everywhere the mounds that tell of logging long ago.

I emerge from the forest into a clearing and welcome the suggestion of sun. Yellow violas in patches, pink anemones scattered on the mossy ground with here and there some little purple spring queen flowers and more trillium lilies. The sorrel leaves are up and white buds coming. The first bleeding heart flowers show their drooping purples, patches of bright spring gold are sprouting up in warmer spots, monkey flowers sporting their own gold on damp rock faces. These first spring flowers that I miss in the deep forest renew me and I once more go into the mossy world, following the voice of a varied thrush, looking out for promised cougars, mindful always of mysterious shapes in the gloom.

How strange it is that while plants became so adept at living on dry land with their roots and waxy coatings, their veins and vessels, their symbionts and co-evolved flowers and insects, pollinators and dispersal agents, a niche remained for the lowly mosses. And side-by-side the large and complex modern plants share time and place with simple plants that lived a hundred million years before the first true flower. This forest is partly dependent on the mosses; they play an important ecological role here. They are epiphytes, growing on surfaces but taking nothing from them, for they take their nutrients from the chemicals in raindrops and when the mosses die they fall to decompose and provide nutrients for the other plants. Collectively these tiny plants create a giant sponge to intercept nutrients from the air, and over time the nutrients circulate throughout the forest landscape.

Each small moss plant seems so ephemeral yet each has its particular niche and needs. Nalini Nadkarni, who studies tree canopies and their epiphytes, found that when the mosses were removed from branches of trees here it took nearly twenty years to regain the same moss species. A slow succession of lichen, then green algae, and then different mosses preceded colonization by the species characteristically present. When I read this my perception of this delicate ecosystem changed. I hesitated to touch the mosses more, or to walk where there was no path. And I felt privileged to be here, to see, to feel, to let my mind wander in the moist landscape. Timeless is the word that comes first into my mind at the streamside and by all the old rotting logs. The slow changes of life here in this cool damp place, where the deepest forest is dark

