



Forests for the Future

Miyawaki Akira

Translated by
Tony Atkinson



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Produced by
Japan Phytotherapy Association and Sango Fund for Nature
Coexistence

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* Japanese names are shown with their family name first.

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Prologue:

What's It Like in a Thirty-year-old Hometown Forest?

Why I Plant Trees

My work as a plant ecologist has taken me throughout Japan and across the world, conducting field surveys and research activities for more than half a century. I've sought to identify those plants currently found on the land—known as the “actual vegetation”—and those plants that would be found on the land if human intervention were to entirely cease—known as the “potential natural vegetation.” In short, I have sought to survey and research the true nature of the indigenous forests of Japan.

People who've heard my name may simply regard me as an eccentric old man who plants trees. For me, however, planting trees is nothing more than an extension of my survey and research work, through which I was shocked to learn that indigenous forests were disappearing all over the world. However, simply complaining about the problem wouldn't have solved anything, so I used my position to promote the revival of indigenous forests wherever and whenever possible, and with the cooperation of my many colleagues, set out

on a life of forest creation. Through this practice, I've planted more than 40 million trees in more than 1,700 locations in Japan and overseas. I marked my 85th birthday in January 2013; I'm still going strong, and I still fly somewhere in the world almost every week. I wrote this book to convey to readers the "power of the forest" that I have experienced through my ongoing surveys, research, and practice.

In the spring of 2013, efforts to restore hometown forests (in Japanese, *furusato-no-mori*) to protect life will finally begin in earnest in the areas affected by the 2011 Great East Japan Earthquake and tsunami. I am fully committed to this endeavor through non-profit foundations such as the Great Forest Wall Project. Once you get serious, you can make anything happen.

Let's all work together to create hometown forests made of hometown trees (in Japanese, *furusato-no-mori ni yoru furusato-no-ki*) that will protect life. Whether you plant two, three, or five trees, you've created a forest in one form or another. Everyone should plant trees with their family, from small children to students, from busy working adults to senior citizens after the end of their working lives. Forty years ago, we came up with the unique idea of potted seedlings that can be easily planted by anyone, and it fills my heart with joy to watch these tiny little seedlings being carefully planted by tiny little hands.



Children planting trees at Yaegaki Shrine in Yamamoto-cho, Miyagi Prefecture.

Source: Report on a tree-planting festival, Tohoku Morinobouchoutei Association website (morinobouchoutei.com).

I once took my two young grandchildren, who were then living in the United States, to a tree-planting festival in Japan, on what turned out to be a dreary, rainy day. When they were about to return home after their summer vacation, my grandchildren told me that they'd had more fun at the tree-planting festival than at Disneyland.

We have also created hometown forests on the grounds of elementary schools and junior high schools, with students playing a leading role. They may have been reluctant at first, but when the work began, the children, their parents, and teachers all became enthusiastic about planting trees.

One of my most enduring memories is that of the tree-planting festival held in Shimane Prefecture, the aim of which was to

exterminate the *Yamata-no-orochi*, a mythical giant serpent with eight heads and tails. The festival attracted about 2,100 students from local elementary schools and junior high schools. Now, more than 60,000 trees have been planted in the prefecture's Hii River Basin 1,000-Year Forestation Project, which began in 2000 under the auspices of the Izumo River Office of the Chugoku Regional Construction Bureau (now the Chugoku Regional Development Bureau) of the then-Ministry of Construction (now the Ministry of Land, Infrastructure, Transport and Tourism). Like the rampaging *Yamata-no-orochi* serpent, flooding by the Hii River has devastated the Izumo region of Shimane Prefecture since ancient times. The ferocity of the river will now be tamed by the power of the forests planted by children. Those who take part in these tree-planting festivals, whether they plant ten trees or twenty trees, feel as if they are leaving something behind for posterity. Children especially remember planting these trees for a long, long time. They care about the growth of their trees. My grandchildren felt the same way, like these elementary school and junior high school students.

Planting trees also leaves an impression in the hearts of children. I've received many essays and letters from children saying things like, "I'm looking forward to growing up together with my little seedlings" or "I'm happy that my trees are growing so well." But it's not just children who remember the trees they planted. Even leading ecologists from overseas feel the same way. When they first

visit Japan, I always take them to a tree-planting festival and make them work up a sweat. Then, when they return to Japan three, five, or even eight years later, the first thing they say is “Hey, Miyawaki, let’s go see those trees we planted,” despite their busy schedules.

Once they plant trees, both adults and children become committed to monitoring their growth and nurturing them. The care of the trees that grow from these seedlings will be passed on to the next generation. Then, one hundred years from now, native forests that protect life will be firmly established all over the country.

While it’s known for its lush greenery, Japan is also prone to natural disasters. Typhoons and earthquakes are ever-present. In such times too, hometown forests will protect us, our families, friends, and life in all its forms from floods, landslides, fires, and tsunamis.

I ask this of anyone who’s ever planted a tree. Come and see your hometown forest five, ten, twenty, and even thirty years from now. I want you to hold not only a tree-planting festival, but also a hometown forest reunion; a “tree-care festival” if you like. A 30-year reunion, where you’ll walk through your own hometown forest after three decades of growth. A forest in the disaster-struck Tohoku region 30 years later.

What will that forest look like?

Let's Go into a Thirty-year-old Hometown Forest

What will a hometown forest look like after growing for 30 years? Let me take you on a tour, imagining what a hometown forest in the disaster-stricken Tohoku region will look like 30 years from now.

We have arrived at the place where we all sweated together to plant trees. A magnificent forest is now before us. The tallest tree that stands out is the *tabunoki*, a member of the laurel family (sometimes abbreviated to *tabu*; *Machilus thunbergii*). Do you remember how, holding tiny potted *tabunoki* seedlings in our hands, we all chanted the name three times in succession: “*tabunoki, tabunoki, tabunoki!*”? Do you remember the short but energetic man with the trademark big straw hat and Wellington boots? The *shirakashi* (*Quercus myrsinifolia*), *urajirogashi* (*Quercus salicina*), and *akagashi* (*Quercus acuta*) oaks and *sudajii* (*Castanopsis sieboldii*) trees that we planted while chanting “Mix ‘em up, mix ‘em up, mix ‘em up!” are all growing beautifully.

Natural forests are formed around the dominant trees of indigenous forests, consistent with the sum of the natural environmental factors. A dominant tree is the main tree species that dominates the canopy layer of a forest. In the evergreen broad-leaved forest zone of Japan stretching from the Pacific coast north of

Otsuchi in Kamihei-gun, Iwate Prefecture, to 800 meters above sea level west of the Kanto region, the dominant trees are canopy trees such as *shii* (Japanese chinquapin, known as the host of the *shiitake* mushroom; *Castanopsis cuspidata*), *tabunoki*, and *kashi* species (the oaks).

Looking more closely at the broad-leaved forest zone, we find *tabunoki* along the coast, *Castanopsis* species including *sudajii* (*Castanopsis sieboldii*) along the ridges, and *kojii* and *shii* inland, oak species such as *shirakashi* (*Quercus myrsinifolia*), *arakashi* (*Quercus glauca*), *urajirogashi* (*Quercus salicina*), *akagashi* (*Quercus acuta*), and *tsukubanegashi* (*Quercus petraea*) in the inland Kanto region, and *ichiigashi* (*Quercus gilva*) west of the Chubu region of central Japan. In addition to *tabunoki*, the *Amami arakashi* (*Quercus glauca* Thunb. var. *amamiana*) oak is found in Okinawa and the Amami Islands, and in the Kunigami Mountains in the northern part of Okinawa Island, the *Okinawa urajirogashi* (*Quercus miyagii*) oak grows in forests of *sudajii* (also known locally as *itajii*) that extend from the mainland.

Now let's go into the forest itself.

The forest is dimly lit because *tabunoki* and other canopy trees absorb the energy of the sun's rays. Growing even in this dim light are trees known as understory or sub-canopy trees such as the *mochinoki* (Japanese holly; *Ilex integra*), the *yabutsubaki* (Japanese camellia; *Camellia japonica*), and the *shirodamo*

(*Neolitsea sericea*, another member of the laurel family). The shrub layer features vigorous growth of *hisakaki* (*Eurya japonica*), *masaki* (*Euonymus japonica*), *aoki* (*Aucuba japonica*), and *yatsude* (*Fatsia japonica*), and nearer the coast, *tobera* (*Pittosporum tobira*), *sharimbai* (*Rhaphiolepis umbellata*), and *hamahisakaki* (*Eurya emarginata*). The sweet fragrance from the *tobera* flowers gently assails our senses. Herbaceous plants flourish underfoot, including *yabukoji* (*Ardisia japonica*) and *teikakazura* (*Trachelospermum asiaticum*), ferns such as *benishida* (*Dryopteris erythrosora*), *itachishida* (*Dryopteris bissetiana*), *yaburan* (*Liriope platyphylla*), and *janohige* (*Ophiopogon japonicus*).

Sub-canopy trees and shrubs in tall forests are generally considered to be shade-tolerant, flourishing in the diffuse light filtering through from the canopy tree layer. From the top down, a natural forest is composed of a canopy layer, a sub-canopy tree layer, a shrub layer, a herbaceous (underbrush) layer, and in some places, a moss layer, altogether forming a vertical green wall.

When plants are small, they coexist in accordance with the relationship known as the competition-density effect. As they grow taller, however, they face the pressures of natural selection and form a multi-layered forest by vertically separating into canopy and sub-canopy tree layers, and a shrub layer, according to the characteristics of each species. Trees eliminated by natural selection

are slowly decomposed by soil organisms on the forest floor to become nutrients that help the trees grow.

Absolutely nothing in nature is wasted.

You may even meet the guards of the forest greenery, adjacent to open spaces such as the water's edge and grasslands. The so-called mantle community covers the edge of the forest like a skirt and includes shrubs such as *kibushi* (*Stachyurus praecox*) and *utsugi* (*Deutzia crenata*), and vines including *ebizuru* (*Vitis ficifolia* var. *lobata*), *kudzu* (*Pueraria montana* var. *lobata*), and *tsuruumemodoki* (*Celastrus orbiculatus*). Beyond this area is a narrow strip of plants known as the fringe community, which includes the herbs *yabujirami* (*Torilis japonica*) and *yaemugura* (*Galium spurium* var. *echinospermon*). Sudden strong winds and light can dry out the forest floor, placing the forest under stress. To prevent this from happening, forests are surrounded by a protective zone composed of these mantle and fringe communities. At first glance, these plants and trees appear plain and unassuming, but they play a key role in protecting the forest. Like a scab that develops when a human is injured, these communities play key roles in protecting the forest from harm. This is the horizontal dimension of the forest system.

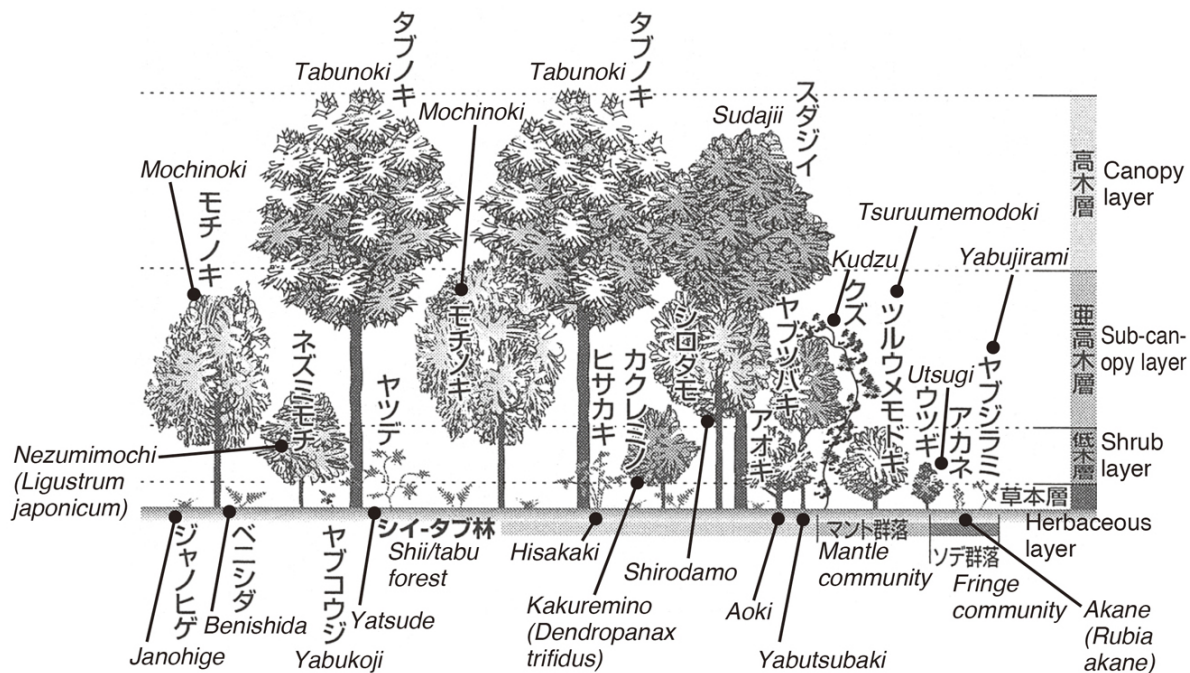
There is a German proverb that reads, "There is another forest beneath the forest," which means that it is the forest below, with its seemingly intrusive undergrowth and shrubs, that supports

the lush forest above. A plant society is the same as human society. If a leader is authentic, their followers will also be authentic, and if a lead actor is authentic, the supporting cast members will also be authentic. Authenticity lasts a long time. It's something that withstands any natural disaster and survives, protecting life in all its forms. Indigenous forests can endure a harsh environment and last for a long time when authentic plants compete, endure, and coexist with each other. Through their long evolutionary history, natural forests have become multi-layered, both vertically and horizontally, giving them the capacity to repair themselves, just like humans.

In Japan, the *Chinju-no-mori*, or sacred shrine forest, symbolizes the indigenous forest of an area. The interior of the *Chinju-no-mori* is quiet and dignified, which is why it has long been considered a place where the gods dwell and descend to Earth, and where punishment will follow its disturbance. It was considered a sanctuary, into which people did not enter without permission. This purposeful quarantining of the *Chinju-no-mori* forest allowed the maintenance of a distinctly hierarchical, multi-layered community that has been largely unaffected by human activity.

Compared to a single-layered community of plants such as a lawn, a multi-layered forest has as much as 30 times more green surface area, and therefore, in addition to environmental protection functions such as noise insulation, dustproofing, water purification, air purification, water catchment recharge, and carbon absorption

and fixation, it also has diverse disaster mitigation functions such as wind protection, tidal protection, and slope conservation.



A healthy evergreen, broad-leaved forest.

Source: *Thirty Million Seedlings: Creating Forests for Life* [in Japanese] NHK, 2006.

A Cyclic System Created by the Sole Producers

Look, there's a beetle! And you can see other small animals! The floor of a hometown forest is a carpet of rolling acorns. It's a forest rich in biodiversity that protects life in all its forms. The dominant trees of evergreen broad-leaved forests (*shii* and *kashi* oaks) and those of deciduous (summergreen) broad-leaved forests (*buna* beech [*Fagus crenata*], *mizunara* [*Quercus crispula*] and *kashiwa*

[*Quercus dentata*] oaks) also produce acorns, the favorite food of wild animals such as boars, bears, and squirrels. Our hometown forests are sometimes known as “acorn forests” and include species such as the *tabunoki*, the seeds of which are carried by wild birds and other animals in their fleshy berries.

A forest with a well-balanced natural environment is home to a variety of living things ranging from microbes, insects, and soil organisms to reptiles, birds, mammals, and fish in its streams. All animals survive on the organic matter created solely by plants, and their carcasses and excrement are taken up and decomposed by rotifers, ants, earthworms, and mites that live on the ground and in the soil. They are further reduced to minerals by a myriad of microorganisms, including molds and bacteria. The dissolved minerals in water are absorbed by plants through their roots via the process of osmotic pressure and reused for their growth. On the other hand, the organic components of the rich humus produced by our bountiful forests, home to a wide variety of living things, flow into the ocean via rivers, supporting the marine ecosystem.

Forests are the basis of the cycle that protects life. They are the sole producers in a material cycle and ecosystem of production, consumption, decomposition, and reconstitution that extends from the local to the global scale. No matter how much we humans try to flatter ourselves, we are very weak players who can only survive within the boundaries of this cyclic system. We are simply being kept

alive as consumers reliant on plant life. The forest is not a chatterbox like us humans. It doesn't try to explain itself. Still, there is no doubt that plants are the only producers on the planet. Only when there is a sustainable supply of materials of plant origin can we humans and other animals survive.

Forests that Protect Life in All its Forms

Forests are the source of life. Forests are full of the vitality of life. They are communities that can maintain a dynamic equilibrium to staunchly defend against natural disasters such as fires, typhoons, floods, earthquakes, and tsunamis. Moreover, evergreen broad-leaved forests, such as those composed of the *shii*, *tabu*, and *kashi*, have thick leaves, high moisture content, and dense foliage. Thus, they serve as a fire mitigation mechanism to prevent fires and stop them from spreading. In the great fire that broke out in Sakata City, Yamagata Prefecture, in October 1976 (known as the Great Sakata Fire), two *tabunoki* trees planted in the grove surrounding the old Honma family compound helped stop the fire from spreading to the compound, leading to the saying, "One *tabunoki* tree is worth one fire truck."

The roots of evergreen broad-leaved forests penetrate deep into the soil with their taproots and have a network of rootlets that spread widely, so they firmly grip the soil and do not topple over,

even in the face of typhoons, earthquakes, or tsunamis. Beneath this hometown forest before us is rubble and debris filled with the memories of those who died in the Great East Japan Earthquake and tsunami. The roots will already be gripping the debris in the soil, which should make them even stronger.

Hometown forests are authentic forests; multi-layered forests; indigenous forests made of potential natural vegetation; forests that protect life in all its forms; and forests that are long-lasting. They are forests that can survive for one hundred or one thousand years without human intervention.

A fresh breeze is blowing. Green leaves are shining and swaying in the breeze. Birds are singing. Listen to the subtle signs of nature; you'll sense the importance, transience, harshness, and grandeur of life. Thirty years from now, hometown forests will teach us that being alive now is the most important thing in this world.

Chapter 1

The Forest that was the Site of My First Encounter



The *Chinju-no-mori* forest at Onzaki-san Shrine (also known as Nakano Shrine).

The *Chinju-no-mori* Forest at Onzaki-san Shrine

In the summer of 1960, as I was nearing the end of my second year in Germany, I received an international telegram from the Dean of the Faculty of Arts and Sciences at Yokohama National University. I was a member of the Department of Biology there, but since research assistants are also members of the teaching faculty, they are required to take leave if they're going to be absent for more than two years. Ominously, the telegram read, "You must return to Japan in October."

At that time, I was being trained intensively in the fields of phytosociology (plant sociology) and potential natural vegetation under Professor Reinhold Tüxen, the director of the German Federal Institute for Vegetation Mapping. Professor Tüxen was an analytical chemist who had majored in organic chemistry at the University of Heidelberg and later studied under Dr. Josias Braun-Blanquet, the founder of phytosociology. He had just published the concept of *potential natural vegetation*: the third type of vegetation after *original vegetation* (i.e., vegetation immediately prior to human influence) and *actual vegetation* (i.e., vegetation after humans have changed it, which we see today).

Professor Tüxen had told me that I'd need to study under him for at least three years to acquire the ability to recognize potential natural vegetation, which I was initially prepared to do, of course. However, when I received that telegram from Japan, I began to miss my home country inexplicably. I wanted to return as soon as

possible, but when I timidly approached Professor Tüxen with my dilemma, he told me, "If you return to Japan now, you'll go nowhere. My name will be mud if you're known as one of my students." He reiterated that I should study in Germany for at least another year. Notwithstanding his stern words, I was still eager to go home. Ultimately, I promised to come back to Germany within three years, and so I returned to Japan. I kept my promise, visiting my mentor 21 times before his death in May 1980.

My mind was full of questions before coming back to Japan. How could the concept of potential natural vegetation that I learned from Professor Tüxen be applied in Japan? Where was the potential natural vegetation in Japan? Did I have the correct insight to answer these questions? I was racked with anxiety. My nights were sleepless.

One night in Germany, just before I was due to return home, I had a strange dream about my hometown. I could see our town's annual festival held at the end of November each year. The *Chinju-no-mori* forest that was the setting for the festival came to life in my dream. That forest was where it all began for me. The hometown forest where I had played with my friends in our childhood. A forest of repose for the memories of our brothers who died in battle.

On January 29, 1928, I was born in a farmhouse in Nakano, Fukiya-cho, Kawakami-gun, Okayama Prefecture (now Nariwa-cho, Takahashi City), the fourth son of six children, all boys. Nakano was

a farming village high up on the Kibi Plateau, 400 meters above sea level. I did have one sister, but she died of illness when I was very young. I was also frail as a small child, and at the age of three, I had spinal tuberculosis and later, kidney problems. This meant I spent more time gazing idly out of the upstairs window of my house than playing outside. The common sight of farmers weeding their fields made me realize how hard they had to work and later inspired me to study weed ecology.

When I was about four years old, I went out one day with my father to cut hay on the mountain. We rode on the back of a cow, making our way through the morning dew. On the way home, I hit my forehead on the branch of a persimmon tree and fell—not from a horse like most people, but from a cow! I was seriously injured, with a permanent scar on my forehead. Was it because of that scar that I wasn't popular with girls?

The forest where it all began for me was about 200 meters along the ridge from my house. This was the *Chinju-no-mori* forest of the township shrine of Onzaki (now Nakano Shrine), which the locals affectionately called Onzaki-san. At the end of each November, Onzaki-san has its annual autumn festival. The shrine was usually unstaffed, but this day is special. I always looked forward to eating seasonal raw fish such as yellowtail sashimi and vinegared octopus at the festival. There was no refrigeration at the time of course, and during the summer we could only eat dried bonito flakes and dried

sardines. It was an era when everyone longed for unsalted, fresh seafood.

At midnight after the end of the banquet dinner, a *kagura* ceremonial dance performance is held in the shrine, decorated with a red and white curtain. The *kagura*, including the dance of the deity *Sarutahiko*, the throwing of rice cakes by *Daikoku-sama*, and the extermination of the serpent *Yamata-no-orochi* by the god *Susano'o-no-mikoto*, were the same every year, and the performance continues until 4:30 or 5 o'clock in the morning. I later learned that this performance known as the *Bicchu Kagura* has now been designated an Important Intangible Folk Cultural Property in Japan. One year, after the *kagura* was over, I was lying under a large tree on the grounds of the shrine and looking up at the sky. The thick branches floated in the inky blackness against the still-dim sky, and the biting cold air was striking. I felt my young body would be engulfed by it.

Far away in a foreign land, this scene suddenly reappeared in my dream, and I had an epiphany: "Perhaps that tree at Onzaki-san is the dominant tree of the potential natural vegetation in my hometown, in the southern mountainous area of the Chugoku region, around 400 meters above sea level."

That *Chinju-no-mori* must no doubt be one of the forests of ancient Japan.

Inspired and excited by this realization, my whole body shuddered. That was the moment of my first encounter with the true forests of Japan. After returning to Japan, I rushed to my hometown of Nakano, and found that these trees were *akagashi* and *urajirogashi* oaks (*Quercus acuta* and *Quercus salicina*), the dominant trees of the potential natural vegetation in the mountains of Okayama Prefecture and other parts of the Chugoku region.

Until I'd studied in Germany, I was only interested in weeds. After returning to Japan, however, I began a series of exhaustive field surveys of vegetation in sites where the original hometown forests made of hometown trees remained: *Chinju-no-mori* forests in shrines, woodlands surrounding old residences, and remnant forests on steep, inaccessible slopes throughout the country.

My Obsession with *Tabunoki*

Of all the dominant trees in hometown forests, I am particularly attached to the *tabunoki* (*Machilus thunbergii*). My students used to tease me that I couldn't help smiling whenever I saw a *tabunoki*. They sometimes said, "When you think of Professor Miyawaki, you think of the *tabunoki*, and when you think of the *tabunoki*, you think of Professor Miyawaki." The *tabunoki* that was the trigger for this obsession stood silently in the place where a *Chinju-no-mori* had once been.

In 1949, four years after the atomic bomb was dropped on Hiroshima, I entered the Department of Botany in the former Hiroshima University of Literature and Science (now Hiroshima University's Faculty of Science), not far from my hometown. This is where I began studying weed ecology in earnest.

Around a 2-kilometer radius of the hypocenter of the atomic bombing in Hiroshima, reddish-brown debris still littered the earth, and there were no trees in sight. People believed that nothing would grow in the area for the next 100 years. One day in mid-May, my research took me to a shrine about a kilometer from the hypocenter. Three devastated *tabunoki* trees reached plaintively up into the sky, their branches and leaves withered into bleached sticks, at the spot where the *Chinju-no-mori* used to be. As I walked around the site, I suddenly saw a light red shoot distinctive to *tabunoki* sprouting from the base of one of the trunks. It had a subtle beauty: shiny and glossy like the feathers of a crested ibis. I vividly remember wondering why only the *tabunoki* was regenerating, and at the same time, being moved by its strong vitality, along with the color of its new shoot. By the time I had graduated three years later, the new shoot had grown to three meters in height.

After conducting systematic field surveys of vegetation throughout Japan, I discovered that the *tabunoki*, though unassuming and inconspicuous, is the dominant tree of the hometown forests of Japan and has been revered and respected by

the Japanese people as the guardian deity of the *Chinju-no-mori* since ancient times.



A new tabunoki shoot.

In the spring of 1975, Ikeda Yasaburo, then a professor at Keio University and a prominent scholar of Japanese literature and folklore, visited my laboratory. He asked, “The frontispiece of the magnum opus written by my mentor, Professor Orikuchi Shinobu, ‘The Ancient Study—*Kodai Kenkyu*,’ includes a photograph of a magnificent, large *tabunoki* tree on the Noto Peninsula in Ishikawa Prefecture. However, there’s no explanation for why this tree was

chosen, and I'd really like to know what you can tell me about its significance."

The great folklorist Professor Orikuchi Shinobu also appeared to be deeply interested in *tabunoki*. I told him, "The *tabunoki* is the source of Japan's evergreen forest culture." I added, "*Tabunoki* grew wild in areas with excellent soil conditions, so they became victims of human development, destroyed to make way for rice paddies, fields, and human settlements. Today, *tabunoki* are found in only a limited number of locations: *Chinju-no-mori*, woodlands surrounding old residences, and in forests on steep, inaccessible slopes."

Professor Ikeda was so moved by the deep connection between the *tabunoki* and Japanese culture that on March 7, 1980, he used part of his retirement allowance to plant a grove of *tabunoki* seedlings on a hill outside the Department of Japanese Literature on Keio University's Mita Campus in Tokyo. I was also able to help him bring this project to fruition. A monument describing the "Origin of the *Tabunoki* Forest" has been erected on the Mita Campus to describe the history of the project.

To See that Which is Hidden

I learned about potential natural vegetation from Professor Tüxen in Germany, and just before returning to Japan, I had a dream in which

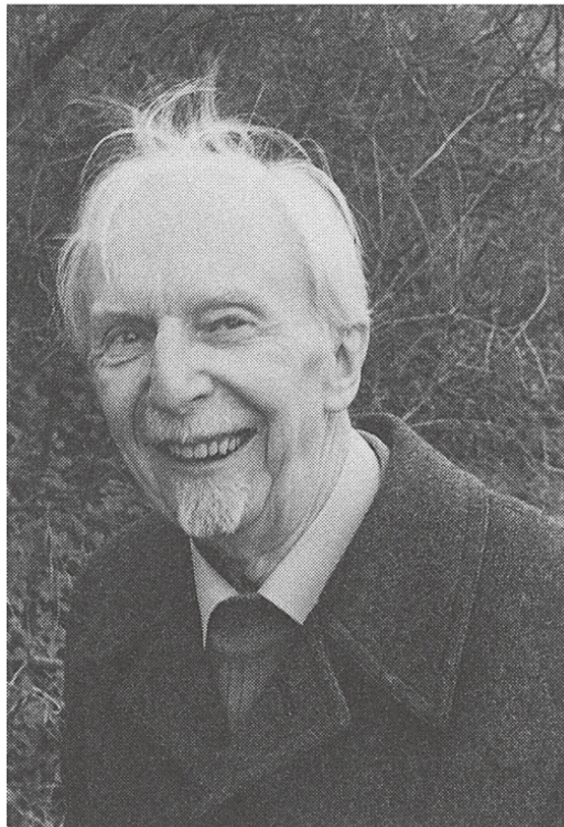
I encountered the *Chinju-no-mori* of my hometown. It also brought back memories of the growing shoots of the *tabunoki* tree in the *Chinju-no-mori* on the site of the Hiroshima atomic bombing. I discovered the potential natural vegetation of Japan in the *Chinju-no-mori* forest, and at that time, I think I already had a vague idea of creating “hometown forests made of hometown trees,” with the *tabunoki* as the dominant tree species.

On one occasion, Professor Tüxen noted to me that many young people try to see only what is superficially visible, and what they do see is only a small part of the picture. He stressed that we should develop the ability to see that which is hidden. To do this, we must go out in the field and use all our senses: to see, smell, lick, touch, and investigate. He said that I have that ability.

Since then, I have remained more committed to fieldwork than ever before, desperately trying to see what is hidden. I strived to develop the ability to recognize that which is authentic. I listened intently to the faint signs of nature. Then you can see the whole that is hidden. Gradually, the substance underneath the surface comes into view. In order to interpret the unseen whole, our focus of interest is not only the forest but also human society. Even now, my life revolves around fieldwork, fieldwork, and more fieldwork.

In May 1980, when I visited Professor Tüxen on his sickbed just before he passed away, he held my hand as best he could with his emaciated hand, smiled, and gave me his last words, “The

phytosociology for which Braun-Blanquet sowed the seeds has grown. I raised these seeds to form a trunk that is the vegetation map. And now that trunk is beginning to bear fruit in Japan with your development of an authentic forest restoration project.” It was Professor Tüxen who had seen my potential, believed in me and regarded me more highly than any other, and followed my progress closely until the end.



Professor Reinhold Tüxen.

Chapter 2

It All Began with Weeds

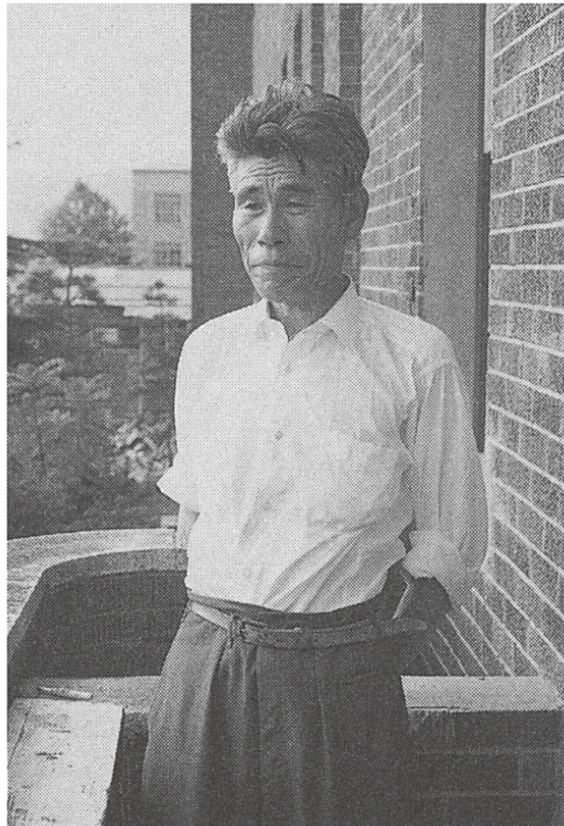


Field survey of weeds, 1956. The author is on the left, and his student assistant on the right is sitting on a sample container.

Two Mentors Thanks to Weeds

My fieldwork-oriented approach was cultivated even before I studied in Germany. The teacher who first inspired me this way was Professor Horikawa Yoshio at the Hiroshima University of Literature

and Science. Professor Horikawa specialized in the taxonomy of mosses and at the same time pursued research into plant ecogeography. He published a major series in English, *Atlas of the Japanese Flora* (1972—76), an internationally acclaimed work based on field surveys of the distribution of plants in various regions of the Japanese archipelago. His students learned about taxonomy and plant ecogeography, Professor Horikawa's way of life, and how to conduct field research. After graduation, they spread their wings as field-oriented researchers, and of course, I was among them.



Professor Horikawa Yoshio.

The title of my graduation thesis at the Hiroshima University of Literature and Science was "A Study of Weed Communities by Raunkiaer's Classification of Life Forms," and my thesis adviser was Professor Horikawa. On New Year's Day near the end of my second year of studies, I visited him at his home and was treated to *zoni*, a traditional Japanese soup eaten on this special day. He asked, "Akira, it's time for you to decide on your graduation thesis. What topic will you choose?" Without hesitation, I replied, "Weed ecology." However, his response went something like this.

"Weeds, eh? Well, yes, they're important, all right. However, take my advice, Miyawaki. If you stick to weed ecology, you'll languish in obscurity your whole life, and no one will take any notice of you. But, if you're willing to dedicate your life to it, go ahead."

Professor Horikawa's advice was spot on. Weeds weren't taken seriously by anyone in the academic world at that time. However, it's thanks to weeds that I have been blessed with two mentors, Professor Horikawa and Professor Reinhold Tüxen.

Wearing Two Hats in Tokyo

I was thinking about going back to my hometown to become a junior high school teacher after graduating from college because I'd already spent a year as a biology and English teacher at my alma mater, Niimi Agricultural High School, between graduating from

Tokyo College of Agriculture and Forestry (now Tokyo University of Agriculture and Technology) and entering Hiroshima University of Literature and Science.

However, Professor Fukuda Yasona, then head of plant physiology in the Department of Biology at the Hiroshima University of Literature and Science, unexpectedly called me and advised me to go to the University of Tokyo before returning home. I walked through the famous *Akamon* red gate to the Department of Botany in the Faculty of Science at the university. Waiting there for me was Professor Ogura Yuzuru of the University of Tokyo, who was then president of the Botanical Society of Japan. Widely known for his contributions to the establishment and development of the disciplines of plant morphology and plant anatomy, he had a proposal for me to study there.

I passed an oral examination and was accepted into the Graduate School of the University of Tokyo. I started working in a laboratory that specialized in plant morphology, when about a month later, Professor Horikawa told me that the faculty of Yokohama National University had decided to hire me as a teaching assistant (under the auspices of the Department of Education) in the Faculty of Literature and Science, so I should transfer there. I couldn't make up my mind. Professor Ogura also told me that I should continue my studies, because I would easily be able to become an assistant researcher or assistant professor at an institution at any time. But I

also appreciated the regular monthly income that would come with being a teaching assistant.

After more discussion, it was decided that I would attend the University of Tokyo Graduate School and Yokohama National University three days a week each. Because it wasn't possible to be simultaneously both a graduate student at a national government institution and a teaching assistant employed by the Department of Education, my status as a graduate student at the University of Tokyo was switched to that of a research student.

Fieldwork, Fieldwork, and More Fieldwork

I thus began a double life as a research student at the University of Tokyo and teaching assistant at Yokohama National University. Although I was supposed to attend each institution three days a week, I only spent about one-third of the year at the two campuses combined. What did I do for the other two-thirds of the year? It was all fieldwork, fieldwork, and more fieldwork.

I first embarked on serious fieldwork to investigate the ecology of weeds in the spring of 1952. I spent 60 days in each of the four seasons, for a total of 240 days per year, in onsite ecological field surveys of weeds. My four trips a year involved visiting about 120 locations throughout Japan, from Hokkaido in the north to Kyushu in the south, a life I lived for six years. In other words, I was

engaged in fieldwork, fieldwork, and more fieldwork for a total of 1,440 days over six years! I measured and documented each type of vegetation in rice paddies, fields, and farm roads, roaming around Japan with a tin sample container on my back to hold the plants I collected.

The university didn't pay for any of my research activities, so I travelled rough. I went by ordinary slow trains or overnight sleepers, and either camped out in the open or bedded down on the trains. Isshi Haruo, author of *Go into the Forest of Souls* (Shincho Bunko) and Miyawaki Akira's *Endless Struggle* (Shueisha International), both of which feature me as the central character, wrote that I was "what can only be described as insane" at the time. Certainly, from our current perspective, those days must seem totally bizarre.

However, I never once wanted to quit because of the difficulties. Looking back now, I recognize that those days were fulfilling and gave me a sense of purpose in life. My spirits were bolstered by the words of encouragement from Professor Horikawa, who, when I submitted my proposal for "60-day round-Japan weed survey trips" in spring, summer, fall, and winter, said, "Hey, Miyawaki, if anyone can do it, you can! Because I'm doing it myself too."

A Letter from Professor Tüxen

During my life dominated by fieldwork, fieldwork, and more fieldwork, I submitted an article in German to the international botanical journal *The Botanical Magazine* entitled "Morphological Investigation of the Roots of Three Species of *Erigeron*." This paper caught the attention of Professor Reinhold Tüxen, who wrote an airmail letter to me that arrived in May 1957. The letter read:

"Weeds are plant communities at the forefront of human activity and nature. They pose the sharpest point of conflict between increased human activity and plants. It is a critically important research topic, not only for fruit trees and crops, but also for the relationship between humans and nature, and as a basis for nature conservation and environmental issues in the future. Come and join me in my research!"

An invitation to study in Germany, the home of plant ecology! An offer completely out of the blue! However, my monthly salary as a teaching assistant at Yokohama National University was only 9,000 yen. A return airfare to Germany at that time was 450,000 yen, so financially it looked like a pipe dream.

Still, I didn't want to totally abandon the idea. Professor Tüxen encouraged me to apply for the Humboldt Foundation's research scholarship program. However, although I could read and write German, I couldn't speak the language well and my listening ability was non-existent, so I failed the oral exam the first time by

repeatedly giving inappropriate answers. I did, however, pass on my second try.

I was desperate to study in Germany, whatever it took, so I enrolled in German classes. The lessons cost 7,000 yen per month. Deducting this amount from my monthly wage of 9,000 yen left only 2,000 yen for living expenses. On top of this, I was now married, so it must have been very rough for my wife, Haru.

Marrying Haru

It was during my studies at Hiroshima University of Literature and Science that I met my future wife Haru, the eldest daughter of a sake brewer in Kitsuki City, Oita Prefecture. She was a student at high school at the time, after which she returned to her parents' home and enrolled in a local junior college. How did I meet her again? I'm a little embarrassed to admit it, but it was also thanks to weeds.

For most of my weed-hunting trips around Japan for 60 days in each of the four seasons, I camped outdoors or bedded down on trains. I was only able to sleep under a roof for a few days on each trip. I'd search through the alumni directory of the Hiroshima University of Literature and Science, then send letters to complete strangers, my seniors, asking if I could stay in their homes. It's also a real treat to eat good food when you're on a field trip in such

straitened circumstances. When I was thinking about where to find good places to stay in Oita Prefecture, I immediately thought of Haru. And that's how it came to be. Four times a year, I visited Haru's home for meals, accompanied by my assistant, the research student Toyama Mikio (later, a professor at Yokohama National University) and was treated to good meals.

Haru and I were married on March 17, 1956, at the Hotel Chinzanso in Tokyo. Professor Ogura Yuzuru and Mrs. Ogura served as the traditional matchmakers. Our honeymoon destination was the Kii Peninsula, and as you might expect, I took the opportunity to do a field vegetation survey there.

Our first son was born on August 15, 1958. I saw him only for a brief moment one night at Haru's family home in Oita, on my way back from the University of the Ryukyus, where I was an invited professor at the time. The neighborhood wondered, "He isn't fulfilling his role as a father at all. He's not human!" About a month later, I would leave for Germany.

Again, I'm embarrassed to admit this, but when I returned to Japan from Germany, I was too busy to contact Haru or her family straightaway to let them know I was back. It must have been about a week after landing in Tokyo. I'd come back much later than the date specified in my official travel documents, so I was staying at my eldest brother's house in Nerima, Tokyo, having to write a letter of explanation and complete other necessary administrative

procedures. Then the telephone rang. It was Haru's father, who had decided to call my brother because he thought I'd be back from Germany soon. But it was me who picked up the phone, not my brother, resulting in an uncomfortable situation to say the least. Surprised, my father-in-law hastily handed the phone to Haru. In the awkward atmosphere that followed, all I heard from the receiver was Haru's icy "Welcome home, dear." I couldn't find the words to reply.

I was utterly dedicated to research. If there was a contest to decide the "man who doesn't care about his family," I would be the runaway winner. I was neither a good husband nor a good father. I don't even remember showing up for "take your child to school day," sports meetings, or school plays. At some point, Haru came to treat me with a sense of resignation.

Studying in Germany

There were some emotions I felt before studying in Germany that I'll never ever forget. Professor Ogura had called me and said, "I've been talking to my wife about your predicament, and we've decided to take some money out of the bank for you to study in Germany." He told me, "Don't worry about the money; just go."

Of course, I couldn't take Professor Ogura up on his kind offer. Still, I was full of gratitude for his generous gesture.

I left for Germany on September 28, 1958. It was the day after the Kanogawa Typhoon had devastated the Izu Peninsula and the Kanto region. I was just 30 years old. For a little more than two years from that day, and intermittently thereafter during my trips to Germany, I was thoroughly trained in the theory and fieldwork of phytosociology and potential natural vegetation by Professor Tüxen, then director of the German Federal Institute for Vegetation Mapping.

I arrived in Bremen, Germany after a series of flights, and went to my first meeting with Professor Tüxen. He had a dignified air about him, like a Teutonic warrior. On seeing me, he said in German, "I've seen Japanese people from a distance at an international conference some years ago, but this is the first time I have seen one up close like this," and pulled out a book from the 23-volume set of the Brockhaus Encyclopedia on his bookshelf. He opened it to the *Japaner* entry and read it out loud.

"A subspecies of the Mongolian people. Small in stature, with protruding cheekbones, black eyes, and black hair."

Then, looking at me, he chuckled and said, "You know what? You fit the description; you are truly Japanese."

The next day, my life of specialized training under Professor Tüxen began. He also prioritized fieldwork above all else. In Germany, as it was in Japan, it was fieldwork, fieldwork, and more fieldwork from morning until night. Professor Tüxen was especially

obsessed with soil profiles. We dug holes all day long to ascertain soil profiles, without respite. I learned that a soil profile can tell us whether the potential natural vegetation is a *mizunara* (*Quercus crispula*) – *buna* (*Fagus crenata*) association or *shirakamba* (*Betula platyphylla*) – *mizunara* association.

The phytosociological research methods I learned from Professor Tüxen were truly precise, objective, and comprehensive methods of vegetation survey and analysis, totally different from the literature-dependent “learning by imitation” research methods used in Japan. I was able to learn objective research methods based on a fundamental view of nature and vegetation to a level that I wouldn’t have been able to attain if I had studied in Japan for 20 or 30 years.

However, as you might expect, I grew weary of digging holes day after day to examine the soil profiles of the vegetation survey sites. There were times when I couldn’t stand putting up with so much “fieldwork, fieldwork, and more fieldwork” in Germany. One day, I plucked up my courage and declared, “I want to study a little more scientifically. I want to listen to lectures by renowned professors. I also want to read papers.”

How do you think Professor Tüxen responded? He fixed me with his gaze and began to speak.

“It’s too soon for you to listen to what others have to say. You might be hearing second- or third-hand information. You shouldn’t read books yet. What you find there could be just a copy of what

someone else wrote. You'll have time for listening to others; you'll have time for reading books. The important thing is not to get caught up in half-baked answers or conclusions in lectures or books."

He continued. "Look at the Earth. Look at nature. The drama of real life is unfolding before our eyes." He was right. His words came tumbling out. "What you need to do is to get out in the field and use your body as your instrument—see it with your eyes, smell it, taste it, feel it, and examine it." This was the moment when Professor Tüxen's philosophy of fieldwork was instilled into my entire being.

A Decade of Turning Crisis into Opportunity and Misfortune into Happiness

It was the late fall of 1960 when I returned to Japan after completing my studies in Germany. The substance of my fieldwork-oriented approach had also changed dramatically. I had gained a strong focus on potential natural vegetation and "the ability to see the unseen." I set my mind to "see the unseen," transforming my life as a researcher. The way I looked at the forest changed dramatically.

However, these ideas were not taken seriously by anyone in Japan at the time. The concept of vegetation, which is now common knowledge, was almost unknown in Japanese academia. I was criticized for being too influenced by German thinking. Days and

weeks went by without any local recognition. Looking back now though, the ten years after returning to Japan were probably the most fulfilling of my life because every crisis can be turned into an opportunity, and misfortune turned into happiness. It was a decade in which I learned how to overcome multiple crises and turn them into opportunities.

So, what on earth was I doing during the 1960s? As you might have guessed, it was fieldwork, fieldwork, and more fieldwork. Fortunately, about 20 young researchers fresh out of university had gathered from all over the country to work with the German-obsessed Miyawaki. They came to me of their own free will at a time when I wasn't even qualified to award them degrees. Together, we again undertook a series of exhaustive field vegetation surveys across Japan, carrying rice balls for our nourishment. These surveys revealed that indigenous forests have been largely destroyed and transformed in Japan, as they have in European countries and China. This meant that as an effect of human activity, secondary vegetation had been planted, consisting of naturalized plants, sun-loving pioneer plants, or trees unsuitable for the habitat.

You may think there's a lot of greenery in Japan today, and in fact, forests in Japan are the most abundant they have been since the Edo period (1603–1867). However, most of them are far removed from the original indigenous plants of their habitats; that is, the potential natural vegetation. Almost all the actual vegetation is

secondary vegetation or replacement communities that have been altered by the effects of various human activities. Just as someone can look completely different with makeup and clothing, most of the greenery you see today has been dressed up with a thick veneer of human activity. The harsh reality of this situation was clearly illustrated by the *Vegetation of Japan*, the series of books that I worked on later.

Chapter 3

The Truth about Japan's Forests



The author with the completed 10-volume *Vegetation of Japan* in 1989.

What is Phytosociology?

I'd like to briefly explain the terms phytosociology and potential natural vegetation. As I mentioned earlier, the concept of potential

natural vegetation was first proposed by Professor Tüxen. He studied under Swiss-born Dr. Josias Braun-Blanquet, who established the study of phytosociology with his book *Pflanzensoziologie* (1928), classifying and systematizing seemingly disparate plant communities, and enabling vegetation types to be compared on a global scale.

The plants that cover the surface of the earth are collectively called vegetation, or the plant community. Just as human society is to some extent organized by kinship, plant phylogenetics (plant taxonomy) is systematized by individual genetic characteristics and morphology. It is also possible to systematize plant populations by combining species that grow in nearly the same environment, just as human societies can be grouped by their social relationships, such as the relationships found in their workplace or in their living environment. Until then, the description of the green component of nature, what we call vegetation, was determined by the dominant species; for example, a forest with many *akamatsu* (*Pinus densiflora*) trees was called an *akamatsu* community, and a *susuki* (*Miscanthus sinensis*) grassland was called a *susuki* community. However, the members of the same dominant species community may vary from place to place. Therefore, it became necessary to determine and systematize comparable community units from a regional to a global scale by more objectively combining the species that comprise each community. As if to answer the call, Dr. Braun-Blanquet appeared on the scene.

Let's look specifically at Dr. Braun-Blanquet's phytosociological methods. The first step involves surveying the approximate community of each vegetation species in the field. We set up a study area where the population is homogeneous, determine all the plant species and their quantitative measures (cover and sociability) within the study area using square frames known as quadrats, and create a vegetation survey form—we can think of it as a green “family album”—with information about the surrounding site conditions, location, and elevation above sea level.



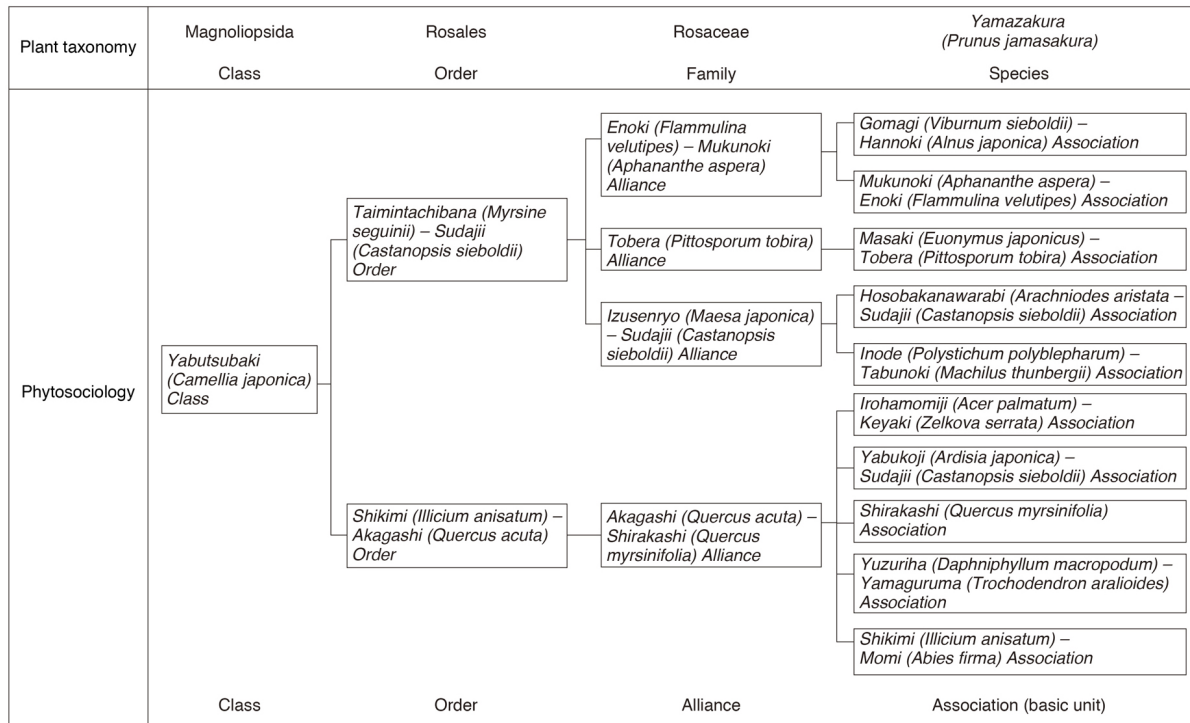
Dr. and Mrs. Blanquet and Professor and Mrs. Tüxen at Dr. Blanquet's laboratory in Montpellier, France, June 1959.

Data from numerous vegetation surveys are compiled into a community table, and community units are first determined by comparing the individual species and combinations of species present. By comparing individual local community tables with those of neighboring communities and existing community tables, we can systematize the basic unit of plant phylogenetic taxonomy, which corresponds to species, into larger units such as associations, alliances, orders, and classes, thereby enabling vegetation to be

objectively compared on a scale that ranges from regional to global. Dr. Braun-Blanquet's phytosociological criteria for classification and systematization of plant communities into categories from Association to Class are still the best and most widely used on the international scene.



Yabutsubaki (Camellia japonica)



Correspondence between phytosociological and plant taxonomic systems.

Source: *Midori Kaifuku no Shohosen* [Prescription for Restoration of Green Environments] [in Japanese] Asahi Sensho (1991)

Japanese evergreen broad-leaved forests, for example, are dominated by *shii*, *tabunoki*, and *kashi* tree species, commonly called *shiinoki* forests, *tabunoki* forests, and various types of *kashi* oak forests, depending on the dominant species in the canopy layer that characterizes the forest. *Yabutsubaki* (*Camellia japonica*) is a typical sub-canopy tree, and *masaki* (*Euonymus japonicus*) and *hisakaki* (*Eurya japonica*) are representative shrubs found in such forests. Because of this combination of species, Japanese evergreen forests are grouped into the *yabutsubaki* class as the highest phytosociological community unit. The key question here is not so much what species are dominant in a location as what species grow

there or not. For example, the fact that the *yabutsubaki* class is the highest unit means, in other words, that the area where *yabutsubaki* grows is an evergreen forest region.

Professor Tüxen's Potential Natural Vegetation

Professor Tüxen, 15 years younger than Dr. Braun-Blanquet, created the vegetation mapping method for visually mapping the spatial extent of phytosociological community units that Dr. Braun-Blanquet had established. In 1956, two years before I arrived in Germany, Professor Tüxen presented his new theory of potential natural vegetation to the world. Potential natural vegetation, as already mentioned, is the third concept of vegetation, after original vegetation (primeval natural vegetation, the vegetation that existed immediately before alteration by human influence) and actual vegetation (the vegetation that we see today after it has been altered by humans). Even if all the effects of human activities were stopped now, it's not necessarily true that the original vegetation would be regenerated immediately because the site conditions and environment may have been altered by human activities over a long period of time. Therefore, potential natural vegetation is a theoretical consideration of what the sum total of the natural environmental factors of the land has the potential to support if all human influence were to cease.

When teaching students about potential natural vegetation, I often used the following analogy in my lectures. Ascertaining the potential natural vegetation, or the indigenous nature of an area, is like trying to work out what a person looks like beneath thick makeup and bulky clothes, just by sight alone. It's not easy to do. That's why you need to meet the person again and again. Nature also tends to be shy. It's reluctant to show its unadorned face and skin. That's why we keep going back. That's why I emphasize the importance of fieldwork, fieldwork, and more fieldwork. By visiting a site many times and carefully examining all the plants, we notice the subtle signs and signals that nature is communicating. That's what we should carefully explore. Only then can you see the whole that is unseen. Gradually, the true underlying essence comes into view.

While conducting field vegetation surveys throughout Japan, we first create actual vegetation maps. We then determine the potential natural vegetation by examining the remaining fragments of natural vegetation, remaining natural trees, secondary vegetation changed by humans, land use patterns, soil cross sections, and other factors, and draw the spatial extent of each community unit on a map to create a potential natural vegetation map. Synthesizing and empirically completing this data constitutes the theory and method of potential natural vegetation and the practice of potential natural vegetation mapping.

After battling through the period of turning crisis into opportunity and misfortune into happiness of the 1960s, when no one took me seriously, the beginning of the 1970s saw the start of my life creating *furusato-no-mori* or hometown forests, which I'll discuss in the next chapter. The next decade of the 1980s saw the culmination of our field vegetation surveys in Japan and the compilation of *Vegetation of Japan*. This ten-year period was also another that, to those on the outside, can only have seemed like madness for days on end.

Publishing *Vegetation of Japan*

From 1980 to 1989, I published all 10 volumes of *Vegetation of Japan*, a comprehensive survey of the vegetation of the Japanese archipelago, at the rate of one volume per year. This effort was the culmination of a massive series of field vegetation surveys in Japan, in which as many as 116 top botanists in their fields and scientists in adjacent disciplines such as climate, geology, and topography from Japanese universities participated. I am very grateful to all those who helped us.

The 1970s was a decade in which Japanese phytosociology rapidly blossomed. Meanwhile, seemingly in opposition to the approach by the Science and Technology Agency at the time, the Ministry of Education sought to encourage measures to tackle

pollution and environmental problems. Amidst the ruins of Japan after its defeat in World War II, the survivors had worked hard day and night to rebuild the country. With development as a top priority, new industrial sites and towns were built, mountains were flattened, and the sea was reclaimed. Due to such large-scale development, concerns about pollution and the destruction of nature and degradation of air and water quality came to the forefront, and we saw the emergence of environmental movements led by ordinary citizens in the 1960s. Forward-thinking companies and local government bodies began to take action to support these movements.

In 1968, I was conducting a field vegetation survey of Mt. Rokko, which had been heavily exploited by developers, at the request of the city of Kobe. A phone call came out of the blue one evening. On the line was Mr. Tezuka Akira, then Director of the Research Grant Division, Science and International Affairs Bureau at the Ministry of Education. He said, "Come to our offices when you come down off the mountain." I wondered what was going on, since I'd had little previous involvement with that Ministry. Worried that I had done something to upset someone, I hurried to the designated office. With no time to change my clothes, I went into the meeting room wearing muddy shoes and sweaty work clothes and carrying a large backpack. The room was filled with elderly professors from the University of Tokyo and Kyoto University, and the main theme of the

meeting appeared to be a search for ideas on projects for ensuring human survival.

The academic luminaries in the room proposed various projects, but when Deputy Director-General Shibuya Keizo asked who would be responsible for those projects, they would say something to the effect of, "I'm personally very busy, so I'll delegate the work to staff in my laboratory." Finally, my turn came, as an assistant professor at a fledgling university. Sitting at the end of the table, I said that I would like to complete a series of maps of the actual vegetation and potential natural vegetation that would summarize the results of vegetation surveys for the Tokyo metropolitan area and the entire Kanto region, not only focusing on single point sites, but also surveying extensive planar areas.

Deputy Director-General Shibuya asked me what my budget would be, and in a trembling voice I said, "I'd like to ask for three million yen." Until then, the Ministry of Education had granted us only about 10,000 or 15,000 yen a year in scientific research funds at most, despite the many applications we submitted, so I'd made a daring proposal. He then asked me, "Who's going to run the project?" I assured him, "I'll personally take full responsibility for its completion." The Deputy Director-General said, "I'm not entirely sure that's enough funding for you to do the research. Come to my office later, and we'll talk about it."

In Mr. Shibuya's office, Director Tezuka said, "The Ministry of Education is familiar with your work. If you're going to go ahead, we want nothing less than outstanding results. Don't hesitate to tell us how much you need." In fact, there was "something" I wanted. At the time, the leading German optical manufacturer Carl Zeiss was making a large telescopic measuring instrument that cost as much as eight million yen. With this, the planar extent of vegetation could be measured more accurately, while the point and line results from the vegetation survey could be corrected with aerial photographs. I took the plunge and boldly asked for 11 million yen. To our astonishment, we received a budget of 13 million yen. I was the most surprised because to date I'd had to submit rather cumbersome application forms for such paltry amounts as 15,000 yen.

Thus began our grand project of publishing one volume of *Vegetation of Japan* a year for ten years, starting with "Volume 1: Yakushima" in 1980. Grants-in-Aid for Scientific Research and Grants for Urgent Publication of Research Results from the Ministry of Education covered most of the costs of the field vegetation survey and printing, but at one point, the grant was almost terminated. A crisis was averted by Mr. Nishio Masahiro (later Mayor of Izumo, Shimane Prefecture), who was then at the Ministry of Education. "This project only has significance when it's completed." Mr. Nishio's

insistence that “not even one volume should be omitted” moved the Ministry of Education to advance us funds to complete the project.

“Professor Miyawaki, Are You Trying to Kill Us?”

From Okinawa and the Ogasawara Islands in the south to Hokkaido in the north of Japan, we struggled through our field vegetation surveys from morning until night. What was the process like? By way of example, let’s look at Takamatsu on the island of Shikoku.

Each field vegetation survey was done by a group of about three people. We’d book a cheap hotel from Tokyo and depart for the site. In the case of Takamatsu, we’d take an overnight train to the port of Uno in Okayama and then take the Uta ferry across the Seto Inland Sea to Takamatsu. After arriving in Takamatsu, each group member would rent a car and make a thoroughgoing investigation of the shrine and temple forests on their designated routes from Takamatsu to the lodgings for the night—from communities of *oobako* (*Plantago asiatica*) on roadside trails to tall forests of trees such as *shii* and *tabunoki*, and from the forests found on old residences, shrines, and temples that remained in the towns to the mountains, wetlands, and grasslands. We’d survey and measure exhaustively until the last rays of the sun set, and then enter the data in the “green family album.”

The surveys were conducted according to the quadrat method, in which a square frame is set over the ground and all plants within the frame are examined. Dr. Braun-Blanquet's phytosociological methods are still used widely: the description is based on two international standard scales, cover and sociability, and is completed by making visual measurements on site. Cover indicates how much area is covered by each species in the plot under investigation. The most widely used method today is Dr. Braun-Blanquet's total estimation method, in which the degree of cover is scored on a six or seven-level scale. Sociability is used to classify how individual plants are distributed. Only the distribution status of individuals, regardless of the degree of cover, is considered, and is divided into five categories. The data obtained in this way is entered into a vegetation survey form, the basic document that we affectionately call the green family album.

The key is not to delay sorting out plant names, communities, and other details, but to always cross-check the day's vegetation survey materials and plant specimens with each other at the night's accommodation to resolve any outstanding questions. Therefore, after dinner, we would immediately compile the materials we'd surveyed during the day.

The all-important vegetation map is created by the following steps. First, the plants and plant communities seen at the site are sketched roughly with colored pencils. This is called a physiognomy

diagram. Taking this physiognomy diagram back to our accommodation, we plot the specifically measured survey points on the map and check them against aerial photographs. Checking and rechecking the extent of the area, we draw in every detail with colored pencils.

Next, we take the physiognomy diagrams back to the laboratory and start preparing the actual vegetation map. At the same time, we establish a guideline for creating a potential natural vegetation map, based on the most natural communities in the actual vegetation map.

Using this guideline, the potential natural vegetation map is created through on-site field surveys, including fragmentary surveys of remnant trees and remnant vegetation, and comparison with the actual vegetation map, while also considering soil profiles, land use patterns, topography, and other factors.

After returning from Germany, I conducted field vegetation surveys throughout Japan. The 1960s experiences of turning crisis into opportunity and misfortune into happiness turned out to be very helpful. Utilizing this vast amount of material, we identified the target locations for the next year's work and went out into the field to repeat the surveys. In the 1980s, I thoroughly researched vegetation all over Japan, repeating the daily grind of research and writing with an eye toward perfection.

Particularly memorable were the surveys of Iwo Jima and Minami-Tori-shima in the Ogasawara Islands. The only way to get there at that time was by Japan Self-Defense Forces aircraft. After asking the Ministry of Education, we were finally able to obtain permission from the SDF. When we arrived at Iwo Jima and dug in the sandy soil on the beach to survey the vegetation, we found clumps of machine gun shell casings. Goats had also become feral during the long period of U.S. military rule in the Ogasawara Islands. Like Europe, China, and Mongolia, it had become a wasteland, and most of the indigenous vegetation had been lost. However, we were able to draw a potential natural vegetation map from the few trees that remained on the steep slopes and ridgelines.

Completing the vegetation maps was not enough because according to our agreement with the Ministry of Education, five printed and bound copies of the completed *Vegetation of Japan* volume were to be submitted by March 26 of each year. Life was incredibly hard as the deadline approached. I was busy proofreading and revising and had to work through the night for days on end.



Preparing vegetation maps in the laboratory, 1980.

I think it was when the fourth volume was finally completed, and we were about to start on the fifth, when the young researchers strongly protested, asking me to give them a year off. "Professor Miyawaki, are you trying to kill us?" I retorted: "Once you stop, you'll stop for good. We must continue at all costs. We have to complete the series." I tried to motivate them, saying, "I'm putting my life on the line for this, so I want you to give it your best, too."

What the Completed *Vegetation of Japan* Reveals

In March 1989, the 10-volume *Vegetation of Japan* was finally completed, with more than 500 pages in each volume, 6,000 pages in all, plus a complete community composition table for each community and 12-color 1:500,000-scale maps of actual and potential natural vegetation. It weighed in at a whopping 35 kilograms! Without receiving worldwide recognition, however, I knew this achievement would be meaningless, so with this in mind, we included explanations of charts and tables and summaries in German and English for each volume. As a result of these efforts, *Vegetation of Japan* can be found in the Smithsonian Institution in the U.S. and other prominent universities, libraries, and research institutions around the world.

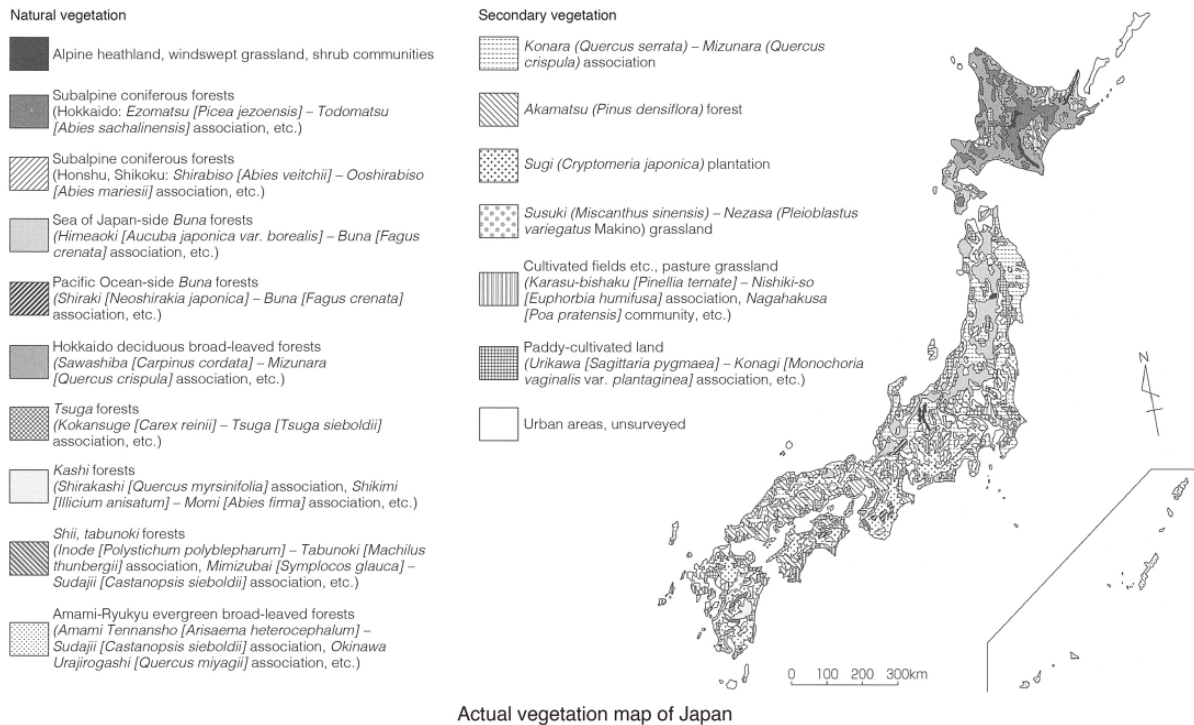
Let's now take a brief look at potential natural vegetation in Japan. From the coast west of the Kanto region to about 800 meters above sea level, evergreen broad-leaved forests composed of trees such as *shii*, *tabunoki*, and *kashi* constitute the potential natural vegetation. From 800 to 1,600 meters above sea level, deciduous (summergreen) broad-leaved forests (*buna* [*Fagus crenata*] and *mizunara* [*Quercus crispula*] forests) are the main potential natural vegetation. The central mountains of Honshu, 1,600 to 2,600 meters

above sea level, and Hokkaido, more than about 400 meters above sea level, feature subalpine coniferous forests, and the dominant trees on Honshu include *shirabiso* (*Abies veitchii*), *ooshirabiso* (*Abies mariesii*), *tohi* (*Picea jezoensis* var. *hondoensis*), and *kometsuga* (*Tsuga diversifolia*). In Hokkaido, the dominant trees are the pines *ezomatsu* (*Picea jezoensis*), *todomatsu* (*Abies sachalinensis*), and *akaezomatsu* (*Picea glehnii*).



Potential natural vegetation map of Japan.

Source: Both maps: Modified in part from Miyawaki 1966, 77; Miyawaki et al., 1980-89; Miyawaki and Fujiwara 1988.



On the other hand, what can we say about the actual vegetation? In both broad-leaved and deciduous (summergreen) forests, regular logging for charcoal, firewood, and building materials has continued every 20 to 25 years for centuries. Especially after World War II, the use of lumber for reconstruction of burned houses increased rapidly, and a national policy of expanding coniferous tree plantations was implemented across Japan. Even the deciduous (summergreen) broad-leaved forests such as *buna* and *mizunara* forests that remained in the mountains have been almost completely cut down and replaced by coniferous forests such as *sugi* cedar (*Cryptomeria japonica*), *hinoki* cypress (*Chamaecyparis obtusa*), and *karamatsu* (Japanese larch; *Larix kaempferi*). Today, natural

forests remain only in the Shirakami Mountains in the Tohoku region, the mountains on the Sea of Japan side, and the Shimokita Peninsula, even in deciduous (summergreen) broad-leaved forest areas. Natural forests in the subalpine coniferous forest zone remain relatively intact. However, near the lower limits, many areas have been cut down, and *karamatsu* has been planted.

Indigenous Forests Constitute Just 0.06 Percent

When viewed in this way, the Japanese forests we thought were natural are actually composed of secondary vegetation: secondary forests that are far removed from the indigenous forests of the area and are instead artificial monocultures of trees such as *sugi*, *hinoki*, and *karamatsu*. To put it as bluntly as possible, you could call them “fake forests.” The wooded areas bordering urban development that are known by the Japanese people as *satoyama* are not indigenous forests, either. These are deciduous broad-leaved coppices of species such as *kunugi* (*Quercus acutissima*), *konara* (*Quercus serrata*), *egonoki* (*Styrax japonicus*), and *yamazakura* (*Prunus jamasakura*) trees, as described in *Musashino* by novelist Kunikida Doppo and *Nature and Man* by writer Tokutomi Roka (the penname of Tokutomi Kenjiro), and for a long time were considered to be natural

forests. That was the prevailing theory in academia until the mid-1960s. However, according to the concept of potential natural vegetation that I learned in Germany, they are not indigenous forests.

Satoyama are regenerated coppices where shoots have grown from stumps of trees that have been periodically cut down by humans for hundreds of years to make firewood and charcoal. They are composed of secondary vegetation that has persisted as a replacement community under the influence of human activities such as clearing underbrush once every two to three years and raking fallen leaves. In the time before the introduction of chemical fertilizers, *satoyama* forests were managed solely for human use to provide resources such as fertilizer, feed, fuel, and building materials.

Satoyama wooded areas that have coexisted with human activities and have been cared for by humans for hundreds of years are preferable for walks in urban parks and in the community. On the other hand, if environmental preservation and disaster prevention functions are important, then indigenous forests based on potential natural vegetation are more desirable.

From the perspective of “succession” (Detailed in Chapter 5. In this case, referring to secondary succession in which the vegetation changes back to the indigenous forest when human influence is eliminated), these coppices will eventually return to their

original state if left unattended for more than 200 to 300 years. So, to what extent should we consider them “natural?” Although there are many different opinions, from the phytosociological perspective it means that the combination of species groups that make up a forest are as close as possible to the indigenous natural vegetation and natural forest of the area. That is, vegetation and forests in which the potential natural vegetation in each location has emerged.

In light of this, what’s happening today in the evergreen forest zone, which has been called the origin of Japanese culture and where 92.8 percent of the Japanese people live? Our field surveys of vegetation throughout Japan over nearly 50 years have produced sobering figures. Even including the remnant native forests, forests on family estates, and forests on steep inaccessible slopes, only 0.06 percent that can be called indigenous forest is left in the evergreen forest area (i.e., area of potential natural vegetation). In other words, very little of the indigenous forests of the land, in the strict ecological sense of the term, remain in the major evergreen forest areas of Japan.

A Lumber Factory for *Matsu*, *Sugi*, and *Hinoki*

Once when Professor Tüxen visited Japan, he was amazed when he saw a mature forest of *matsu* (pine), *sugi* (cedar), and *hinoki* (cypress) trees, saying, “This is nothing more than a production

plant for lumber.” Japan’s postwar policy of expanding coniferous afforestation was encouraged across the board, and to my mentor, who witnessed it firsthand, it looked as if its sole purpose was to produce wood for lumber. This kind of forest is dark and there’s no undergrowth at all. With no other trees than *matsu*, *sugi*, and *hinoki* in evidence, it’s simply a lumber factory. Naturally, it also severely lacks biodiversity.

Originally, conifers such as *matsu*, *sugi*, and *hinoki* were less competitive than evergreen broad-leaved trees such as *shii*, *tabunoki*, and *kashi*, and deciduous (summergreen) broad-leaved trees such as *buna* and *mizunara* in mountainous regions, and were relegated to areas with extremely harsh natural conditions, such as ridges with exposed granite, rocky areas, and near water, where they grew only locally. However, in the Kansai region, and especially in the westernmost part of the island of Honshu (known as Chugoku), the original evergreen broad-leaved forests of the land and deciduous (summergreen) broad-leaved forests in the mountains had been cut down for firewood and charcoal for hundreds of years for smelting iron in furnaces and producing salt by evaporation. Seeds of sun-loving *matsu* pines with their parachute-like wings land as pioneer plants at the site of their logging. People welcomed such pioneers because *matsu* is a quick-growing tree, so its initial growth is rapid, and it can be harvested quickly. It grows straight, and is soft and easy to use, so it was valued and planted in

places where pines were originally not meant to grow. Along the coast, *kuromatsu* pines (*Pinus thunbergii*) proliferated, especially during the Edo period (1603–1867), when the coastline was described in the popular imagination as “white sand and green pines,” while inland, the *akamatsu* (*Pinus densiflora*) spread beyond its original native habitat. Pine, bamboo, and plum are also regarded as symbols of congratulations and good fortune.

Bamboo and Japanese plum were actually brought over from China, and the recent heavy growth of *moso* bamboo (*Phyllostachys edulis*), which was introduced by the Shimazu clan about 200 years ago, has become a problem, especially in the Kinki, Chugoku, Shikoku, and Kyushu regions. *Moso* bamboo will invade and thrive in areas where trees are planted that are not suited to the area. True indigenous forests are not so easily penetrated due to the presence of “forest guards” such as the fringe and mantle communities.

On the other hand, there are coniferous forests that look authentic because they were heavily protected by humans, such as those made up of the five sacred trees of the Kiso valley (*hinoki* cypress, *sawara* cypress [*Chamaecyparis pisifera*], *kurobe* cypress [*Thuja standishii*], *koyamaki* pine [*Sciadopitys verticillata*], and *asunaro* cypress [*Thujopsis dolabrata*]) and the *koyamaki* on Mount Koya. According to records kept at Mount Koya, *sugi* and other trees have been planted there for as long as 800 years.

In Japan, where timber construction is the most common building method, conifers such as Japanese *sugi*, *hinoki*, and *matsu* have been planted for economic reasons and use in daily life, and for their ease of processing. Especially after World War II, the demand for building materials increased for reconstruction, and the entire country promoted afforestation with coniferous trees. Even deciduous (summergreen) broad-leaved forests such as mountain beech forests that had been left were designated for logging.

Our field surveys of vegetation in five prefectures in the Chugoku region in the early 1980s revealed that pine forests had increased more than 250 times in the existing potential natural vegetation area than in the indigenous forest area. During the Occupation in Japan after World War II, the General Headquarters Supreme Commander for the Allied Powers (GHQ) instituted a program of agrarian reform, in which farmland held by landowners was compulsorily acquired by the government at low prices and sold to small farmers. However, mountain forests were excluded from the program. As a result, large landowners who once owned large tracts of farmland were deprived of their land and impoverished. Conversely, mountain forest owners became richer as the price of lumber soared on the back of demand for mass construction of housing to rebuild after the devastation caused by war.

In my hometown too, located in the inter-mountain region of the northern part of Okayama Prefecture, it was rumored that

mountain forest owners had become so rich that everyone was envious of them. I still vividly remember this from my childhood. However, after the full liberalization of lumber imports in 1964, the supply of foreign lumber increased rapidly to the extent that it surpassed the supply from domestic sources from 1969 onward. Trees had been regularly logged and used for lumber, but due to the large volume of inexpensive foreign product entering the country, companies lost money when they logged forests and produced lumber. This made it financially impossible to manage the forests, resulting naturally in an increase in the number of abandoned monoculture forested areas.

Exotic conifers such as *sugi*, *hinoki*, *karamatsu*, *kuromatsu*, and *akamatsu* were originally planted after the indigenous forests were logged. As soon as human forest management activities such as clearing underbrush, pruning, and thinning are stopped, plants such as Japanese *nezasa* dwarf bamboo (*Pleioblastus variegatus* Makino), *susuki* grass (*Miscanthus sinensis*), kudzu (*Pueraria montana*) and other vine species, and *yamabudo* (*Vitis coignetiae*) invade the forest because the coniferous species were not suited to the land. This is why the mountains look neglected. Another recent problem for mountain owners is the invasion and flourishing of the naturalized *moso* bamboo, as mentioned earlier.

Monocultures of conifers planted as exotic species are more susceptible to natural disasters, wildfires, diseases, insects such as

pine weevil, and overmature growth (forests where tree growth has exceeded the “normal” rate). When organisms weaken, they become more reproductively active to increase the number of their offspring. Thus, trees give off more pollen in a bid to increase their offspring. Hay fever has become a major problem in Japan in recent times, and it’s suspected that the root cause may have been the postwar policy of expanding coniferous afforestation, in which too many trees were planted in monoculture plantations.

Still, there is a deep-rooted belief in *matsu*, *sugi*, and *hinoki*. The “Miracle Pine” tree was the only survivor of the Takada Matsubara pine forest in Rikuzentakata City, which was destroyed by the tsunami caused by the Great East Japan Earthquake and became a symbol of reconstruction. To me, it seemed to be a symbol of the *matsu*, *sugi*, and *hinoki* faith. Before the tsunami, there were about 70,000 pine trees in Takada Matsubara. What happened to the other pine trees? Almost all the 70,000 trees were toppled and washed away, and some became driftwood that destroyed homes in residential areas and injured residents. And the Miracle Pine also eventually withered and died. There’s no doubt that the *kuromatsu* fares well in a maritime environment. It can also be said that this is where the wisdom of the Japanese people comes into play. Where the location is appropriate and people can continue to manage them well, *matsu*, *sugi*, and *hinoki* may be planted in the future as needed.

However, now that we have experienced the Great East Japan Earthquake, we must ask ourselves what should be protected: artificial custom and precedent, ease of processing, the economy, or the landscape? Or perhaps we need to think about life itself.

Chapter 4

Planting Trees



Chinju-no-mori forest in Kakegawa, Shizuoka Prefecture.

First Steps as a Practicing Plant Ecologist

What do Japanese people associate with the concept of a *Chinju-no-mori* forest? They might think of the song that was sung in elementary school, “Our Village’s Guardian God.” Or perhaps they think of a secret place where they went to catch cicadas and beetles during their summer holidays. This is a forest where the natural

indigenous greenery of the land—its unadorned skin and true face—is found in concentrated form. From the standpoint of plant ecology and vegetation, it is a forest where we can find the potential natural vegetation.

My starting point was the *Onzaki-san Chinju-no-mori* forest near my birthplace. My first encounter with the *tabunoki* tree was also in a *Chinju-no-mori* at the site of the Hiroshima atomic bombing. *Chinju-no-mori* forests were also the key to deciphering potential natural vegetation. My life has progressed hand in hand with *Chinju-no-mori*. In 1972, I introduced the concept of the *Chinju-no-mori* to the world, writing an article for the magazine *Jimu to Keiei* (Business and Management) titled “The *Chinju-no-mori* Forest—Let’s Bring Back the Greenery of the Past.” The first International Symposium on Vegetation Science in Japan was held in 1974, where I presented my research on potential natural vegetation. I introduced the *Chinju-no-mori* as a specific example of forests that have been preserved throughout Japan, practically untouched by human hands. It is a sacred place that has been adored, respected, and protected by the Japanese people since ancient times as a forest where gods and Buddha dwell, as a place for finding peace of mind, as a place to mourn the spirits of our ancestors, as a place for healing, relaxation, and festivals, and as a place of rest and spirituality with diverse functions, which people did not disturb without good reason. And that’s how these magnificent

multi-layered community forests have been preserved. The *Chinju-no-mori* forest, with its three-dimensional form suited to the Japanese climate, was lauded at this international symposium, and the term has since gained de facto official recognition at the International Vegetation Society as [*Chinju-no-mori* after Miyawaki]. Just as the word “tsunami” has found its way into the English lexicon, the Japanese term can now be used without explanation across the globe.

On the other hand, the reality is that rapid development, logging, and habitat destruction are leading to the loss of forests. Should we just sit back and do nothing? Is it sufficient to simply protect and preserve nature as it exists today? The belief that it's necessary to proactively restore and revitalize greenery and forests is growing stronger by the day. However, not just any greenery will do. It is important to regenerate indigenous forests, which symbolize a landscape that coexists with the community, maintain biodiversity, and have both environmental protection and disaster prevention functions.

I have not only continued to promote this concept at every opportunity available to me, but also in a practical way, to create *furusato-no-mori*, or hometown forests. This was my new path as a practicing plant ecologist.

My First Tree Planting Project with Nippon Steel

In the 1970s, I finally embarked on the creation of my first hometown forest, before which I had been little more than a lone voice in the wilderness. After returning from Germany, the 1960s were a time of turning crisis into opportunity and misfortune into happiness for me. For ten years, almost no one took me seriously. The steady accumulation of field vegetation surveys during that time became my basic training for forest development.

Over time, humans interfere with plants and nature in a variety of ways, a trend that has been exacerbated even further by large-scale nature development and industrial site development. If this situation continues, our indigenous forests will be lost. *Chinju-no-mori* forests are disappearing. I could see this clearly as I spent the 1960s doing field vegetation surveys with my young colleagues, even though I was considered a heretic by those around me. This sense of urgency and fear drove me towards the creation of hometown forests.

Society was also changing. In the 1960s, pollution-related illnesses such as *Minamata* disease, *Itai-itai* disease, and *Yokkaichi* asthma raised major warning flags, and pollution issues more broadly, which until then had been subordinated to rapid economic growth, became important societal concerns. In 1967, the Basic Law

for Environmental Pollution Control was enacted, and companies could no longer afford to ignore these social trends.

In April 1971, I gave a lecture at the *Keizai Doyukai* (Japan Association of Corporate Executives). I was introduced to the meeting by Mr. Tamura Tsuyoshi (the first deputy director of the Nature Conservation Society of Japan, and a key figure in the establishment of national parks in Japan), with whom I had developed a relationship after returning from Germany. Amid growing public interest in problems caused by pollution, the business community was primed and ready to tackle pollution head-on. For the first time in my life, I was able to present my philosophy of ecology to the top executives of key Japanese corporations. Among those in attendance were Nakayama Sohei, then Chairman of the Industrial Bank of Japan, and Kikawada Kazutaka, then president of Tokyo Electric Power Company, Incorporated.

I recall that I addressed the group in an impassioned tone, "If we do nothing, industry might continue to develop and profits may be made temporarily, but our lives will be at risk. We absolutely must plant indigenous trees! Don't the Japanese people have a long history of creating *Chinju-no-mori* forests?"

In my mind, the Japanese term *inochi*, meaning "life," and *Chinju-no-mori* forests were already firmly intertwined. Life was an inseparable part of the concept of *Chinju-no-mori*. The presentation ended with a round of applause from the full house. A week later, I

received a call from the secretary of the *Keizai Doyukai*. He said, "Your presentation to corporate leaders was very thought-provoking. Can you repeat it for frontline department and section managers?" The best and brightest were present at this managerial-level presentation, but my words seemed to be largely falling on deaf ears. I didn't get much feedback at all. Perhaps it was so far removed from their daily work that it really didn't seem to click with them.

At seven o'clock the next morning, I got a phone call at Yokohama National University. At the time I was nicknamed "Mr. Seven" because I was always in my university laboratory by 7:00 A.M. The caller was Mr. Shikimura Ken, who introduced himself as the manager of the newly created Environmental Management Office (later the Environmental Management Department) of Nippon Steel Corporation, Japan's largest steel company by sales. Mr. Shikimura said, "Nippon Steel is keen to embark on the forest development project that you mentioned in your presentation. Can you help us out?" I was taken aback by the unexpected call because, at the time, large corporations like Nippon Steel were regarded as the main culprits responsible for pollution. Moreover, Yokohama National University was regarded as a hotbed of Communists and leftists. With the growing sentiment on campus that corporations were evil, I wondered whether we should lend a hand to Nippon Steel at all. I had to consider the risks associated with cooperation.

Timidly, I asked, "Are you serious?" Mr. Shikimura said, "Of course I am." When I said, "Okay, if you're really serious, I'm ready to hear specifics," he answered, "I want you to create a forest at our Oita Steel Works." In a manner that can only be described as youthful exuberance in retrospect, I rashly decided to set two preconditions for cooperation with Nippon Steel.

The first condition was potent, one that would force Japan's largest steelmaker to be prepared to shutter its business. "As long as the forest we create in accordance with the potential natural vegetation flourishes, I will stand up in court to defend Nippon Steel in response to any lawsuit brought by your opponents on the issue of pollution. However, if this indigenous forest—like the *Chinju-no-mori* that has survived for hundreds of years in the local community—was to one day suddenly wither away and die, it would be evidence of a devastating impact on humanity. In that event, I want you to agree to shut down your blast furnaces."

My second condition was that if they were serious about starting this forest creation project, they were to repeat it for disaster prevention and environmental conservation purposes at all their steel mills. "If it's just going to be Oita, I'm not interested. If you are going to do it, I want you to develop forests at all your steel mills (of which there were ten at the time)." As you might expect, Mr. Shikimura wasn't able to give an immediate answer to my two

conditions. The conversation this day ended with the words, "Give me a few days to think about it."

I never thought for a moment that Nippon Steel would accept my terms. I figured that the proposal would disappear as if it had never happened.

Three days later, however, Mr. Shikimura called again: "Let's do it. I'm looking forward to your guidance." Some in Nippon Steel queried whether it was necessary to go to such lengths as to plant trees, but in any event, the company took steps to prevent the newly created forest from dying. Pollution filters made in Czechoslovakia were installed in all steel mills to combat the production of carbon dioxide and nitrogen oxides. I heard that these pollution filters cost about 1.4 billion yen at that time for a single steel mill.

This is how my hometown forest project was finally about to begin. I took the first step toward creating a hometown forest with hometown trees at Nippon Steel's Oita Works.

Invention of the Potted Seedling Method

"If I'm going to do something, I'm going to go all out to do it. But first, I want you to show me the site." When I arrived at Nippon Steel's Oita site, a tree graveyard was waiting for me. Trees had been planted around the factory while it was under construction, but

all that remained now were sad-looking sticks that resembled the stakes that originally supported them. All the trees had lost their leaves. The withered figures looked ghost-like. Salt had also spewed out on the surface of the ground. Because the coastal strip of land on which the Oita Works was built had been reclaimed from the ocean, saline groundwater had risen to the surface! Under such circumstances, I wondered what we should plant first. The immediate task was to investigate the potential natural vegetation of the area, so we conducted a local vegetation survey around the Oita Steel Works.



The tree graveyard awaiting the author (center) at Nippon Steel's Oita Steel Works.

Conveniently, near the Oita Steel Works were the *Chinju-no-mori* forests of *Usa Jingu*, the head shrine of those dedicated to the god Hachiman, founded in the year 725, and the *Yusuhara Hachimangu* Shrine, founded in 827. There we found evergreen broad-leaved trees such as the *ichiigashi* (*Quercus gilva*), *arakashi* (*Quercus glauca*), and *urajirogashi* (*Quercus salicina*) oaks, *sudajii* (*Castanopsis sieboldii*), and *tabunoki*. It was July when we conducted the field survey of the vegetation, and the seeds of the

tabunoki had begun to fall. With the permission of the shrine, and fortified with drinks of sacred *sake*, we collected acorns, the hard fruits of the *shii* and *kashi* (*Quercus*) trees, in October and November. The problem then arose how to turn the acorns into seedlings for planting. It was a time when landscape gardeners were reluctant to directly plant evergreen broad-leaved trees with their deep tap roots into the soil. I suggested putting the acorns in pots and allowing their roots to become fully established before planting them out.

Nakagawa Hideaki, who was appointed as the first general manager of Nippon Steel's Environmental Management Department, was every bit a steelmaker. He came up with the idea of using surplus scrap iron to make iron pot containers. Experiments with such containers did not go well because the roots grew and grew faster than the reddish rusting of the iron, and they wound up inside the pot in a tangled mess.

Through repeated trial and error, I proposed using a pot made of thin plastic. Although plastic pots were already available at the time, I believe this was the first time they'd been used for tall evergreen trees. This is how the so-called "Miyawaki Method" using potted seedlings, indispensable for the creation of hometown forests, was established.



The Oita Steel Works, before planting began, 1972.



The Oita Steel Works forest, 20 years later in 1992.

Surprised by Toyota's Excitement

Following the example of Nippon Steel, we have planted trees using potted seedlings at the invitation of forward-looking companies and local government bodies. Together with Toyota Motor Corporation, we also began full-scale forest creation on factory sites for disaster prevention and environmental preservation purposes, both in Japan and overseas. Of course, I also asked Toyota to collect acorns and make potted seedlings for the forestation projects. One day a while later, I received a call from Toyota's factory in India, and everyone seemed very excited about something.

"Professor Miyawaki, we can see the roots growing. There are buds, too. Everyone is surprised. Everyone is thrilled!"

Even the Toyota plant manager told us, "The local Indian staff are amazed, but I'm also impressed."

I was more surprised by Toyota's surprise.

I wondered, "Why are they so excited and impressed when it's simply natural for roots to emerge and buds to develop?" The same was true for our forest creation projects around the overseas factories of Toyoda Gosei, Sango, and Yokohama Rubber. We asked these companies to collect acorns and make potted seedlings from the dominant trees of the potential natural vegetation in their

respective areas, and when they saw the “birth of life—sprouting,” they all exclaimed with excitement, “We can see the shoots; they’ve actually pushed up from the soil.” It must have been quite an exhilarating occurrence for the world’s leading manufacturing professionals working in factories using state-of-the-art technology and producing automobiles and their parts. Is this because of the growing alienation of humankind from nature?

Plants are Only as Good as Their Roots

The soil at Nippon Steel Corporation’s Oita Works was poor due to the land being reclaimed, and salt was spewing from the ground surface because of the saline groundwater. To counter this problem, the mounding (fill) procedure at the heart of the “Miyawaki Method” was started at the Oita Works, along with the potted seedling concept. Deep-growing tap-rooted evergreen broad-leaved trees, such as *shii*, *tabu*, and *kashi*, have fast-growing roots, but they can’t grow successfully without an adequate supply of oxygen to their roots. Plants are root-driven, and to achieve this, they need oxygen, oxygen, and more oxygen; to sum up, “plants need roots, and roots need oxygen.” Roots breathe. They cannot live without oxygen.

In Japan with its high rainfall, there’s a risk of oxygen depletion due to the accumulation of water on flat terrain. The

typical oxygen content in water is miniscule, less than one percent, compared to about 20 percent in the air. If roots are immersed in stagnant water for more than 70 hours, they won't be able to breathe due to the lack of oxygen, resulting in the development of root rot. To avoid this, we use a pyramid or egg-shaped mound to create a base in which to plant our trees. This shape is the result of 40 years of trial and error. The mounds we used at Nippon Steel's sites were not only made of clay to maintain oxygen in the soil, but also included a mixture of non-toxic construction waste and slag generated during the melting and reduction of iron ore, carefully screened on site. The method we adopted was to place organic soil on top of the slag, which allows the mound to be built higher and creates a more air-permeable base for tree planting. I strongly recommended this method because the construction debris mixed with the soil produced from digging the hole creates pockets of air in the soil and allows the roots to go deeper into the ground in search of more oxygen. Furthermore, the roots embrace the construction debris and other materials as they grow, making the trees stronger. We believed that the trees would be less likely to topple over in the event of typhoons, floods, earthquakes, and tsunamis.

When I was studying in Germany, forest development initiatives in many places that utilized debris as a global resource had already begun. In Berlin, Munich, Hamburg, Hannover, and other cities, they were burying a mixture of World War II debris,

concrete pieces, and wood chips. Even damaged tanks were buried there. Afforestation using debris was not only taking place in Germany, but also in the Netherlands and other countries. Professor Tüxen took me to inspect some of these sites.

Although technically not a forest, Yamashita Park in the Japanese city of Yokohama was created in 1930 using rubble from the Great Kanto Earthquake. The Great Forest Wall project that I have advocated in the wake of the Great East Japan Earthquake is by no means a thought experiment by a desk-bound academic but is based on my own long years of experience in the field and the achievements of our predecessors.

***Tabunoki* and *Shirodamo*: Lessons Taught**

Let me now relate a story about what happened at Nippon Steel's Nagoya Steel Works. Our field vegetation survey showed that the original dominant tree of the area was the *tabunoki*, so it was decided to plant a mixture of 15 different types of saplings, but mainly *tabunoki* trees. However, when I went to the site to check on progress, I found that the entire area was covered with *shirodamo* (*Neolitsea sericea*), a laurel tree that was related to, but was definitely not *tabunoki*. I pointed out: "These aren't *tabunoki*. They're *shirodamo*." The head of the construction section insisted,

"Sir, these are *tabunoki* trees. The contract specifies *tabunoki* trees, so they must be *tabunoki*."

Nonetheless, they were *shirodamo*. I huffily protested, "This is all fake." There were two landscaping companies involved in the project, and the president of one of the companies, who was listening to the exchange, interrupted.

"Professor Miyawaki, this tree is also known as a *shirotabu*."

I exploded with anger at this nonsense, retorting:

"You might call it a *shirotabu*, but it's no *tabunoki*. It's a relative of the *tabu*, the *shirodamo*!"

Everyone stared in silence.

In the awkward atmosphere that followed, I thought I needed something to convince them, so I took them to see the real *tabunoki*, *Machilus thunbergii*. Mr. Shikimura of Nippon Steel Headquarters and more than a dozen people including the president and employees of the landscaping company joined me as we made our way to the nearby *Chinju-no-mori* forest. In the *Chinju-no-mori*, a huge old *tabunoki* tree, perhaps 30 meters high, towered over us. Underneath the tree were *shirodamo* trees with the white undersides of their leaves standing out in sharp contrast. The leaves were clearly different. I was a young man at the time, pointing out to the president of the landscaping company, "That is *tabunoki*, and this is *shirodamo*," and I said, "If a professional gardener delivers *shirodamo* when the order is for *tabunoki*, that's fraud and

deception. If you didn't know that, you're not qualified to be a landscaping contractor." The president of the company could offer no excuse. He agreed to replace the *shirodamo* trees with *tabunoki*.

This episode also had a sequel, less than a week later. I received a phone call from the president of one of the landscaping companies, Mr. Maeda Michitaka. He apologized, "Professor Miyawaki, I am so sorry. We had no idea." He went on to ask me to train an employee of his who had just graduated from Shimane University with a degree in forestry, a young man named Nishi Fumikazu. What awaited poor young Nishi was a crazy life of training in fieldwork with me. Nishi later married President Maeda's eldest daughter, Shuko, and took the name Maeda Fumikazu on his adoption by his in-laws. He established a potted seedling production and tree planting company called Espec Mic to support the creation of hometown forests, and we have now been friends for 40 years.

Fifty Thousand Pine Saplings! Why!?

Following the development of hometown forests at the Nagoya Steel Works and the Hirohata Steel Works in Himeji, a hometown forest was created at the Yawata Steel Works in Kitakyushu. What awaited me at the site when I went to visit the completed project was a large plantation of trees that were all pines, pines, and more pines! Absolutely nothing but pine saplings!

I said to the executives of the Yawata Steel Works.

"Why did you plant only pines when I gave you a prescription for planting trees according to the potential natural vegetation, consisting mainly of *shii*, *tabu*, and *kashi* trees?"

The section manager in charge replied.

"Seedlings of *shii* and *tabu* are hard to come by. We planted pine trees because they're cheap and in plentiful supply."

I didn't hold back:

"Nippon Steel, which claims to be the number one steel company in the world, should never, ever stoop to using fake products, even if they're free!"

Here too, everyone stared in silence.

Looking like he was about to burst into tears, the responsible manager appealed to his superiors: "I still have 50,000 pine seedlings left. What am I going to do?" Mizuno Isao, the Plant Manager, cut him off sharply, yelling: "Shut up!" Mizuno is usually mild-mannered, but here he was fired up. He and I worked together on a forest creation project when he was manager of the Hirohata Steel Works. At times like this, the best place to turn to is the town's *Chinju-no-mori* forest. We all made our way to the *Takami Jinja* shrine, which was built when the government-run Yawata Steel Works was constructed. The *Takami Jinja* is the local deity of the Yawata Works and is home to a magnificent *Chinju-no-mori* forest

of *shii*, *tabu*, and *kashi* growing in the shrine's grounds. I declared, "This is the true forest," and everyone agreed.

The International Vegetation Conference was held in Japan for a second time in 1984. Professor Heinz Ellenberg of the University of Göttingen, Professor Tüxen's number one disciple, and others also came to Japan for the conference. We took them to a hometown forest with Mr. Shikimura Ken of Nippon Steel Corporation. At that time, Professor Ellenberg intently said to Mr. Shikimura, "I could understand why you would ask Miyawaki now about a project. However, he was still a young assistant professor at the time. If he'd failed, you would have been held responsible. Why then did you entrust Miyawaki with the project?" Mr. Shikimura smiled. "My biological instincts told me that I could lay my life on the line alongside Professor Miyawaki."

Citizen-led Creation of Native Forests: The Aeon Group and More

Following the example of Nippon Steel, we began to work on hometown forest creation projects with various electric power companies, including the Tokyo Electric Power Company, Kansai Electric Power Company, Chubu Electric Power Company, Kyushu Electric Power Company, and Okinawa Electric Power Company; railway companies including JR East and JR Hokkaido; and

miscellaneous companies such as Toyota Motor Corporation, Toyoda Gosei, Honda Motor Company, Yokohama Rubber, Toyo Rayon, Mitsui Fudosan, Mitsubishi Corporation, Mitsubishi Materials Corporation, Sango, Futatomi Real Estate, Toray Industries, Inc., Sumitomo Metal Mining Co. (Nippon Steel Corporation), Hioki Corporation in Ueda City, Nagano Prefecture, Nansei Sekiyu in Okinawa Prefecture, Valor Holdings in Gifu Prefecture, Mainichi Newspapers, Bank of Kyoto, Iyo Bank, Wakuden restaurants, and Yamada Bee Farm in Kagaminocho, Okayama Prefecture, my home town.

We also launched similar activities in municipalities such as Yokohama, Sasebo, Kakamigahara, Tokai, Gyoda, Kakegawa, Numazu, Kirishima, Toshima-ku in Tokyo, and other local governments, as well as for the Ministry of Land, Infrastructure, Transport and Tourism, in the latter case focusing on cut slopes along roads, rivers, and dams.



Kansai Electric's Gobo power station, situated on an artificial island.
Upper: Before planting, 1982.
Lower: Thirty years later in 2012.

Mr. Okada Takuya, honorary chairman of the Aeon Group, was enthusiastic about forest creation, and in 1991, the “Aeon Hometown Forest” initiative was launched, in which trees were planted on the premises of each store. Until then, forest development activities had mainly involved corporate employees and local government officials, but with the Aeon Group’s initiative, community-centered, citizen-led forest development began in earnest, a trend that has now become mainstream. The key advantage of potted seedlings, that they can be easily planted by anyone, was put to good use. Young children were taken by their parents to plant trees at Aeon’s premises. Some of these children are now adults, who visit the stores again and again to see the growth of the trees they planted.

Disappearing *Chinju-no-mori* Forests

There are other *Chinju-no-mori* forests that I have used as teaching models. On the Tokaido Shinkansen train line from Tokyo to Nagoya or Osaka, you’ll see flat residential and industrial areas along with rural scenery once you pass the city of Mishima. You can make out small islands of green trees, even in winter, rising out of the landscape. Most are Shinto shrines or Buddhist temples. When you look closer, you find that they are not necessarily major sites but are

rather small uninhabited shrines with rotting wooden torii gates and rows of *Jizo-san* Buddhist statues. Enveloping these shrines in soft green clouds are the canopy species of evergreen broad-leaved trees such as *shii*, *tabu*, and *kashi*, the indigenous trees of the area. This is the kind of scenery that fills my heart with joy.

These are the hometown trees in the catchphrase “a hometown forest made of hometown trees” that we Japanese have always preserved, protected, and created, even as we destroyed the rest of the natural environment to build villages and rice paddies. The Japanese are the only people to have created and preserved such *Chinju-no-mori* forests in Shinto shrines. Therein lies the ancient wisdom of Japan.



Tabunoki tree at Shonan International Village.

If you visit Shonan International Village (*Shonan Kokusai Mura*), you will be greeted by my favorite *tabunoki* tree.

Kanagawa Prefecture, together with the real estate developer Mitsui Fudosan, was planning to establish this multipurpose village in the Miura Hills in the center of the Miura Peninsula, so we conducted field surveys of the local vegetation from the early 1980's. The entire area was a miscellany of cedar plantations, deciduous trees, and sun-loving shrubs, but among them stood a magnificent *tabunoki* tree with a chest-high diameter of more than one meter. Surprised, I

approached it, finding that there was also a small shrine beneath it. Flowers and a sacred branch from the *sakaki* shrub (*Cleyera japonica*) had been placed there as offerings. I was filled with emotion. This is the pride of Japan, “a hometown forest made of hometown trees.” As an ancient tree inhabited by the gods, it must have been respected, loved, cherished, and preserved by the people who live nearby. While establishing a small shrine in this way, the people did not carelessly disturb the tree, out of a sense of reverence for nature. Thanks to their restraint, this magnificent *tabunoki* tree has been able to survive to the present day.

However, other *Chinju-no-mori* forests in Kanagawa Prefecture are disappearing. The fact that the *tabunoki* tree in Shonan International Village is still standing may almost be regarded as a miracle. Records show that there were once 2,846 *Chinju-no-mori* forests in shrines and temples in Kanagawa Prefecture. However, according to the results of our field survey of vegetation in the late 1970s, we found that only 40 of these forests had managed to retain their original form; that is, they still had a multi-layered community system. *Chinju-no-mori* are disappearing at a frightening pace across the country.

Fighting Prejudice Against the Name *Chinju-no-mori*

It's unfortunate that there is still a prejudice against *Chinju-no-mori* forests. Many Japanese people harbor negative feelings towards the concept of *Chinju-no-mori* because of its perceived religious or historical connotations. From my point of view, they seem to be people who only see superficial imagery and don't understand or even try to understand the true nature of things. In the mid-1970s, I was interviewed by the Asahi Shimbun newspaper. Mr. Kihara Keikichi, a talented young editorial writer, was interested in the forests at Nippon Steel's Oita Works. When asked about the model for this forest creation project, I replied: "The *Chinju-no-mori* forests of nearby *Usa Jingu* and *Yusuhara Hachimangu* shrines." The interview had gone smoothly and enthusiastically until that point, but for some reason his face suddenly reddened, and he said, "Professor Miyawaki, I'd prefer you avoid talking about *Chinju-no-mori*. The word is evocative of Japan's militarism." I was dumbfounded by his statement. I looked him in the eye and said, "What are you saying? What's the relationship between *Chinju-no-mori* and militarism? The *Chinju-no-mori* forest is innocence personified. *Chinju-no-mori* is the wellspring of Japanese culture." Ultimately, Mr. Kihara did not write up the interview, but we continue to have a good relationship.

I've been open about the relationship between *Chinju-no-mori* and religion on every occasion. After the war, people began to

talk about ideas such as freedom of religion, but the reality is that religion was ignored. I think this is a serious mistake. For example, there are sacred forests and small shrines at shrines and sacred places such as groves and mountains in Okinawa. I have often visited a sacred place at Miyazato, near the Nago coast, where there's a magnificent forest covered with large old trees, including a massive *hasunohagiri* tree (*Hernandia ovigera*). However, even the locals do not know the reason why the forest is there. It's truly a shame.

Shrines and sacred places in Okinawa are located near villages or agricultural lands that are likely to be severely damaged by the direct hit of a typhoon. Perhaps our ancestors left these forests intact from long ago to protect their own lives, using awareness of religious curses to say, "If you cut down this forest, you will be punished severely." These forests not only serve to protect communities from severe rain events and storm surges but also serve to regulate local water levels by drawing up groundwater through their roots and transpiring it through their leaves. This transpiration from their large leaves provides a cool environment in summer and a mild environment in winter. Fallen leaves also serve as fertilizer. This is truly the ancient wisdom of Japan. Unfortunately, though, we are losing sight of this wisdom today.

Bringing *Chinju-no-mori* to the World

In March 1997, an international symposium “Shinto and Ecology” was held at Harvard University in the United States. Some Western religious scholars contend that Japanese Shintoism is not a religion at all. Shinto holds that there are countless many gods, and that even forests and ancient trees may be inhabited by gods, but that doesn’t mean that it’s a religion. In fact, some people would even say that only monotheisms qualify as religions.

During the symposium, a religious scholar at the University of Naples raised his hand and made the following statement.

“*Chinju-no-mori*’ or ‘shrine forests’ have been created in every corner of Japan and have long been considered a center for people’s daily lives and spirituality. These unique Japanese traditional forests with their four-thousand-year history have progressively been destroyed in less than the last 100 years. Before the war, they were used for political purposes; after the war, they were held up in the name of religious freedom. Today, many Japanese are indifferent to religion. Even the mere mention of the word ‘*torii*’ (a shrine gate) or ‘*Chinju-no-mori*’ is enough to elicit a negative reaction in some Japanese people. This is extremely unfortunate. We should reclaim the wisdom, philosophy, and

way of life of the Japanese people, who have long lived in harmony with their hometown forests.”

I felt compelled to applaud. The monotheistic religions of Christianity and Islam regarded nature as an object to be subjugated, and in just two thousand years, they have ruined the earth’s environment. By contrast, Japanese indigenous religions have long protected and handed down the *Chinju-no-mori* forests as sacred spaces. Japanese Shinto and Buddhism, which came to Japan through mainland China in the sixth century, had a philosophy of coexistence with nature, something I have long believed to be the case.

On the afternoon of the third day of the symposium, I gave a special presentation titled “Bringing *Chinju-no-mori* to the World.” In it, I asserted that “We Japanese did not wipe out all our nature. In parallel with our agricultural and forestry practices, we also created and protected natural forests, calling them *Chinju-no-mori*. Shinto is the philosophical foundation for the restoration and protection of ecological hometown forests,” emphasizing that “the *Chinju-no-mori* forests can be the springboard to save the world in the 21st century.”

At the reception that evening, Professor Ezra Vogel, known for his book *Japan as Number One*, came to shake my hand. He said, “Professor Miyawaki, I’m a happy man today. I have hope for Japan

again.” He continued, “The people of Japan are taking the lead in creating hometown forests modelled after the traditional Japanese Shinto shrine forests and following the rules of ecology, not only in Japan, but also in the Amazon and Borneo. This is a wonderful thing. Japan will again become Number One if you share this knowledge with the rest of the world.”

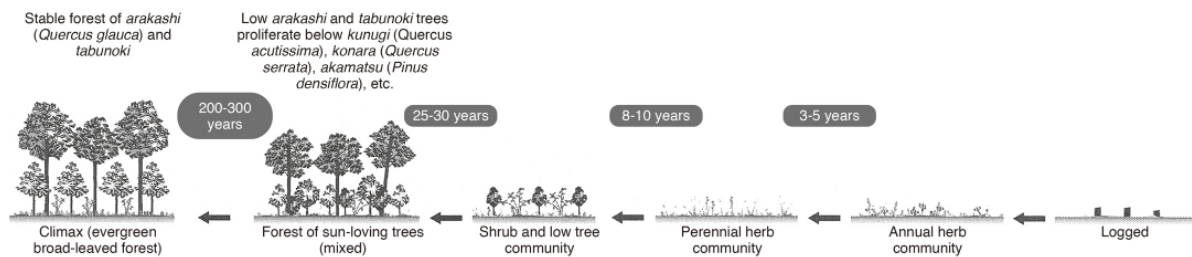
The traditional Japanese *Chinju-no-mori* is a typical multi-layered community forest. It has served as a spiritual center for its local community and as a disaster mitigation and evacuation site in times of catastrophe. Since ancient times, *Chinju-no-mori* forests may have formed the basis of national development and security in the Japanese archipelago, where natural disasters are frequent. The Japanese also cleared forests to create fields, villages, and towns for their livelihood. However, the Japanese did not wipe out all their forests. They have created, preserved, and protected the *Chinju-no-mori*. They have preserved hometown forests made of hometown trees. But after World War II, we may have forgotten that. Creating hometown forests to protect life is an effort to revitalize the *Chinju-no-mori* in the 21st century. It is also an activity to restore the heart and soul of the Japanese people. Protecting, creating, and globally spreading the concept of *Chinju-no-mori* forests, of which the Japanese people should be proud, will indeed serve as a springboard for saving the world in the 21st century.

Chapter 5

The Miyawaki Method



Planting trees in Kenya, Africa, 2007.



Schematic diagram of secondary succession in the evergreen broad-leaved forest zone.

Source: *Thirty Million Seedlings: Creating Forests for Life* [in Japanese] NHK, 2006.

Achieving Succession Sooner

I believe that Clements' theory of succession may have been overemphasized in conventional ecology textbooks. This was the starting point for the Miyawaki Method, and I turned my attention next to soil conditions.

As we have seen, most of the forests we see today are heavily altered from their original state. They are now composed of secondary vegetation established and maintained under the influence of human activities. What would happen if all human influence were to cease? The vegetation will immediately revert toward the "potential natural vegetation," that is, the indigenous forest of the land consistent with the sum total of the natural environmental factors of the area. This is called succession (secondary succession).

Clements' theory of succession was proposed by the American plant ecologist Frederick Clements (1874–1945) in 1908. He described the indigenous forest of an area as being in the "climax" stage and proposed the monoclimax theory which holds that all vegetation eventually becomes that single climax community.

On bare land created by volcanic eruption, lichens and mosses appear first (in reality, mosses are rare), followed by annual herbaceous plants, then perennial herbaceous plants and shrubs,

then sun-loving sub-canopy or tall tree forests, and finally, if in an evergreen forest zone, a climax forest, a forest of shade-tolerant trees indigenous to the area. Clements described this process graphically, and his diagram is widely used in textbooks around the world.

On the other hand, Dr. Braun-Blanquet and Professor Tüxen and others, while acknowledging the merits of Clements' succession theory to a certain extent, pointed out that "It is too formulaic. From a broader perspective, climate has a substantial influence on the development of vegetation in the natural world and on the determination of the final phase, but locally, soil conditions and other factors also play a role." They note that "There are in fact many forests that do not reach climax due to periodic natural upheavals, such as heavy storms and floods, and remain one stage short."

What happens if we leave land to the natural succession that Clements proposed? Even on the Japanese archipelago, where *matsu* pine, *sugi* cedar, and *hinoki* cypress are now widespread, the land will return to the indigenous evergreen broad-leaved forest and deciduous (summergreen) broad-leaved forest (Hokkaido, northern Tohoku, most of Honshu, and in the mountains from 800 meters above sea level to 1,600 meters above sea level Shikoku and Kyushu) after 200 to 300 years without any human intervention.

However, when the effects of human activities are being felt on such a global scale, is it possible to leave forested land alone in

its natural state for long periods of time without affecting it? It's virtually impossible. In the process of long-term succession, there may be various adverse effects, such as natural disasters caused by forest degradation.

What should we do, then?

Succession is the process by which one plant community transitions to another. Indeed, in the natural succession on bare ground produced by volcanic eruption, for example, plants slowly build soil over time, and that soil allows for more stable vegetation development.

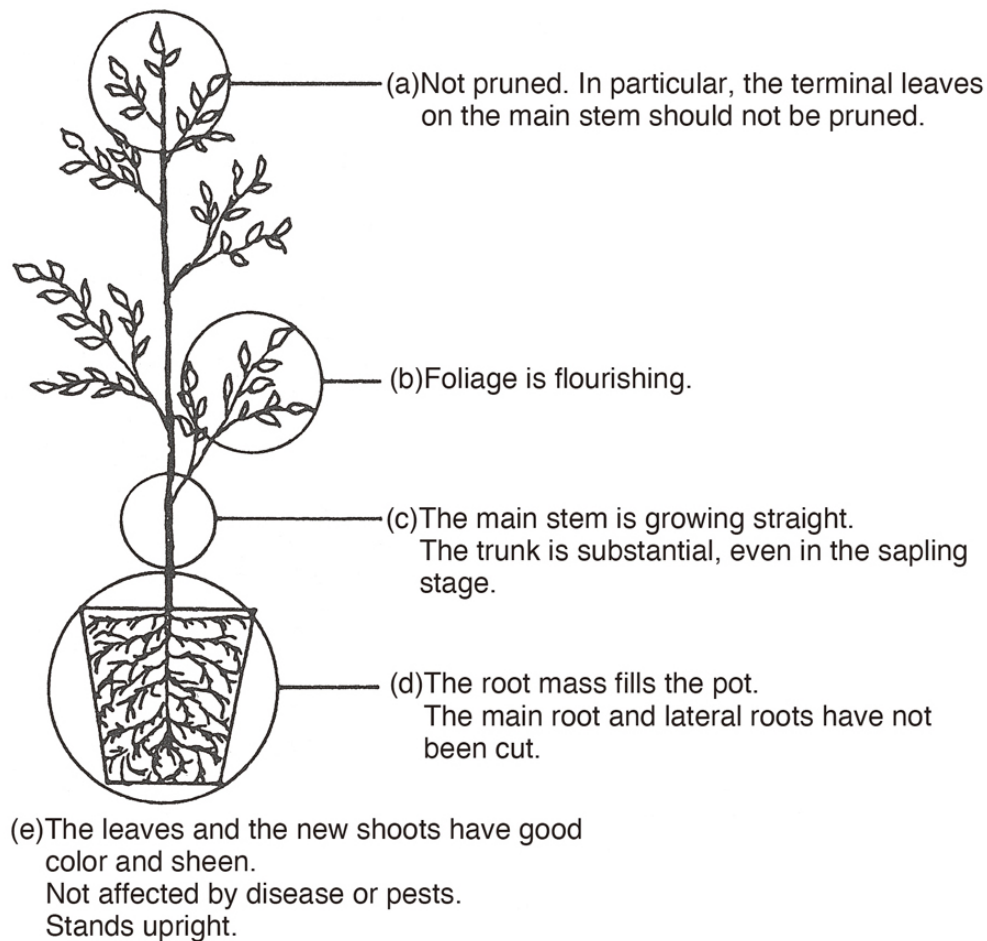
Textbooks have taught that primary natural succession requires 200 to 300 years in Japan and 300 to 500 years or longer in tropical regions for the indigenous forests of an area to be established. In fact, it's thought that it takes about that long for a reclaimed coastal area to convert to a natural forest. However, broader climatic conditions have remained largely constant for thousands of years. The only difference is in the soil conditions, a factor on which I have focused my attention.

I suggested that by restoring the topsoil, which is rich in organic matter and highly permeable to air, I could create indigenous hometown forests in a shorter period of time, and I have practiced and verified this proposal. First, the minimum depth of the topsoil restored should be 20 to 30 cm. This is because plant roots absorb nutrients such as nitrogen, phosphate, and potassium, the three

major elements, from only 20 to 30 cm below the surface, or 50 cm at the deepest. Of course, the main roots that support the tree can grow as deep as 3 to 6 meters underground, as long as the soil is well aerated and allows for respiration.

By densely planting a mixture of tree species in accordance with the potential natural vegetation in the surface soil after allowing the seedlings' roots to develop in pots, the land can be made to function as a forest in a short period of time. At that point, the plants will be able to slowly create their own soil. This is the basis of my belief.

Potted seedlings planted according to the Miyawaki Method start out at a height of 30 to 40 cm, grow to three meters in three years, and five meters in five years. Three to five years after planting, the saplings, though small, will have established the original form of the forest. After that, as the trees grow, the process of natural selection will continue, and the trees will build their own soil with their own fallen leaves and other materials. As a result, it is possible to create a multi-layered forest that is as close to nature as possible in about 20 to 30 years and facilitates the emergence of the potential natural vegetation.



Characteristics of a good potted seedling.

Source: Theory and Practice for Methods of Environmental Conservation. Japanese Center for International Studies in Ecology, 1995.

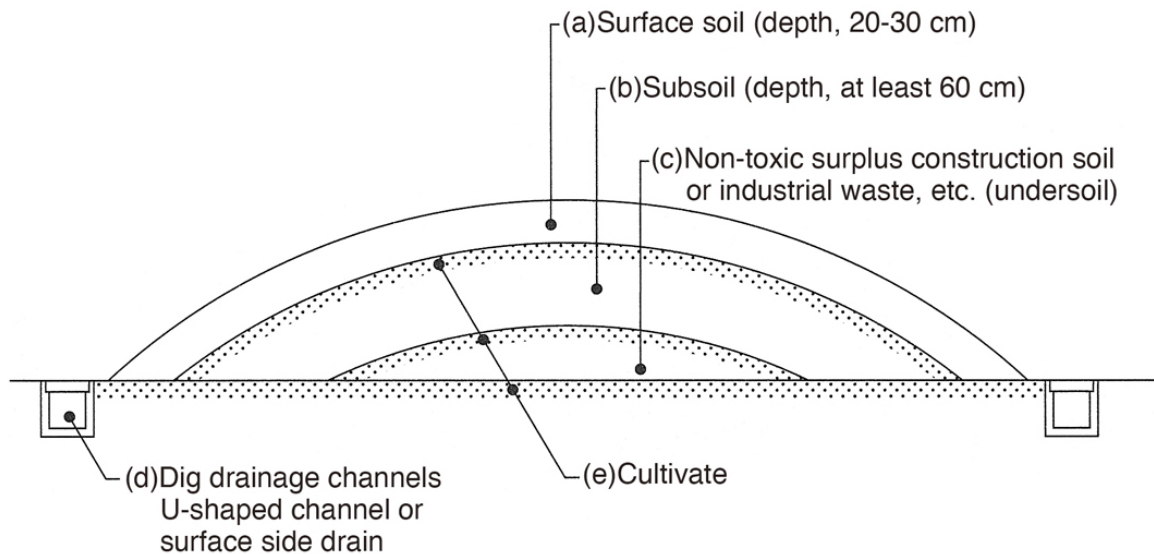
Creating a Good Foundation for Tree Planting is Key

For the first two to three years after planting, weeding and other management activities are needed once or twice a year. After the third year, however, excessive management such as pruning,

thinning, and underbrush clearing is unnecessary. Basically, it's important to let nature itself manage and allow natural selection to take its course.

The prerequisite for this process is the creation of a mound of soil composed of topsoil mixed with organic matter and other materials, the selection of tree species appropriate to the site based on the potential natural vegetation, and the mixed and dense planting of potted saplings.

Creating a proper foundation before planting trees is crucial. As I mentioned earlier, plants compete with their roots. Roots live or die by the soil that surrounds them. It's crucial that the roots can breathe, a factor that has escaped a great deal of attention until now. Since "plants need roots and roots need oxygen," plants need oxygen, oxygen, and more oxygen. To improve drainage, the preferred mound shape is a pyramid or egg shape. A mound with a constant slope on both sides is very effective. In fact, I'd initially thought that a plateau-shaped mound would be best, but when I planted trees on such mounds, the growth of trees planted on the slopes was much better than that of trees planted on the flat section. Subsequent trial and error proved that pyramidal and egg-shaped mounds are better. On plateau-like mounds, there are always depressions or puddles on the flat portions. This leads to root rot and poor growth.



Profile of suggested mound shape.

Source: Theory and Practice for Methods of Environmental Conservation. Japanese Center for International Studies in Ecology, 1995.

The topsoil should be restored by mixing in as much organic matter as possible, such as fallen leaves, dead grass, wood waste, and scrap wood, into the soil. Then, as shown in practice at Nippon Steel's Oita Works, we recommend digging holes and filling them with global resources such as grass clippings, household trash, construction debris, industrial waste that has been confirmed to be non-toxic, and debris after removing toxic and difficult-to-degrade plastic and other materials, mixed well with the excavated soil. We recommend burying such materials. This should make the mound higher and less expensive.

The presence of rubble and debris creates pockets of air between the soil and allows the roots to penetrate deep into the

ground in search of oxygen. By taking full advantage of the deep-growing, tap-rooted characteristic of *shii*, *tabu*, and *kashi* trees, we can create forests that are unaffected by typhoons, floods, earthquakes, tsunami, and landslides, and that protect life and property.

Toward a Climax Forest Community

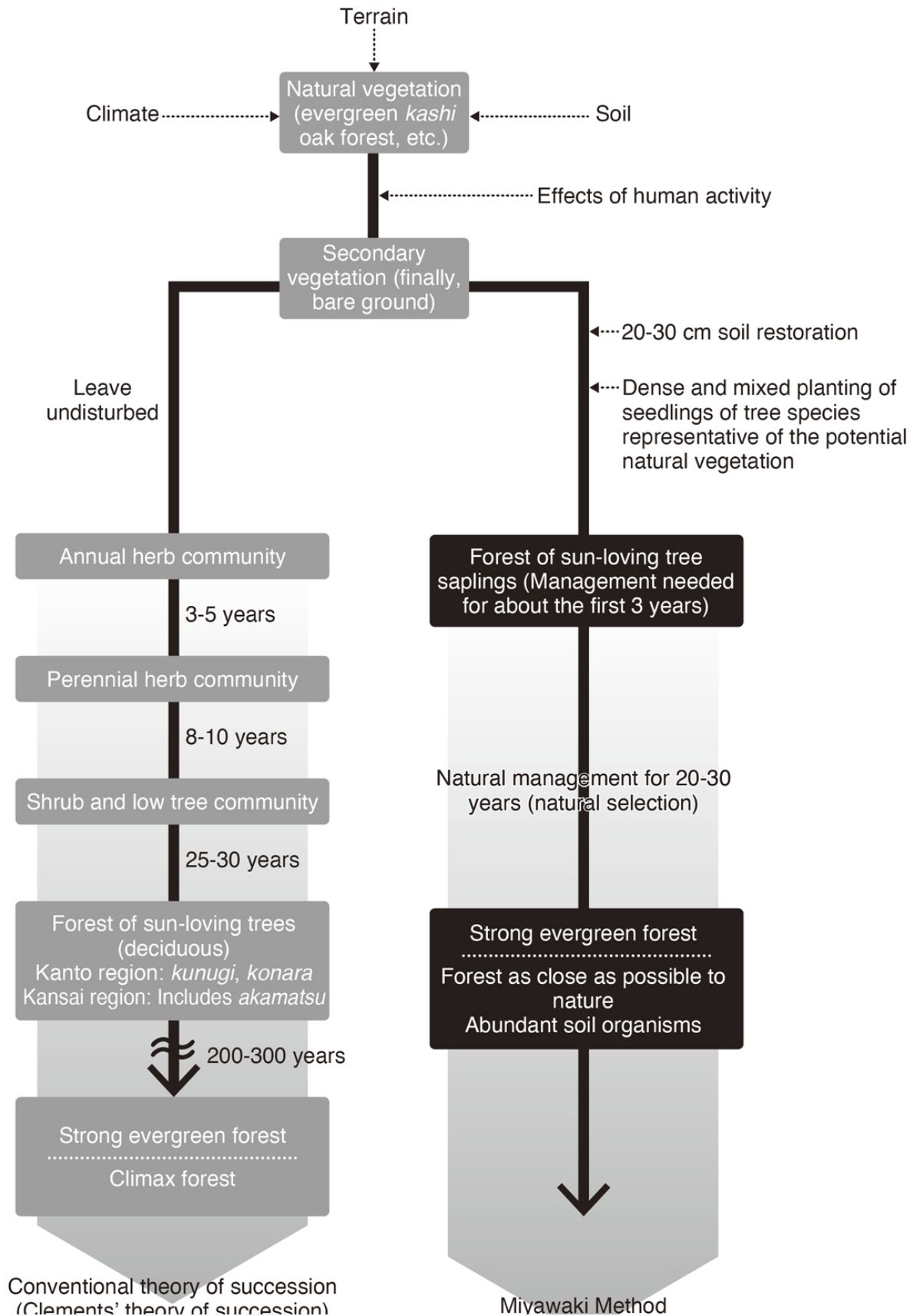
The *shii*, *tabu*, and *kashi* trees planted in this way will survive for hundreds of years or more, and over time will form multi-layered forests and a lush natural environment. The forests maintain their dynamic strength, rich in biodiversity. The Miyawaki Method of creating hometown forests leads to the climax of the project as quickly and surely as possible, i.e., achieving a multi-layered, near-climax forest in one fell swoop. Some people call the Miyawaki Method a modern-style short-cut, but it's a technique that leverages the natural forest system that has been cultivated for hundreds or thousands of years and is based solely on the rules of natural forests.

In the Brazilian Amazon, we compared Clements' theory of succession and the Miyawaki Method. We planted a mixture of fast-growing balsa and other fast-growing trees based on Clements' theory, and Virola, which we judged to be the dominant species. The balsa trees grew to a height of four meters in two years and 14

meters in six years, but after ten years, the number of fallen trees increased despite the near absence of wind, and these fallen trees blanketed the main tree species such as *Virola*, blocking them from growing and hindering the development of the native forest. In brief, the balsa trees became an impediment to the development of the indigenous forest.

On the other hand, in the district of Breves on Marajó Island, with an area similar to that of the Japanese island of Kyushu, we densely planted a mixture of 14 types of potted seedlings that included *Virola* and *Cedro*, which were believed to be the dominant trees of the potential natural vegetation. The forest grew to a height of eight to ten meters in the tenth year, primarily the *Virola* species, and now, about 20 years later, its appearance is approaching that of the indigenous forests of the area.

This experience in the Amazon teaches us that to regenerate an indigenous forest in the shortest possible time, we should use potted seedlings of young trees based on the potential natural vegetation and use the dominant tree and as many species as possible from the indigenous forest of the area. We have concluded that mixed and dense planting of constituent species achieves more reliable outcomes.



Differences between the conventional theory of succession and the Miyawaki Method.

Source: Modified from *Thirty Million Seedlings: Creating Forests for Life* [in Japanese] NHK, 2006.

These internationally acclaimed results were presented at the 45th annual meeting of the International Association for Vegetation Science held in Porto Alegre, southern Brazil, in March 2002.

Why Do We Mix Them Up?

“A roadside lawn will bloom in the spring, even though it has been trampled on by countless feet.”—From a Japanese tanka poem

Oobako plantain (*Plantago asiatica*) also grows extensively in the Northern Hemisphere on farm roads, trails, and other areas bordering bare land that are trafficked by pedestrians. In fact, plantain communities survive simply because of the trampling. When no longer trampled on, plantain still grows rapidly but loses its place to other grasses that are more competitive.

In biological societies, including plant communities, a place where all physiological desires can be satisfied is a dangerous place where competition is intense. The long evolutionary history of plant communities tells us that the best conditions for longevity are those

that demand a little patience. There's a difference between the best conditions and the optimum conditions for healthy survival and maintenance of life.

Whenever I go to any tree-planting event, I have a habit of calling out, "Mix 'em up, mix 'em up, mix 'em up!" So why do I say this? The answer is that we want to provide an opportunity for competition through mixed and dense planting, resulting in the creation of a strong natural forest, to create a hometown forest that will last as long as a *Chinju-no-mori* forest. Forests thrive on competition, endurance, and coexistence among diverse tree species.

It was the *karamatsu* (*Larix kaempferi*) that provided us with the opportunity to learn about the rules of this biological society. Natural *karamatsu* can be found in places such as where the volcano of Mt. Asama erupted and the soil is not yet fully developed, or around the parking lot of *Fujisan Komitake* shrine (215 meters above sea level) on the flank of Mt. Fuji. The natural habitat is a harsh location where lava is exposed and nutrients are washed away as soon as it rains, and in such a dry location, a natural forest of *karamatsu*, also known as heavenly *kara* (large larch), can be found.

Ozegahara Marsh in Gumma Prefecture was recognized as an important habitat in the 1960s, and with the permission of the then Agency for Cultural Affairs, I was conducting a vegetation survey,

immersed in the marsh up to my waist. The low temperatures, high humidity, and strong acidity of the site meant that only dwarf species such as the *ibomizu goke* (*Sphagnum papillosum* Lindb.), *murasaki mizugoke* (*Sphagnum magellanicum* Brid.), and other sphagnum mosses, as well as the *tsurukokemomo* cranberry (*Vaccinium oxycoccos*), *himeshakunage* (*Andromeda polifolia* Linn.), and *isotsutsuji* (*Ledum palustre* var. *diversipilosum*) and other dwarf shrubs, grew in the peat marsh called the “highland marsh.” When you looked closer, however, you could see that the first tall trees to grow were *karamatsu*. I had always assumed that plants like to grow where conditions are favorable, so when I saw the *karamatsu*, I was honestly puzzled. I wondered, “Does it prefer dry or humid locations?”

The mystery was solved by recalling the research by Professor Heinz Ellenberg and his colleagues at the University of Göttingen, which I learned about while studying in Germany. Professor Ellenberg conducted the following water table experiment with Professor Heinrich Walter of the University of Hohenheim and others. Soil was placed on a slope in an aquarium. Naturally, the upper part of the slope is less damp and drier, and the lower part is progressively wetter. When five to six native grasses were planted in a mixture, the Japanese springtime meadow grasses such as *suzumenoteppou* (*Alopecurus aequalis*), showed the greatest amount of growth in the wettest areas closest to the water’s edge,

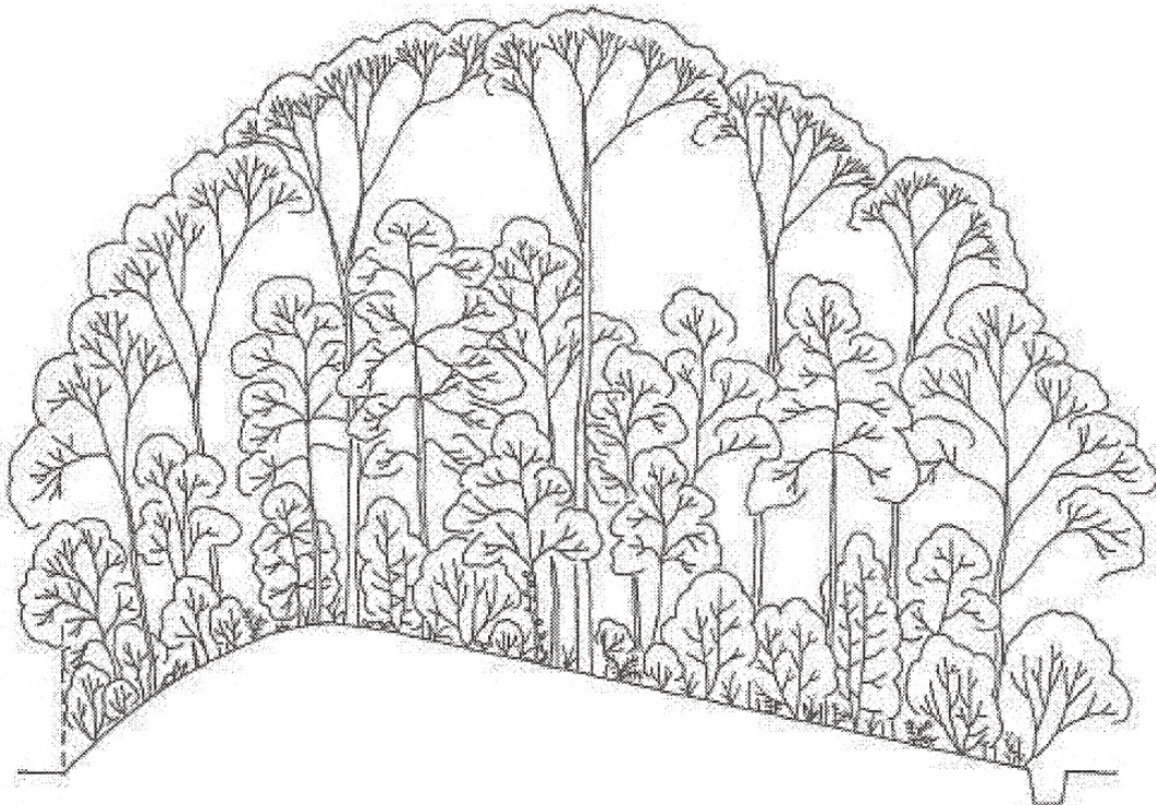
but disappeared in the dry areas. On the other hand, pasture *suzumenchahiki* (*Bromus japonicus*), which grow abundantly on dry Jurassic coal rocks in Europe, showed maximum growth in areas that were neither too wet nor too dry when planted singly, but showed maximum growth in the driest areas when mixed, and disappeared completely when the soil began to get a little wetter.

Professor Ellenberg and his colleagues decided to call the former the “physiological optimum” and the latter the “ecological optimum” after considering which is the true state of growth: growth in the absence of competition, or growth when pushed out of favorable conditions because of competition. In other words, the physiological optimum zone and the ecological optimum zone are different in a biological society. From this research, I concluded that in a natural biological society, conditions that are a little less than physiologically optimal, a little harsher, and that force the organism to become a little more tolerant, are the ecologically optimal conditions for healthy survival tomorrow and into the future. In other words, my “Mix ‘em up, mix ‘em up, mix ‘em up!” approach is aimed to create ecologically optimal conditions.

Potted seedlings of young trees consistent with the potential natural vegetation are used to plant a mixture of as many of the original forest component species as possible around the dominant tree. If the trees are planted densely, a layer of canopy trees, sub-canopy trees, and shrubs will form over the next 15 to 20 years.

Some of the trees will die by natural selection. However, if left untouched, they will be slowly decomposed by soil organisms on the forest floor to become nutrients that will help the surviving trees grow. In the meantime, the seeds and spores of the undergrowth are carried by birds and wind, taking root and forming a herbaceous layer, creating a dynamic, stable, multi-layered forest where the indigenous potential natural vegetation of the land develops.

The power of a multi-layered community forest should survive for 100 or 1000 years, while protecting life in all its forms.



A completed Miyawaki forest.

Source: Miyawaki Akira, Nakamura Yukito. "Report of a Vegetation Survey in the Vicinity of Yasu: Vegetation of the Southern Side of Lake Biwa in Shiga Prefecture" [in Japanese], 1981.

Chapter 6

Am I Really Their Nemesis?



A forest of stakes used in the traditional method of tree planting.

Confessions of an Egotist

The hometown forest project began as a corporate initiative. By the time we had finished creating forests at all Nippon Steel Corporation's steel mills, from the Oita and Yawata Works in the south of Japan to Tomakomai in Hokkaido in the north, we began to receive a stream of commissions from other companies and

governments. Another stimulus for the creation of forests came from the Factory Location Law, enacted in 1974, which mandated the development of green space equivalent to 20 percent of the site area for new factories.

I'm not a romantic nature lover. Researchers are extremely egotistic about their research, and I too, am an egotist. If there are sites on steep slopes, windswept ridges, or coastal areas where forests are said to be impossible, I will try and make the Miyawaki Method work under such severe conditions. Why? Because I want to be successful and give presentations at international conferences.

Whenever a company asked us to create a forest, we proposed a set of preconditions before starting any work: we wanted to conduct adequate vegetation surveys and research at the site and surrounding areas, in advance. We didn't have sufficient funds to travel for field vegetation surveys, so we asked companies to meet our expenses, and also asked them to cover the costs of printing papers and reports.

We really had no money until I started working on *Vegetation of Japan* in the 1980's. That was the time when I had to submit rather cumbersome applications to the Ministry of Education, and our claim for research expenses for a year was a paltry 15,000 yen. Of course, I was particularly dogged about the work we undertook. Whenever we conducted a vegetation survey, we worked night and day to assemble the results for presentation at conferences. We

published the results of our research, identifying the companies that paid for the research, and we always included a summary and explanation of the data in a Western language so that we could disseminate the results more widely outside Japan. We made sure that the name of the company would remain with the papers and reports as they spread worldwide.

The Economics of Hometown Forests

Requests from companies for forest creation projects kept coming in, due to the advantages they perceived. Compared to conventional “greening” projects, the results and scale of hometown forest projects are completely different, added to which they are more economical. This is how our mutually beneficial relationship with companies came about.

The initial process of creating breathable mounds for hometown forests is expensive and time-consuming. However, the cost of planting the seedlings in pots is less than one-tenth the cost of planting the trees themselves, because the traditional method of planting trees involves securing high-priced mature trees with expensive, sturdy stakes. Moreover, subsequent maintenance is limited to weeding for the first three years, and then little management is required. The companies surely benefited from the fact that management costs could be kept down and that a forest

intended for disaster mitigation and environmental conservation would reliably grow, even after subtracting the costs of the vegetation survey and printing.

The Honda Motor Company, for example, had been spending 220 million yen on annual planting and management costs for all its factories and laboratories. When I went to see the sites first-hand, I found only patches of lawn and sad-looking trees propped up by stakes. And to manage this, the company was spending 220 million yen every year! Measurements of green space area are also different for lawns and forests. Moreover, there are big differences in terms of carbon dioxide absorption and noise prevention.

So, what is the current state of the former Honda Motor Company lawns? Hometown forests made of indigenous trees are growing there.

No Stakes for the Great Wall of China

In 1997, discussions between Mr. Okada Takuya, chairman of the Aeon Environmental Foundation, and the mayor of Beijing resulted in a plan to restore the indigenous forest in the vicinity of the Great Wall of China. The plan called for Japanese and Chinese participants to plant 400,000 seedlings, with a long-term target of 1,000,000 pots, and I was chosen to oversee the project. At a dinner hosted by

the mayor of Beijing, the mayor approached me with a serious look on his face:

“Professor Miyawaki, I actually don’t want people from Japan to come on tree-planting tours just for their own satisfaction.” I was surprised and asked, “What do you mean?” He told me confidentially why, “In the past when people have come from Japan on tree-planting tours, all there is to show after three years are stakes and a signboard.”

The mayor went on to say:

“We want real forests that prevent yellow sandstorms, stop desertification, and retain and purify water.”

I explained that we were there to create an authentic forest, an indigenous forest. I asked him to leave the choice of species to us and noted that the Mongolian oak (*Quercus mongolica*) would be the star of the show.

In 1977 in fact, 20 years earlier, I had been invited by the Chinese Academy of Sciences and East China Normal University in Shanghai to conduct a series of field vegetation surveys. Due to restrictions on our movements imposed by the Chinese government, we could only survey the areas around temples, but we did confirm that Mongolian oak was growing in the mountains behind temples north of Beijing.

Based on the results of our subsequent research, we proposed that the area along the Great Wall of China (near the part

of Beijing known as Yanqing District) be planted mainly with Mongolian oak, the dominant tree of the potential natural vegetation.

However, the director of the Beijing Municipal Bureau of Agriculture and Forestry and the director of the Bureau of Greening said, "Those trees have long since disappeared. The only trees that remain are poplars (*Populus*), locust trees (*Robinia pseudoacacia*), willows (*Salix* spp), and alder (*Alnus japonica*)." These are pioneer plants, just like pine trees. They grow quickly but don't last long.

While the discussion wasn't going well, a former director of a forestry experiment station in Yanqing District, who was at the far end of the table, raised his hand uncertainly. He said, "Come to think of it, there was one Mongolian oak tree in the Songshan National Nature Reserve." If there's even one natural tree left, check around there, and you'll surely find others.

The next day, seven or eight of us got into a truck and headed for Songshan, across fields and mountains. We found a forest of Mongolian oak trees on a steep slope that neither sheep nor goats could. When we asked them to collect one million acorns every year, the Chinese said there was no way they could find even ten thousand. They were, however, determined to finish what they set out to do, and they gathered 100,000 to 200,000 acorns every year.

Thanks to their efforts, the first tree-planting event was held the following year on July 4, 1998. It was a great success, attracting the attention of major media in both countries, with a total of 2,600 volunteers, 1,400 from Japan, and 1,200 from China, including Aeon Environmental Foundation chairman Okada and his wife.

At first, the Chinese side was skeptical about whether the Miyawaki Method would work. However, nearly all the potted seedlings sprouted beautifully. When a Chinese official on the ground saw the results, he said to me, "We're very happy to see that the Miyawaki Method is working."

"Professor Miyawaki, it's amazing. It's a miracle. The potted seedlings are all healthy. To be honest, if I actually said that 100 percent were healthy, the bureau chiefs and the director of the People's Government of the Beijing Municipality wouldn't believe me. That's why I'm going to report that the survival rate of the seedlings is 98 percent. I'm sure you'll understand."

In China, we have also planted trees in the Pudong area of Shanghai, Qingdao City, Guangzhou City, and Xilinhote in Inner Mongolia.



At the Great Wall of China. The author with the planted Mongolian oaks, 2002.

The Nemesis of the Forestry Agency, Landscapers, and Foresters

Supporting stakes were a hot topic of conversation in China. Landscape contractors tell me that they guarantee a survival period of one year for their trees after planting, but at the Honda Motor Company site, it seemed that the trees began to wither at around 13 months. Landscapers and forest workers plant mature trees, which

have first had their branches removed and roots cut to make them easier to transport by truck or other means. Again, I stress that plants are only as good as their roots. That alone should tell you that this is a method that ignores plant ecology. Then, as if to add value, the trunks are dressed with straw and supported by three stakes. Moreover, they are planted sparsely to avoid competition. After that, it's fertilizer and more fertilizer, water and more water. And then there is underbrush clearing, vine cutting, branch pruning, thinning, and so on. All these activities are their source of income.

It may be one of my weaknesses, but I tend to say things that are better left unsaid. I've repeatedly called out as "fake" the introduced *niseakashia* (black locust; *Robinia pseudoacacia*) and the monoculture of coniferous trees such as *matsu*, *sugi*, and *hinoki*, which need to be managed forever and are susceptible to natural disasters. Perhaps partly because of this, at some point in time, both I and hometown forests came to be regarded as natural enemies by the Forestry Agency, landscape architects, and forestry workers. Although I have never heard it directly from them myself, it seems that they called me their "nemesis" as if to counter the "fake" label. I haven't rejected monoculture forests of *matsu*, *sugi*, and *hinoki* for the purpose of lumber production. I've only argued that uniform monoculture forest development in areas that cannot be managed or in locations prone to natural disasters is dangerous. Still, from their point of view, they must have felt that I was trying to

downplay the value of their work, or perhaps that I was seeking to deprive them of their livelihoods.

Some people look at trees planted according to the Miyawaki Method and criticize the trees, saying things like, “Are you okay with such a straggly look?” However, this is characteristic of the initial competitive stage, and after 10 years, the process of natural selection will begin, and the dominant trees will begin to gain weight and thicken up. When they see this, my critics become silent, too.

A Surprise Visit to their Nemesis

After World War II, the Forestry Agency took the lead in planting coniferous trees such as *matsu*, *sugi*, and *hinoki* in national forests, in accordance with national policy. Many Japanese urban areas with wooden houses were devastated by incendiary carpet bombing by the U.S. military, so it was only natural that these timber species would be required for the reconstruction effort.

When we travel in mountainous areas throughout the Japanese archipelago for field surveys of vegetation, we see *sugi*, *hinoki*, and *karamatsu* (Japanese larch, *Larix kaempferi*) planted in straight rows from steep mountain peaks to deep valley floors, making us wonder with admiration how the foresters did it. These trees were planted mainly for economic uses, such as lumber production. However, as I mentioned earlier, the supply of foreign

lumber increased rapidly after imports were fully liberalized in 1964, making the domestic forestry industry economically unviable. The number of forestry workers also declined sharply, from 440,000 in 1960 to slightly more than one-tenth of that number, about 50,000, by 2007. Consistent with the aging of the broader Japanese population during this period, about a quarter of the forestry workers are now aged 65 years or older.

The era of post-war reconstruction has passed, and that of rapid economic growth is over. The boom times for mountain land-owners will never return. The time of forests for disaster prevention and environmental conservation is coming. I have been advocating this for the past 40 years; not only advocating, but also putting it into practice, all alone. I have repeatedly asked the forestry administration to plant indigenous evergreen broad-leaved trees as the dominant tree communities in accordance with the potential natural vegetation to create forests for disaster prevention and environmental conservation on steep slopes, ridges, and beside waterways that are sensitive to human activities. That's not a criticism but a suggestion. The Forestry Agency has indeed begun to listen to my suggestions recently. They are also beginning to recognize the limits of their one-size-fits-all approach to coniferous trees.

In February 2009, Mr. Shimada Taisuke, Deputy Director-General of the Forestry Agency (later Director-General of the

Forestry Agency), accompanied by the Director of the Forest Management Department, made a surprise visit to my laboratory. He told me the following,

“There are certainly places where too many cedars have been planted. We’d like to create forests for disaster prevention and environmental conservation in the national forest estate. We want to create the forests that you advocate, starting with disaster-stricken areas, so we’d like to ask you to work with us.”

In response, I asked,

“For more than 100 years, the government has been saying that anything other than *sugi*, *hinoki*, and *karamatsu* is not a real tree. Even if the executive wants to go down this path, will you be able to persuade the staff on the ground in the District Forest Offices?”

Deputy Director-General Shimada responded, “It’s definitely going to be tough, but we’ll get it done.” He continued, “We’ve been studying your accomplishments very carefully. I hope you’ll work with us.” He said that they’d not only reviewed the results of my hometown forest projects, but also looked closely into my approach, based on my past publications and field practice. His earnest statement “We’ll get it done” reflected the outcome of this process. When top management decides to do something, the staff at the coalface move into action. Regional Forest Offices around Japan have begun to move, little by little.

In June that year, in the Mount Noro National Forest in Kure, Hiroshima Prefecture, we planted potted seedlings of evergreen broad-leaved trees on the site of a windfallen *sugi* (cedar) plantation. People from the local District Forest Office, as well as middle-ranking staff from various Regional Forest Offices from across the country, joined in the tree planting. I was frankly surprised and impressed, as I had thought it would be impossible during my lifetime to work on forest creation with the Forestry Agency.

How to Make the Most of *Matsu*, *Sugi*, and *Hinoki*

I'm not saying that all conifers are bad. Nor am I advocating that all conifers be replaced by evergreen broad-leaved trees. Conifers that are beneficial should be retained. If proper management activities such as weeding, pruning, thinning, and clearing can be reliably sustained, conifers such as *matsu*, *sugi*, and *hinoki* will continue to be necessary, as long as the right trees are in the right locations.

One problem is that monoculture plantations have been planted uniformly in areas that are not suitable for them. Another is that *matsu*, *sugi*, and *hinoki* have been planted in large numbers outside their original habitats, making them unmanageable. *Matsu*, *sugi*, and *hinoki* are not themselves to blame. From now on, we

should wherever possible consider planting them on land only where they used to grow naturally, and managing them appropriately and sustainably.

So, what should we do if we can no longer manage them, even if we wanted to? The attitude in the press seems to be that “if you don’t manage the forests, the mountains will become wasted,” but this is half true and half false from an ecological standpoint. The indigenous forests of an area should rather be left to nature without human intervention such as excessive undergrowth clearing. Many indigenous forests that fulfill functions such as disaster prevention and environmental conservation based on potential natural vegetation, such as the *Chinju-no-mori* forests, have survived simply because they have been left untouched by human hand.

There’s also a way to make ecological use of the *matsu-sugi-hinoki* triad that we have now. Standing trees that can be economically supported in the future should be left as they are. On the other hand, *matsu*, *sugi*, and *hinoki* trees that have been toppled by storms or thinned should be left lying against the slopes without being burned. This will allow fallen leaves to accumulate and enrich the soil.

If we then create hometown forests in accordance with the potential natural vegetation, the forests will naturally return to their original state. The forests will play diverse roles, such as that of disaster prevention and environmental conservation, and will form a

rich green landscape unique to the region that can also serve as a tourist resource. *Sugi*, *hinoki*, *matsu*, and even broad-leaved forests that have grown sufficiently tall can be carefully selected for use.

When logging has been completed for exotic tree species such as *matsu*, *sugi*, or *hinoki* that are unsuited to the land, the area must be reforested. However, after logging selectively in the indigenous forests based on potential natural vegetation, successor trees are waiting in the wings, so the power of the multi-layered community forest that performs a variety of functions in coexistence with the local economy will be sustained, as the old is replaced with the new.

Viewed from the perspective of biological evolution, conifers such as *matsu*, *sugi*, and *hinoki*, which seem to be thriving amidst human activity today, are gymnosperms that emerged after ferns, like cycads and ginkgo, with their naked ovules. Pollen analysis and other results show that such gymnosperms, conifers such as *matsu*, *sugi*, and *hinoki*, flourished in the Japanese archipelago from tens of thousands of years ago to about 10,000 years ago during the Last Glacial Period. Today, however, most of the plants that we encounter are angiosperms. The ovules of angiosperms are enclosed by the ovary, and as a result they are likely more resistant to environmental changes.

In the case of trees, the main types of angiosperms are trees with broad leaves such as *shii*, *tabu*, and *kashi*, the dominant trees

in evergreen broad-leaved forests, and *mizunara* oak (*Quercus crispula*), *buna* beech (*Fagus crenata*), and *kaede* maple (*Acer palmatum*) in deciduous (summergreen) broad-leaved forests in the mountainous region of Tohoku and in Hokkaido.

From the perspective of biological evolution, conifers such as *matsu*, *sugi*, and *hinoki* are therefore “plants of the past,” so to speak. They were forced to grow locally in harsh locations on ridges, rocky ground, and near water because of pressure from broad-leaved trees such as *shii*, *tabu*, *kashi*, *mizunara*, *buna*, and *kaede*.

The method of creating indigenous hometown forests known as the Miyawaki Method is not something I dreamed up at my desk. It's the very system of the natural forest that has been cultivated for hundreds and thousands of years. It is the long history of biological evolution itself. We are practicing forest creation within that framework.

Meeting the Prime Minister

On February 9, 2010, I gave a lecture at the Hatoyama Yuai Jyuku private school. The president of the school Inoue Kazuko, sister of the then Prime Minister Hatoyama Yukio, listened attentively to the end. After the lecture, she said to me, “I’d very much like you to tell Yukio about this,” and I was later invited to the Prime Minister’s official residence.

The meeting was held at the Prime Minister's office on April 8, about two months later. The then Minister of Agriculture, Forestry, and Fisheries, Mr. Akamatsu Hirotaka, and the Director-General of the Forestry Agency, Mr. Shimada Taisuke, were also present. The invited participants were to speak to the meeting in turn for 10 or 15 minutes each. The famous actor Sugawara Bunta, who was also invited to the event, told us, "I'm here as a supporter of Professor Miyawaki, so I want him to speak during my time." I think I spoke for about 20 minutes, taking advantage of Mr. Sugawara's kind offer. I said that I would like to see the restoration of hometown forests throughout Japan addressed as a national policy. Prime Minister Hatoyama then asked me a question, and I candidly suggested the following.

"No matter how much trouble we have in national politics, many of these difficulties are only fleeting problems of the moment. What should be prioritized above all else are efforts to protect the land of Japan and to safeguard the lives, culture, and genes of the Japanese people for the future."

I went on to say this.

"If the Prime Minister gives the go-ahead and the Minister of Agriculture, Forestry and Fisheries in turn instructs the Forestry Agency, the Regional Forest Offices and District Forest Offices nationwide will also act. I want to create forests for life not only in the national forest areas, but throughout the entire country."

Prime Minister Hatoyama was also persuaded by this suggestion and added, "I want this to be a national movement."

On January 19, 2011, I had the opportunity to meet Mr. Minagawa Yoshitsugu, then Director-General of the Forestry Agency (now Vice-Minister for Agriculture, Forestry and Fisheries). I invited him to participate in a tree-planting festival that was planned to take place at a pyroclastic flow site on Fugen-dake, one of the peaks of Mount Unzen in Nagasaki Prefecture. In response, Mr. Minagawa promised that he would be happy to go. He also expressed interest in participating in a tree-planting festival planned for the Toyohashi National Forest in Aichi Prefecture, which was damaged by Typhoon No. 18 in 2009.

I had a premonition that a national movement to create hometown forests to protect life throughout the land was stirring in Japan. However, the Great East Japan Earthquake was looming on the horizon at that very moment.

Chapter 7

Forests and Life



A *tabunoki* tree on Tsubaki Island, Minamisanriku, Miyagi Prefecture. The tree sustained no major damage in the Great East Japan Earthquake. May 2012.

Memories of War and a Commitment to Life

There is one day that I can never forget, even if I wanted to. It was March 10, 1945, the day of the Tokyo Air Raid, in which more than 100,000 people are said to have died or gone missing. My eldest

brother Norio who, like me was physically weak and ineligible to serve in the military, was an aspiring writer of children's literature who lived in Urawa City, Saitama Prefecture. I arrived at his house on the evening of March 9.

The previous month, I hadn't been able to take the entrance examination for Tokyo Agricultural and Forestry College (now Tokyo University of Agriculture and Technology) because the train to Tokyo couldn't proceed any further than Nagoya due to bombing by the U.S. military. I was booked to take the examination again at 1:00 P.M. on March 10, so I had to take the San'in Line along the Sea of Japan coast and alternative local train routes for three days and nights to reach Tokyo. I went to bed in good time because I had an early start the next morning, but as soon as I did, I heard the sirens warning of an air raid. Venturing outside, I found that the southern sky had turned blood red.

I was in a terrible quandary; I desperately wanted to sit the examination this time because I knew I probably wouldn't have a third opportunity. Norio's wife's eldest brother, who was the head of the Tokyo Metropolitan Government's transportation bureau, was going to go into work out of a sense of obligation, so we decided to walk into the city with Norio accompanying us. Wearing air-raid hoods, we made our way along the railroad tracks to Shinjuku. The rubble was still fresh. I have no idea how many bodies I saw there,

blackened, and stiff. I had to avoid the bodies as we walked on, an experience I will never forget.

Although I was successfully admitted to the College, I was thoroughly intimidated on the sports ground because of the wartime situation. A retired army colonel who was our physical education instructor would bellow daily, "The enemy will surely land on the Kashima coast or Kujukuri-hama beach, aiming at the capital Tokyo. As defenders of the imperial capital, you must hide in foxholes with explosives at the ready, and when their tanks approach, jump out with the explosives to destroy the enemy." My classmates were all very motivated. I was prepared for the ultimate sacrifice, but I knew that one or two of us would survive, and I secretly wanted to be one of them if I could. It was a time when everyone believed in the kamikaze spirit and was ready to die. Because I lived through such a time, when asked what the most important thing in the world is, I always answer "life." The most wonderful and happiest thing on earth is to be alive now.

People today don't seem to understand the value, transience, and harshness of life. I have come to believe this more and more as I look at the Japanese people these days. I have a strong attachment to life. Is this a mindset unique to the generation born in the first decade of the Showa era (1925 to 1935), who experienced the horrors of war? No, I think that's not the case at all.

We're concerned about hometown forests because we're concerned about life. It's precisely because we have now experienced the disastrous Great East Japan Earthquake that we must seriously consider the importance of hometown forests for protecting life.

As a starting point for reflection, I'd like to look back on the tragic events associated with three major earthquakes.

The Green Wall that Saved 20,000 Lives in the Great Kanto Earthquake

The Great Kanto Earthquake struck on September 1, 1923. The disaster was one of the worst in Japan's history, affecting 1.9 million people, with the total number of dead and missing more than 105,000.

A well-known sequel to the earthquake is the disaster at the Honjo Military Clothing Depot. At the urging of local police, as many as 40,000 people fled to the ruins of the Honjo Military Clothing Depot in Sumida-ku, Tokyo (now known as Yokoamicho Park). Once they were ensconced there, however, a whirlwind of fire broke out, fanned by strong winds, taking the lives of 38,000 people.

On the other hand, about 20,000 people fled to the estate of the former Iwasaki clan in Koto-ku, Tokyo, located just two kilometers south of the ruins of the Honjo Military Clothing Depot.

After they took refuge there, one baby died from being trodden on, but no-one else perished.

What was the difference between life and death? The gardens of the Iwasaki estate were surrounded by a mound, on top of which trees had been planted in a fire prevention buffer that was just two to three meters in width. The evergreen broad-leaved trees such as *tabunoki*, *shii*, and *kashi* acted as a green wall to protect the people from fire. The former Iwasaki estate was severely damaged by the fire that destroyed the residence, but the garden successfully fulfilled its role as an evacuation site. The Iwasaki family, the founders of Mitsubishi Corporation, recognized the disaster-mitigating function of the garden and donated its eastern half to the city of Tokyo the year after the earthquake. It was opened to the public as Kiyosumi Garden in 1932. Surrounded by a three-dimensional broad-leaved forest that is green even in winter, the garden continues to be visited by many people today.

The Great Hanshin-Awaji Earthquake Reaffirms the Power of Indigenous Forests

My long-held belief is that scientists must be accountable for what they say and do. I have always held that indigenous tree species are deep-rooted with tap roots, making them impervious to fires,

typhoons, floods, and earthquakes. The day would come when my beliefs and assertions were suddenly and severely put to the test.

The Great Hanshin-Awaji Earthquake struck on January 17, 1995. On that day, I was conducting a field vegetation survey for rainforest regeneration in the mountains of Sarawak on the island of Borneo, Malaysia. In 1990, we'd started a "Tropical Forest Regeneration Project" together with Mitsubishi Corporation. Since then, we'd conducted vegetation surveys and tree planting activities in the area, year in, year out.

When I returned to my ageing accommodation after the survey, an employee of Mitsubishi Corporation said, "Terrible news, Professor Miyawaki. There's been a major earthquake in the city of Kobe." I hurried to turn on the TV and saw CNN's breaking news reports showing the devastating scene. While I prayed that the damage was minimal, I was prepared to be accountable if the earthquake had damaged the dominant trees of the potential natural vegetation.

Returning from Borneo, I immediately tried to get into the city, but without success. Finally, thanks to help from Shimizu Corporation's Environment Department Manager, I was able to fly in by helicopter from Kansai International Airport on the 10th day after the earthquake. Kobe from the sky was in the same wretched state as the burnt ruins of the Tokyo Air Raid that I had witnessed. Smoke was still rising from some parts of the city. We managed to land in

an open area along the coastal breakwater, but liquefaction of the surrounding ground made it difficult to walk. The damaged cement breakwaters sticking up in the air seemed to show the limits of the latest technology. However, the *yabutsubaki* (*Camellia japonica*), an endemic species planted in the area, looked healthy.



A hometown forest in a park that survived the conflagration following the Great Hanshin-Awaji Earthquake.



Arakashi (*Quercus glauca*) and *kusunoki* (*Cinnamomum camphora*) trees that halted the spread of fire in the Great Hanshin-Awaji Earthquake.

We chartered a cab and entered the city proper. Nagata Ward, for example, was an incredible sight, with even reinforcing steel bars collapsed and reduced to reddish-brown rubble. Highways, overpasses, and Shinkansen bullet train railway piers, which were supposed to have been built with the latest technology, were either half- or completely destroyed, and most of the wooden houses had burned to ashes. Every time we came to a small park, I got out of the cab to see how the trees were faring. The interior of one park was being used as an evacuation center and had ambulances and other emergency vehicles stationed there.

Bordering the park were evergreen broad-leaved trees such as *arakashi* oaks (*Quercus glauca*) and *shii* (*Castanopsis cuspidata*) trees, the dominant group of trees in the potential natural vegetation, as well as *kusunoki* (camphor tree, *Cinnamomum camphora*), which is also recognized as potential natural vegetation, and other evergreen broad-leaved trees such as *yabutsubaki* (*Camellia japonica*), *shirodamo* (*Neolitsea sericea*), and the holly tree *mochinoki* (*Ilex integra*). Although their leaves were scorched, the fire had stopped there, and the trees were still alive. The avenue of *arakashi* trees was particularly impressive. The

apartment building behind it, across the street, escaped the spread of the fire. The rows of evergreen broad-leaved *arakashi* had probably halted the fire.

Next, we surveyed the *Chinju-no-mori* forests. Some of the shrine *torii* gates were on a lean and buildings had been burned down. But what about the *Chinju-no-mori* themselves? Not a single tree in a forest had fallen, *shii*, *kashi*, *mochinoki*, or *shirodamo*. Some of the leaves had been burned off, but the trees were still alive. A repeat survey carried out in September of that year confirmed that they had returned to their original state.

Our final destination was Mount Rokko. I had previously conducted a field vegetation survey of Mount Rokko at the invitation of Kobe City, so I was keen to find out the situation. Yes, that's right. It was on Mount Rokko that I received that unexpected phone call from Mr. Tezuka Akira, then Director of the Research Grants Office, Science and International Affairs Bureau, Ministry of Education; the call that led to the publication of *Vegetation of Japan*. The damage around Mount Rokko was also minimal. In the exclusive residential area at the bottom of the hill too, the indigenous evergreen broad-leaved trees such as the oaks *arakashi*, *urajirogashi*, and *shirakashi*, the castanopsis *kojii* and *sudajii*, and the *mochinoki* and *yabutsubaki* were thriving. At that instant, I realized anew the power of the *Chinju-no-mori*, the forests of indigenous trees, and at

the same time, I was convinced that my previous claims based on fieldwork had been correct.

Surviving the Great East Japan Earthquake and Tsunami

Because the authentic tree species that are indigenous to the area are deep-rooted with tap roots, they are unaffected by fires, typhoons, floods, and earthquakes. How would they fare against a major tsunami? The day of that test came suddenly and unexpectedly again.

On March 11, 2011, the Great East Japan Earthquake struck. On that day, I was again conducting a field vegetation survey outside Japan, this time on the island of Java in Indonesia. As I returned from the mountain to my small hotel in the village, I could see the television screen glowing in the dimly lit lobby. I saw raging, muddy torrents on the screen as the tsunami engulfed everything in its path. When I realized this was happening in Japan, I was filled with intense shock and deep sadness at this devastation. I wanted to return home immediately, but it was three days before I could do so because of the chaos in Japan and fully booked airlines.

On returning to Japan, I contacted Mr. Hioki Doryu, head priest of Rinnoji Soto Zen Temple in Sendai City, my regular collaborator on hometown forest creation, to organize a field survey.

Immediately after the earthquake, the disaster area was chaotic, and it was difficult for the general public to enter, so we weren't able to do our first onsite survey until April 7 and 8, nearly three weeks later. We were left speechless at the sight of the disaster area, which had been hit so cruelly and horrifically. Everything had been reduced to rubble. When I saw the rubble, what did I think? I was convinced that this rubble could be useful. This was my intuition, as an ecologist who has been creating hometown forests in accordance with field vegetation surveys in Japan and abroad for 40 years.

Pine forests along the Pacific coast, the image of which had been romantically described as "white sand dotted with green pines," were all destroyed by the tsunami. In some places, uprooted pine trees were swept inland by the tsunami, causing secondary disasters, damaging houses and cars. On the other hand, evergreen broad-leaved trees such as *masaki* (*Euonymus japonicus*), *tobira* (*Pittosporum tobira*), and *nezumimochi* (*Ligustrum japonicum*), which were growing wild on the "white sand and green pine" forest floor, survived. Conducting a survey in Minamisanriku, Miyagi Prefecture for a second time, we saw that a large *tabunoki* tree had survived the tsunami, supported by a thick tap root, as if it had pushed back against the tsunami. Other *tabunoki* trees along the road near Ofunato Junior High School in Iwate Prefecture had also survived the tsunami.





Disaster-mitigating forests that withstood the massive tsunami and prevented vehicles and other debris from being washed away. Aeon Tagajo store, March 18, 2011. (Courtesy of Aeon)

Now, what happened at the Aeon Tagajo store adjacent to Sendai City, where we planted trees together with local people in 1993? On a mound two to three meters wide, mixed with construction debris, *tabu*, *sudajii*, *shirakashi*, *arakashi*, *urajirogashi*, and *yamamomo* (*Myrica rubra*) were all in good health as they were originally. Aeon also conducted an independent survey at the Tagajo store on March 18, one week after the earthquake. Not only had the trees we planted survived the tsunami, but they had not been toppled, despite being battered by the many automobiles and other forms of debris that were swept away by the tsunami.

This is the power of an authentic forest.

The Great Forest Wall Project

While continuing the onsite surveys, I immediately started a program of forest development activities. First, I proposed to the mayor of Sendai City and the mayor of Minamisanriku Town, among others, the creation of a “forest breakwater,” a disaster-mitigation

and environmental-conservation forest using indigenous tree species. I also went to the Cabinet Office and visited the government's Reconstruction Design Council in Response to the Great East Japan Earthquake to discuss a "Great Forest Wall Project" to protect lives from the tsunami—making use of debris to protect life. I suggested we join forces to build a monument to the future.

About two months later, on June 25, 2011, the Reconstruction Design Council in Response to the Great East Japan Earthquake submitted a document "Towards Reconstruction: Hope Beyond the Disaster" to then Prime Minister Kan Naoto. The first of the seven principles of the Reconstruction Framework read as follows.

"For us, the surviving, there is no other starting point for the path to recovery than to remember and honor the many lives that have been lost. Accordingly, we shall record the disaster for eternity, including through the creation of memorial forests and monuments, and we shall have the disaster scientifically analyzed by a broad range of scholars to draw lessons that will be shared with the world and passed down to posterity."

If you're serious, you can make something work. While I continued to submit proposals to government officials, all that remained was to carry them out. The Great Forest Wall Project was finally underway.

On July 31, 2011, we held a training session on how to plant trees at Kaigan Park Adventure Field in Wakabayashi Ward, Sendai City. On that occasion, Minagawa Yoshitsugu, Director General of the Forestry Agency, and members of the Tohoku Regional Forest Office also attended. As promised, Mr. Minagawa also participated in the tree-planting festival held in Toyohashi National Forest in Aichi Prefecture on July 10 the same year, together with members of the Chubu Forest Office. At the tree-planting festival held on October 30, 2011, at Unzen Fugendake in Nagasaki Prefecture, Mr. Numata Masatoshi, Deputy Director-General of the Forestry Agency (now Director-General of the Forestry Agency), planted the seedlings in pots with members of the Kyushu Forest Management Bureau, despite the pouring rain.

On March 20, 2012, I met with then Prime Minister Noda Yoshihiko at a hotel in Tokyo, together with former Prime Minister Hosokawa Morihiro, and formally set out the Great Forest Wall Project. Thanks to their efforts, the Forestry Agency launched a “Green Trees Restoration Project” which utilized rubble, incorporating some of my recommendations.

About a month later, on April 24, Prime Minister Noda wrote in his Prime Minister’s Office blog *Kantei Kawaraban* that “I would like to plant not only pine trees but also broad-leaved trees so that the forests will become a kind of *Chinju-no-mori* blessed with a variety of vegetation.” But would these really be authentic *Chinju-no-mori*?

Looking at the actual tree-planting proposal, I am still not fully convinced of the Forestry Agency's motivation.

On April 30, I led a tree-planting event sponsored by Yokohama Rubber in the town of Otsuchi in Kamihei-gun, Iwate Prefecture, as part of the "Creating a Thousand-Year Forest" project. Yokohama Rubber Chairman Nagumo Tadanobu, all Yokohama Rubber executives, Otsuchi Mayor Ikarigawa Yutaka, former Prime Minister Hosokawa, and then Minister of the Environment Hosono Goshi also participated in the event. On May 25, a press conference was held to announce the establishment of a general incorporated foundation (later to become a public interest incorporated foundation), to be known as the "Great Forest Wall Project." The chairman of the board of directors was former Prime Minister Hosokawa, the board members included lyricist and producer Akimoto Yasushi and University of Tokyo Professor Robert Campbell, and the trustee, screenwriter Kuramoto Sou.

After the press conference, I went straight to Sendai with former Prime Minister Hosokawa. The following day, May 26, I worked hard with Mr. Hosokawa and Rinnoji Temple head priest Hioki at the Millennium Hope Hills tree-planting ceremony held at Airport Minami Park in Iwanuma City, Miyagi Prefecture, led by Iwanuma Mayor Iguchi Tsuneaki.

Tree-planting festivals were held in the town of Otsuchi in April and in Iwanuma City in May. Both these events were held in

remembrance and honor of the victims. Beneath the mounds are buried nontoxic debris consisting of fallen trees and concrete rubble, which also harbor the memories of those who died in the Great East Japan Earthquake.

On Thursday, July 5th, I had the unique privilege of telling Their Majesties the Emperor and Empress about the creation of coastal disaster-mitigation forests through the planting of evergreen broad-leaved trees. The audience was originally scheduled for 40 minutes, but at the firm request of Their Majesties, it was extended by 30 minutes, giving me a total of one hour and ten minutes of valuable time. Their Majesties were deeply concerned about and keenly interested in reconstruction activities following the Great East Japan Earthquake. I was profoundly moved to witness firsthand their concern for the well-being of all people as they look toward the future.

I have resolved to devote my life to overcome this crisis and create more *Chinju-no-mori* forests for the 21st century to protect lives, as a forward-looking national project and a national movement. I am determined to reward Their Majesties' faith by presenting results and processes that will serve as a model for the world. For reference, the explanatory materials I submitted to them are presented at the end of this book.

I wish now to share an old journal article with you. It's from *Civil Engineering*, the journal of the Japan Society of Civil Engineers

(Vol. 10, No. 2) published in April 1924, the year after the Great Kanto Earthquake. It contains an interesting article describing the status of evacuation centers at the time of the earthquake. This paper was written by Kawada Masaru, an engineer at the Forestry Experiment Station of the Ministry of Agriculture and Commerce, the forerunner of the Forestry Agency, and Yanagita Yoshizo, an engineer. The title of the paper is "The Relationship between Fire and Forests and Trees." The paper clearly states that "coniferous trees are less fire-resistant than broad-leaved trees." If we had learned this lesson and put it into practice, we may have been able to minimize the damage caused by the subsequent Great Hanshin-Awaji Earthquake.

Should another major earthquake strike again, will the lessons learned so far be applied this time? I still feel uneasy. How serious are the government, the Forestry Agency, and the various ministries and agencies? They tend to be focused only on negativity: "That's not a good option; this one's no good, either." They lack the resolve to look to the future and risk their jobs in a forthright manner. They never try to take responsibility for anything. And with a constant change of administrations, accountability goes missing. Herein lies the fundamental problem.

Let's not allow the disaster of the Honjo Military Clothing Depot to lead us in the wrong direction, and let's work together with

the government, businesses, organizations, and citizens to create *Chinju-no-mori* forests for the 21st century to protect our lives.

The Difference Between Dead Matter and Living Greenery

The tsunami generated by the Great East Japan Earthquake destroyed all manner of man-made structures. It engulfed not only houses and public facilities, but also steel-framed buildings such as luxury resort hotels and large hospitals. In some cases, even the concrete foundations of underground structures were destroyed. Construction of the Kamaishi Port breakwater had been completed in March 2009 at a huge total cost of 120 billion yen, a structure that had been recognized by Guinness World Records as the world's deepest breakwater. However, the northern breakwater at the mouth of the harbor was almost completely wiped out by the tsunami, and the southern breakwater was partially destroyed. The tsunami responsible for their destruction then swept into the center of Kamaishi, leaving more than 1,000 people dead or missing in its wake.

Currently, 49 billion yen is being invested in restoration efforts. Although it is said that the disaster was mitigated to some extent by the breakwater, this may have shown the limits of disaster-reduction measures based on hardware—man-made infrastructure—

alone. Natural disasters are complex. When an earthquake strikes, tsunamis can occur, as well as house collapses and fires. A typhoon can cause flooding, mudslides, power outages, and disrupted water supplies. If we try to cope with such complex natural disasters with one-dimensional disaster-mitigation measures involving hardware alone, the economic burden will continue to grow. That is why the challenge facing us now is how to use living greenery as a material for construction. Moreover, no matter how much we invest in artificial materials such as reinforcing steel and concrete, they are at their best just after completion, and their performance deteriorates over time. After 100 years, they will probably have to be rebuilt. Of course, some measures involving hardware are necessary. At the same time, however, we should also promote the creation of indigenous hometown forests which can protect life.

The key to disaster prevention and mitigation lies in how we utilize and consume non-living man-made materials, and green building materials that will persist for thousands of years.

There is a stark difference between dead matter and living greenery. The former does not seek to survive, but the latter tries desperately to survive unaided. We should actively utilize the vitality and regenerative power of greenery; we should lean on the power of the forest. We should try to survive together with our forests. Now is the time to test the wisdom of the Japanese people, who have

created, preserved, and protected the *Chinju-no-mori*, the forests of their ancestors.

The critical task of protecting the nation and making our land more resilient is naturally a national endeavor. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is at the center of this endeavor. In fact, I have been involved in several projects with the MLIT since the time of its predecessor, the Ministry of Construction. As with the tree-planting festival to exterminate the *Yamata-no-orochoi* in Izumo, Shimane Prefecture, discussed in the prologue, the first such event was a hometown forest planted on a cut-and-fill slope created by the construction of the Nomura Dam in Ehime Prefecture in the late 1970s. When the Ministry of Construction asked us at first, we conducted a thoroughgoing field survey of vegetation in all prefectures on the island of Shikoku under the pretext of surveying the vegetation around the Nomura Dam. Based on these findings, we planted potted seedlings of *sudajii*, *tabu*, *kashi*, *yamamomo* (*Myrica rubra*), *horutonoki* (*Elaeocarpus sylvestris*), and other varieties in 1978. Now, more than 30 years later, an authentic forest has grown around the Nomura Dam that is impregnable against wildfires, torrential rains, and major earthquakes.

However, until now, the responsibility for these projects has remained at the level of a single person in charge at a regional bureau, and replacement or reassignment of that person signals the

end of the project. The weakness of these projects is that they do not spread throughout the country. Success stories—and the associated know-how—are not shared. I think this is a significant failing.

During the Great East Japan Earthquake, the embankment structure of the Sendai-Tobu Road blocked the tsunami and saved the lives of about 230 people who rushed up its slopes. In recognition of this outcome and responding to calls from local residents, evacuation stairways have already been installed on the embankment. I was impressed by the quick response that made use of the lessons learned from the earthquake, and I hope that in addition to the evacuation stairways, hometown forests will be created along the entire slope to help protect life. The slopes on both sides of any roads, railroad tracks, and concrete embankments to be constructed along the coast of the Japanese archipelago should be built with highly permeable foundations that make use of rubble. They should also incorporate evacuation stairways, and be planted with hometown forests that protect life, making a Great Wall of *Chinju-no-mori* forests.

By making these slopes temporarily accessible for people to participate in community-led tree-planting events, we will be able to see what real public works projects should be like. We can turn a crisis into an opportunity. We will be able to ascertain what realistic and sustainable public works projects should look like under today's

challenging financial circumstances. This will be an opportunity to rethink the nature of public works; to ask ourselves the question, “Just who are public works projects intended to benefit?”

As a disaster-prevention and mitigation measure, I wish to propose a new community-led and citizen-participatory model for public works called “Building Green Resilience,” utilizing the vitality and regenerative power of greenery to complement artificial materials such as reinforcing steel, concrete, and asphalt. Green jobs will be created through this use of biomass and other materials in Building Green Resilience. The model could also prompt the revitalization of the forestry industry. However, disaster prevention and mitigation measures with living green building materials take time to implement. We should therefore begin now, wherever possible. In the meantime, if a catastrophe strikes again, where should we escape to? There are places in Tokyo that I can confidently recommend. They are the places known to everyone as the *Chinju-no-mori* forests.

Chapter 8

The Laws of Nature



Seedlings of *shirakashi* (*Quercus myrsinifolia*), *arakashi* (*Quercus glauca*), and other species growing in the Meiji Jingu Shrine forest. September 2012.

The *Chinju-no-mori* Forest of Meiji Jingu Shrine is the Green Heart of Tokyo that Protects Life

Thanks to the work of our forebears, indigenous forests can still be found in urban areas. Here, they protect life in all its forms.

The Hamarikyū Gardens in Chūō-ku, Tokyo, is a typical garden created for the *daimyō* feudal lords of the Edo period. It was renovated several times by successive shōguns and was completed in almost its present form during the reign of the eleventh shōgun, Tokugawa Ienari (1787–1837). Evergreen broad-leaved trees such as *tabunoki* (*Machilus thunbergii*) and *sudajii* (*Castanopsis sieboldii*) planted in this garden more than 250 years ago have survived the Great Kanto Earthquake and the air raids of World War II and are still thriving. The dominant trees of the garden are the oaks *shirakashi* (*Quercus myrsinifolia*) and *arakashi* (*Quercus glauca*), the indigenous canopy trees of the area, together with sub-canopy trees such as *yabutsubaki* (*Camellia japonica*), *mochinoki* (*Chamaecyparis obtusa*), and *shirodamo* (*Neolitsea sericea*), shrubs including *aoki* (*Aucuba japonica*), *yatsude* (*Fatsia japonica*), and *hisakaki* (*Eurya japonica*), and undergrowth such as the ferns *benishida* (*Dryopteris erythrosora*) and *itachishida* (*Dryopteris bissetiana*), and the grass-like perennial *yaburan* (*Liriope spicata*), forming a magnificent multi-layered community.

And of course, Meiji Jingu Shrine needs no introduction. No matter what disaster befalls them, people in the neighbourhood of the shrine will be able to survive if they evacuate to the shrine's forest. The Meiji Jingu Shrine forest, created in the Taishō era

(1912–1926), also survived the Great Kanto Earthquake, like the Hamarikyu Gardens. The main shrine building and shrine office were burned during the bombing of Tokyo during World War II, but thanks to the *kusunoki* (*Cinnamomum camphora*), *shii* (*Castanopsis* spp.) *kashi* oaks (*Quercus* spp.), and other trees that grew there, they escaped total devastation from the fire and the grounds of Meiji Jingu Shrine remain a popular place for the people of Japan to rest and relax.

Thanks to the wisdom of our forebears, the forest of Meiji Jingu Shrine is one of the world's premier man-made forests. Moreover, it was created with an eye on the decades and centuries ahead. It is a *Chinju-no-mori* that functions today as an idyllic urban park in Japan. People with foresight, determination, and the ability to execute their plans supported the creation of the Meiji Jingu Shrine forest. They included Dr. Honda Seiroku, who contributed to the development of the Meiji Jingu Shrine forest in his capacity as advisor to the Meiji Jingu Construction Bureau. Factories were beginning to spring up in the area at the time, pollution was already becoming a threat, and Tokyo's large trees and old trees were withering and dying. Measures to deal with pollution problems were also being examined.

Dr. Honda and his colleagues believed that the Imperial Capital of Tokyo was likely to become permanently blanketed in smoke and that coniferous trees such as *sugi*, *hinoki*, and *matsu*

(cedar, cypress, and pine) would not remain safe forever from smoke damage. They decided to use evergreen broad-leaved trees such as *shii*, *kashi*, and *kusunoki* (*Cinnamomum camphora*; camphor) as the dominant trees in the forest.

The *Meiji Jingu Gokeidai Rin'en Keikaku* (Plan for the Forest Garden in the Precincts of Meiji Jingu Shrine) prepared in 1921 by Hongo Takanori, engineer with the Meiji Jingu Shrine Construction Bureau, notes that evergreen broad-leaved trees such as *shii*, *kashi*, and *kusunoki* are not only resistant to smoke but also grow most vigorously under the climatic conditions of the area. Moreover, they also regenerate by dropping their seeds, thereby sustaining themselves naturally without human intervention. This is a key observation that aligns with the most reliable principles of modern plant ecology and vegetation science, leading us to more properly appreciate the wisdom and foresight of those involved.

Dr. Honda and others believed that the Meiji Jingu Shrine forest had to be an evergreen forest. Evergreen broad-leaved trees were chosen because they can be sustained and regenerated for many years without human intervention, are resistant to smoke damage, and are also appropriate for a shrine.

**Okuma Shigenobu's "*Matsu-Sugi-Hinoki*"
Faith**

The then-Prime Minister of Japan, Okuma Shigenobu, raised complaints about the plans proposed by Dr. Honda and his colleagues. His argument included elements of the well-worn “*matsu-sugi-hinoki* (pine, cedar, and cypress) faith.” He said, “I would prefer to see a majestic and solemn setting like that of Ise Jingu Shrine or the *sugi* trees in Nikko. A thicket of random bushes is not appropriate for a shrine in my opinion.”

Prime Minister Okuma went on to say,

“It’s not a matter of planting something unknown. There are many large *sugi* trees near Kiyomasa’s Well in the inner garden of the shrine, and the formula doesn’t have to be as strictly followed as it is in Nikko. Isn’t it the role of science to make the impossible possible by devising ways to cultivate these trees so that they will grow well?”

In response, Dr. Honda replied,

“The big trees near Kiyomasa’s Well have fresh water gushing from their roots. The soil in that area has become preferred by *sugi*, which have grown tall as a result. However, this is a rare exception, and in general, *sugi* forests do not grow well around here.”

Dr. Honda also provided an explanation that compared *sugi* in Tokyo and Nikko, using a method known as tree trunk analysis. This explanation is included in *Secrets of the Meiji Shrine Forest* (in Japanese, published by Shogakukan Bunko) edited by Meiji Jingu

Shrine Office, which also introduces the following quote. "If the Meiji Jingu Shrine forest had been planted only with *sugi* and *hinoki*, as per the opinion of Prime Minister Okuma, I can only imagine what kind of miserable spectacle it would have been."

So, what did they actually plant in the Meiji Jingu Shrine forest, the development of which began in 1915? The top 10 species planted were *inutsuge* (*Ilex crenata*, Japanese holly, 21,783 trees [similarly below]), *kuromatsu* (*Pinus thunbergii*, 12,317), *kusunoki* (*Cinnamomum camphora*, 8,957), *sakaki* (*Cleyera japonica*, 7,886), and *kashi* oak species (6,666), *hinoki* (*Chamaecyparis obtusa*, Japanese cypress, 6,243), *hisakaki* (*Eurya japonica*, 5,989), *akamatsu* (*Pinus densiflora*, 4,054), *sugi* (*Cryptomeria japonica*, 3,938), *tsutsuji* (*Rhododendron* sect. *Tsutsusi*, 3,732), followed by *sudajii* (*Castanopsis sieboldii*), *sawara* (*Chamaecyparis pisifera*, Sawara cypress), and *keyaki* (*Zelkova serrata*, Japanese elm).

As is clear, the donated trees did not match the original forest development plan. They included numerous conifers such as *kuromatsu*, *hinoki*, *akamatsu*, and *sugi*. The organizers probably couldn't refuse them because the trees were donated, but rather than discard them, they simply modified their planting program.

The *matsu*, *sugi*, and *hinoki* trees have now all but disappeared from the forest. They couldn't survive, a certain outcome that follows the laws of nature. With the passage of 50 to

100 years, the Meiji Jingu Shrine forest has come to resemble the indigenous forest of the area, and now, the forest is as close to its natural state as possible.

As part of the Meiji Jingu Shrine 50th Anniversary Project, I was asked to survey the vegetation of the shrine forest, and I published my findings in "Phytosociology Study of Meiji Jingu Shrine Forest in Tokyo (*Pflanzensoziologische Untersuchungen in den Wäldern des Meiji-Schreins in Tokyo*)" in 1980. The results of this survey showed without a doubt that the forest was approaching its natural state.

The *Tabunoki-Kusunoki* Controversy in *Chinju-no-mori*

Kusunoki camphor trees more than 20 meters tall can be seen in the Meiji Jingu Shrine forest. Many people, especially those living in western Japan, think of the *kusunoki* as representative species of the forest. When the construction of Meiji Jingu Shrine began, *kusunoki* trees were still thought to be native to Japan. Even later, it was believed that they grew naturally in Kyushu at least. However, the current theory holds that Taiwan is the northern limit of the *kusunoki*'s range. Perhaps someone brought the tree to Japan long ago in a dugout canoe, or perhaps the seeds arrived on ocean

currents. I believe that *kusunoki* trees were probably planted mainly in western Japan after their arrival because they grow rapidly. They may have been planted to make dugout canoes or to yield camphor, which you can smell by tearing off a *kusunoki* leaf. In the olden days, herbal medicines were made from *kusunoki*, and camphor was useful as an insecticide, preservative, and topical medicine.

In terms of plant ecology, *kusunoki* trees have no offspring. They are often seen standing alone in Shinto *Chinju-no-mori* forests. If *kusunoki* were indigenous, it would have a parent-offspring relationship like the *tabunoki* (*Machilus thunbergii*) tree. The *tabunoki*, for example, forms a vertical, multi-layered community that is set off from other evergreen broad-leaved trees such as the sub-canopy trees *yabutsubaki* (*Camellia japonica*, Japanese camellia), *shirodamo* (*Neolitsea sericea*), the cypress *mochinoki* (*Chamaecyparis obtusa*), and the shrubs *aoki* (*Aucuba japonica*), *yatsude* (*Fatsia japonica*), and *hisakaki* (*Eurya japonica*). *Kusunoki* can be considered an invasive species, although it is within the range of the potential natural vegetation of southwestern Japan's broad-leaved forests, given the species composition of the community.

The *kusunoki* trees of the Meiji Jingu Shrine forest may survive for the next 100 or 150 years, but I don't think they will last for 500 or 1,000 years. By that time, the forest will be composed of indigenous trees of the area, with oaks such as *shirakashi* (*Quercus*

myrsinifolia), *arakashi* (*Quercus glauca*), *akagashi* (*Quercus acuta*), and *urajirogashi* (*Quercus salicina*), and *sudajii* and *tabunoki* as the dominant trees.

Go to the Meiji Jingu Shrine forest and look for the *shirakashi* oak trees. Sprouting beneath the trees you will find dozens or hundreds of young seedlings of *shirakashi*, *arakashi*, and *akagashi*. If you don't manage the weeds and undergrowth poorly, most of the area will eventually become a coppice of Japanese *shirakashi* mixed with *arakashi*, *akagashi*, and *urajirogashi*. That is what nature is all about. Nature follows its own laws. Let's also consider the fact that a real natural forest is a forest that can be maintained without human management.

The indigenous "hometown forest," as symbolized by the *Chinju-no-mori*, is indeed the most stable form of forest, a place where we can perceive the vitality and regenerative power of plants.

Epilogue:

Human Society as Seen by the *Tabunoki* Tree

If you were a giant *tabunoki* (*Machilus thunbergii*) tree looking at human society over your long life, you'd see that Japan is again in trouble. The forest doesn't communicate like us; it doesn't try to use logic. Still, trees do seem to be concerned about human society. As plants compete with their roots, humans also compete with theirs; in the latter case, the lower parts of their bodies. It seems that our human society has more and more people with heads puffed up with knowledge who are unsteady on their feet. They look like they're about to collapse at any moment.

In terms of how we Japanese use our brains, it seems that while we are good at superficial, short-term thinking, we are not so good at long-term vision, planning, and implementation of measures with an eye on the future. After the Great East Japan Earthquake, I met with many politicians and people from various ministries and agencies, but I found that the people at the top were desperate only for short-term solutions to immediate problems. To me, it looks like the futile exercise known in Japan as "catching grasshoppers in the rice paddies in the fall." It doesn't matter how many grasshoppers you catch, there will always be more popping up. Nevertheless, catching grasshoppers is not a fundamental solution to the problem.

Human society can't succeed if relationships are solely competitive; relationships in which people pursue only their own desires and try to beat others. On the other hand, people who form echo chambers, surrounding themselves with only what they want to hear are at risk of losing sight of the wider world around them. I wonder whether my principle "mix 'em up, mix 'em up, mix 'em up!" should apply in the political and government worlds, too. The three elements of "competition – endurance – coexistence" seen in the plant community are truly the sine qua non for the survival of all living things, including human beings.

Some people who attend my presentations say that plant society and human society are "quite similar." However, from my point of view, they are not similar, but the same. I think of them not as analogous, but as identical.

Living organisms are conservative by nature; once a decision is made, it is not easily changed. Unable to move, plants are more honest than all other organisms. That's why the fundamental nature of biological society is manifested in the plant kingdom. It may be a simple concept of mine as a botanist, but that's how I read the situation.

Go out into the field and listen for the subtle signs of nature, and you will see the entirety that is unseen. You'll also be able to see the true underlying essence of nature.

As the celebrated German writer Goethe said, the true form of nature can be seen only when we see it "als Ganzheit," that is, "the entirety with all its connections." Hence, we should recognize that nature and humans are parts of an integrated system and humbly re-examine the one-sided anthropocentric view that we have had in the past.

The 20th century was marked by dramatic progress in science and technology. It's now possible to travel to the other side of the world in a day, and to communicate directly with people far away at minimal cost. Life has become much more convenient and comfortable.

The scientific method has been adopted as a way of understanding the world, both in the sciences and the humanities. It's believed that by accumulating and analyzing data and making the appropriate calculations, we can make sense of everything under the sun. However, from the end of the 20th century to the turn of the 21st century, it's become clear that this was nothing more than human arrogance. The recent economic turmoil and problems with nuclear power are symbolic of this arrogance.

However, even with the latest science and technology, we still cannot see "the entirety with all its connections." No matter how many computer calculations we do, we can only see a single moment in time for life that has continued for four billion years and a single point on the global stage. What is it that lies behind this

computer analysis? Without neglecting individual data points, perhaps when we look to the future, we need to make comprehensive judgments and assessments of time and space, including things that cannot be seen, that cannot be quantified, and that cannot be expressed in financial terms, such as thoughts, findings, philosophies, actions, and ways of life.

What must be protected should be resolutely protected. All we need to do is to work together to create what needs to be created.

I have witnessed the drama of real life in the field for more than half a century. The life before us gives birth to new life, foreshadowing new dramas. I have seen and experienced first-hand in the field the amazing vitality and regenerative power of plants. Each life is connected to all other lives beyond time and space. The whole is formed by the connection of all these lives, and the drama of real life has continued uninterruptedly without end. That is why it is miraculous that we are alive today, and more than anything else, it is a fortunate and unique outcome.

If we try hard to see that which is hidden, focusing intently on the scene before us, we will naturally develop the ability to recognize authenticity. This is true even when dealing with human beings. That is why I have never been betrayed by someone I trusted.

It is thanks to the support of *people, people, and more people* that I have been able to doggedly continue my research and practice. People are nurtured by other people. We should seek out mentors, friends, and like-minded colleagues.

There's a saying, "Love is always a debut performance," and I believe that tree planting is an example of this. Each time a tree is planted, there are new emotions, new discoveries, and new encounters. I sense the profoundness of "life." Once, when I mentioned this in a lecture, a woman in the audience raised her hand and said, "It's my husband who sings that love is always a debut performance." This was the beginning of my relationship with the phytotherapist Ikeda Akiko, and her husband, the entertainer Umezawa Tomio. Through the creation of hometown forests, I have made many new friends like this and worked together with friends old and new. What all of them have in common is their keen foresight, courage to confront any obstacle, and strength to carve out a future with their own hands, in the face of their own concerns.

There is a saying among ethnic minorities in China's Yunnan Province: "To cut down a forest is to cut down a path to your future." If so, then the converse is also true: "To create a forest is to create a path for your future." People create forests, and forests create people. A forest nurtures a soul like a large tree unflappably gazing over the entire forest, and a spirit like a tough weed that sees crises as opportunities.

As I have asked many times in this book, what is the most important thing in an individual's life, in a society, a nation, humanity, or a living thing? The answer is life. My life, your life, and those of your loved ones, friends, and the Japanese people and those of the peoples of the Earth. No matter what happens, no matter what we lack, we'll be all right if we have life.

I am still only 85 years old. I will continue to plant trees tomorrow and the day after tomorrow with all of you, aiming to plant 100 million trees to create forests for life. I pledge to you all that I will continue to plant trees not only in the disaster-stricken areas in Tohoku, but also in other parts of Japan, Asia, and the world, as long as I am alive.

I hope to see you all again at a hometown forest reunion in 30 years' time. I hope that the disaster-stricken areas in Tohoku are revitalized. I hope that the lives of the Japanese people will be protected. I hope that the irreplaceable culture and genes of our Japanese people will flow through to the future. I hope that the process and results of our project spread widely throughout the world.

In Conclusion

In closing, I would like to express my gratitude, more deeply than I have ever articulated before, to my parents who raised me in the

harsh pre-war and wartime environment, to the many teachers and mentors who supported me during my university days when I had no money for future research, and to my old friends who have always helped me.

You can manage your life somehow if you set your mind to it, a principle that has guided my self-centered existence. I continued to follow the same principle even after I got married at the age of 28.

The 1960s was a time of turning crisis into opportunity and misfortune into happiness for me. I didn't know at the time, but my wife Haru had to pawn a brand-new kimono that was a gift from her mother in Oita. I only learned about her sacrifice later when Isshi Haruo, who wrote *Go into the Forest of Souls* (Shincho Bunko) and *Miyawaki Akira's Endless Struggle* (Shueisha International), told me about it. That's why first and foremost, I want to express my deep gratitude to Haru.

When I received the Kanagawa Cultural Prize in 1974, Haru told a newspaper reporter that "Plants are my rival in love."

Once, she even said this to me: "Our marriage and children mean nothing to you. You go wherever you like and do whatever you like, so wherever and whenever it ends, don't ask me to cry."

She continued in a whisper.

"And when the time comes, I'll pray that you had a happy life. So don't worry; just carry on doing as you please, as you've always

done.”

I have a bit of an obsession with the phrase “whatever I like,” and I want to stress that I continued doing what I liked because I never disliked it.

Journalists have often asked me, “When did you first fall in love with plants?” I don’t think I’ve ever particularly loved plants, even now. But if you don’t dislike something without necessarily loving it, and you continue to do so your whole life, you can still have a meaningful life.

We were able to put this book together thanks to the enthusiasm of Tanaka Hiroshi, Publishing Director of Kodansha Gendai Shinsho, and Sonoda Yoshiaki, President of the non-profit organization “*Chinju-no-mori* Supporters Group [*Chinju no Mori no Oendan*]” whose symbol is a *yatagarasu*, a mythical three-legged crow. I am grateful to have met these two genuine people.

Finally, I would like to dedicate this book to all those who have given me tireless guidance and support over the years, both publicly and privately.

March 2013

Miyawaki Akira

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Briefing Materials for Their Majesties the Emperor and Empress. July 5, 2012

The Japanese People and *Chinju-no Mori*—Building A Seawall Forest after the Great East Japan Earthquake

1. Civilization, Science and Technology, and Natural Disasters

It is said that humans have existed on the Earth for five million years, and for most of that time, they have lived in forests. Since time immemorial, the rich bounty of forests has been the foundation of human survival and life. Walking on two legs and using their hands freely, humans first used soil and stone, then copper and iron to make tools, and eventually created civilization as we know it. Our cerebral cortex was far more developed than that of other animals, allowing us to remember, to think, to accumulate knowledge, and to reason comprehensively. We have made astonishing progress in science and technology, but with it we have destroyed or extinguished our natural forests.

Today, we even have nuclear power for the supply of energy, and notwithstanding regional differences, we have more convenience, abundance, and energy than our ancestors could have dreamed of. Humans are, so to speak, living in the best of conditions.

Given the latest science and technology, predictions and preventive measures for natural disasters should have been adequate. Kamaishi, which has in the past been hit countless times by tsunamis, boasts a concrete breakwater (total length two kilometers, rising eight meters above the surface of the sea, and thickness 20 meters) built in the deepest waters to date (63 meters). However, on March 11 last year, it was destroyed when it could not withstand the massive tsunami generated by the Great East Japan Earthquake, an event that far exceeded all predictions. In this 1-in-1000-year catastrophe, nearly 20,000 people lost their lives in an instant.

Given the potential threats inherent in nature that far exceed anything posed by humans, I have been reminded again over the past year or so that the most important thing is life.

2. The Functions of Forests and *Chinju-no-mori*

The primitive life that was born on the Earth about four billion years ago has continued unbroken until today, and we are now using this time as a milestone to pass on the long history of life to the future.

Hometown forests made of hometown trees that are indigenous to each area are belts of greenery that connect our irreplaceable DNA to the future. Hometown forests are multi-layered communities composed of a canopy layer, a sub-canopy layer, a shrub layer, and a herbaceous layer, and the surface area of their greenery is some 30 times that of single-layer communities of grasses. Green plants are the sole producers in the earth's ecosystem, and indigenous forests rich in greenery are indispensable to the existence of the consumers, humans, and all other animals.

Forests composed of deep- and straight-rooted evergreen broad-leaved trees have a variety of functions: environmental preservation and disaster prevention, maintenance of biodiversity, and absorption and fixation of carbon, thereby helping to reduce global warming.

However, indigenous forests have been destroyed by centuries of overgrazing by livestock in forests worldwide and have been drastically reduced by urbanization and land alienation to agriculture. The Japanese have also cut down forests to build villages, towns, and agricultural land, but on the other hand, they are the only people in the world who have always left, protected, or created hometown forests made of hometown trees – the *Chinju-*

no-mori – when building new communities. Sadly, the number of these *Chinju-no-mori* forests has been declining in recent years. In Kanagawa Prefecture, for example, there used to be 2,850 *Chinju-no-mori* (shrine and temple forests), but today only 40 remain.

3. Disaster-prone *Matsu* versus Disaster-resistant *Shii*, *Tabunoki*, and *Kashi*

Immediately following the Great East Japan Earthquake, we conducted a series of field vegetation surveys in the affected areas. Monocultures of *matsu* pine trees planted in the Sendai Plain and elsewhere along the coast were completely uprooted, then washed away hundreds of meters by the second and third tsunami waves, causing extensive damage to homes and cars. However, the *Chinju-no-mori* forests of Minamisanriku, Otsuchi, and other towns were unbowed. *Tabunoki* (*Machilus thunbergii*), *yabutsubaki* (*Camellia japonica*), and *masaki* (*Euonymus japonicus*), the indigenous trees found on steep slopes in the area, also held back the tsunami without toppling, although the soil on the slopes was washed away by the waves, exposing their sturdy tap roots and root masses.

At Nippon Steel's Kamaishi Steel Works, a forest was created 30 years ago by planting *tabunoki*, *shirakashi*, and other trees in accordance with ecological concepts. The trees along the coast were

cleared when the port was built, but the *shirakashi* (*Quercus myrsinifolia*), which had grown to more than 10 meters tall in the hinterland, were still in place after the earthquake and tsunami, along with young *shirakashi* trees in the forest, *yabutsubaki*, *masaki*, and *nezumimochi* (*Ligustrum japonicum*). An authentic tree is one that can withstand a harsh environment and survive a long time.

4. Turning Crisis into Opportunity: Forests for Life that will Last for 9,000 Years

Japan is a beautiful country, rich in nature. Nonetheless, natural disasters such as major earthquakes, fires, tsunamis, typhoons, and floods are extremely common. I am convinced that what is important, and what we must do now, is to use the crisis as an opportunity to create life-preserving forests to protect our nation and its 120 million-plus people, that will last for the next 9,000 years when the next ice age is predicted to arrive.

While it is still important to build hard infrastructure, it is also crucial to create genuine forests that can withstand natural disasters for the 21st century – *Chinju-no-mori* forests, based on the traditional knowledge embedded in the traditional Japanese practice of creating such forests when building new villages and towns since

ancient times—and, though perhaps still insufficient, based on research and results from the comprehensive science of life and the environment and plant ecology. We are advocating widely and seeking cooperation from all sectors of the community to create these ecological forests, seizing this moment to start wherever possible.

They say that the towns should be moved to higher ground because they were damaged due to their location along the coast. However, if you look at the history of human civilization in regions such as Mesopotamia, Egypt, Greece, many large cities such as London, New York, Boston, Tokyo, Yokohama, Nagoya, and Osaka are today in coastal locations. Coastal and riverside locations are the most ecologically rich and liveable places.

Even if the population of a town in mountainous Japan was to temporarily move to higher ground, one or two people will move back down after 10 or 20 years, and gradually all the shops, schools, companies, hospitals, and other facilities will be back by the sea again after 30 years. The best place to live is where you have lived for generations. It is important to survive there no matter what. As the physicist Terada Torahiko (1878-1935) said, disasters always strike again when we have forgotten the last time. We hope to promote the creation of forests that will protect the lives of our citizens, starting wherever we can right now.

5. Most Forms of Debris are Global Resources

Both national and local governments are having trouble disposing of the debris generated by the earthquake and tsunami. Hazardous materials must of course be separated and removed, but we should reuse what we can. Our field survey revealed that more than 90 percent of the debris consists of wood and concrete fragments of house foundations. The debris contains the history and thoughts of those who were born, raised, and lived there for generations, and may be mixed with items that are proof of the lives of those who have passed away. The rubble, filled with people's memories, is being taken away to other locations in Japan for incineration. Since 50 percent of the wooden materials are composed of carbon, burning them will produce carbon dioxide and may further accelerate global warming.

My proposal is to create forests that make use of this rubble. A deep trench will be dug along the coast in the disaster area, rubble will be mixed with soil to create as high a mound as possible, and young seedlings of tree species indigenous to the area will be planted on top of the mound. A *Chinju-no mori* of the 21st century will be created to save people's lives, one that will offer hope for the victims of the disaster, and one that will rest the souls of those who passed away. Mixing rubble with soil creates an air-permeable

mound that allows the roots to readily absorb oxygen, and so the resulting trees will be healthy.

A former official from the Ministry of Land, Infrastructure, Transport and Tourism calculated that if all the debris was mixed with soil to create a mound 100 meters wide and 22 meters high along a 300 km stretch of coastline from north to south of the disaster area, the debris would account for only 4.8 percent of the total volume of the mound. Hazardous components must of course be removed. However, the law that requires all garbage including vegetable scraps from kitchens to be incinerated as general waste was enacted in 1971, when the loach known as the *dojo*, the Japanese ricefish *medaka*, and the freshwater snail *tanishi* were disappearing due to the discharge of highly toxic pesticides such as DDT into waterways.

Do we really have to incinerate all the furniture and wooden structural poles and beams we currently use? We hope to use as much of the available global resources as possible to form mounds for reforestation and other purposes.

6. A National Project and Nationwide Movement

Fortunately, former Prime Minister Hosokawa Morihiro, with whom we previously collaborated on a forest development project in

Kumamoto Prefecture, is also working with us to create forests utilizing rubble. We have also met personally with and sought support from Prime Minister Noda, Minister for Reconstruction Hirano Tatsuo, Environment Minister Hosono, and others. Everyone listens attentively, but perhaps because the administrative system is too massive, it is difficult to make progress. In the meantime, more and more rubble, a precious global resource, is being incinerated. We want to utilize this global resource – earthquake debris – to mix in with soil to create mounds for our forestation activities.

The inclusion of debris is highly effective in ensuring that the soil contains sufficient oxygen, which is essential for plant growth. We don't plant expensive mature trees. A grouping of dominant trees of the potential natural vegetation of the area that will grow reliably, and young seedlings about 30 cm tall of evergreen broad-leaved trees that have survived in the *Chinju-no-mori* will be mixed up and densely planted according to the laws of the natural forest.

The choice of tree species is key. Pine trees are important, but mono-culture pine plantations lack resilience in the face of disaster. In the evolution of plants, 300 million years ago was the heyday of ferns, the source of the fossil fuels coal and oil. Later, plants slowly evolved to produce gymnosperms such as cycads and ginkgo, conifers such as cedar, cypress, and pine, and now we are in the age of angiosperms. On the Pacific Ocean side of Japan, up to

the north of Kamaishi and Otsuchi Town, the trees are evergreen broad-leaved varieties with deep and straight roots.

The main tree species in the indigenous forests of the area include the *tabunoki* (*Machilus thunbergii*), which is said to have prevented the spread of fire during the Great Fire of Sakata in 1976, as well as *akagashi* (*Quercus acuta*), *urajirogashi* (*Quercus salicina*), *shirakashi* (*Quercus myrsinifolia*), and *shirodamo* (*Neolitsea sericea*), and further south, the *sudajii* (*Castanopsis sieboldii*).

This dominant tree grouping will be the focus of our selection, and as many species as possible will be chosen, including the supporting sub-canopy trees such as the *yabutsubaki* (*Camellia japonica*), *mochinoki* (*Chamaecyparis obtusa*), *nezumimochi* (*Ligustrum japonicum*), *yamamomo* (*Myrica rubra*), and *kakuremino* (*Dendropanax trifidus*), and shrubs such as *aoki* (*Aucuba japonica*), *yatsude* (*Fatsia japonica*), and *hisakaki* (*Eurya japonica*). These potted seedlings are nurtured for six months to a year until their root clusters fill the container, and then mixed up and densely planted out according to the laws of the natural forest. After three years, no more management costs are incurred. If we leave the rest to natural selection, the forest will grow to a height of 10 meters in 10 years and nearly 20 meters in 20 years, becoming a forest that protects lives by mitigating disasters and preserving the environment.

By our calculations, 90 million seedlings in pots with an established root mass would be needed to create a forest on a mound 300 kilometers from north to south and 100 meters wide at a rate of three seedlings per square meter. Naturally, it's not something we can do overnight.

We have started this mission wherever we were able, and under the direction of visionary and decisive local government leaders, we have held tree-planting events for testing purposes in the town of Otsuchi and city of Iwanuma on the Sendai Plain. These seedlings, planted by volunteers from all over Japan and former Prime Minister Hosokawa, are firmly taking root.

7. Bringing a *Heisei* Forest to the World: Requiem for Souls and Hope for the Future

Our forests for life project is a future-oriented plan for which Japan, a country with few natural resources, can share its processes and results with the world. The Great Wall of Forests, extending for 300 kilometers from north to south, will protect the lives of local people, provide learning and healing for visitors, play a leading role in the lush local landscape, coexist with the local economy, and be a genuine forest that will last for 9,000 years. We hope to build such a Great Wall of *Heisei* Forests (named for the *Heisei* era, which corresponds to the reign of the Japanese Emperor Akihito).

Over the past 40 years, together with many visionary companies, governments, organizations, and above all, local citizens, we have planted seedlings of indigenous tree species in 1,700 locations in Japan and abroad, and all have grown into forests that can withstand any disaster and protect life. And if the trees that have grown substantially are selectively logged in 80- or 120-year cycles, as in the German forestry industry, even hardwood zelkova trees can be sold for reportedly more than 10 million yen, thereby contributing to the local economy.

We hope that each and every Japanese will plant a small seedling, with the sweat of their brow and fingers deep in the soil, to protect their own life, that of their beloved family, and that of the Japanese people, and the life of an authentic verdant land, and that the results and knowledge underlying these efforts will be shared from Japan to the rest of the world.

Now 84 years old, I will continue to do my best. Biologically, women have the potential to live to 130 years of age and men to 120 years of age. If we do nothing, we will go backwards. I promise to continue planting trees with you all, at the very least until this project becomes a reality.

I wish to humbly express my gratitude for this rare and valuable opportunity.

Thank you very much.

Miyawaki Akira

Born in 1928 in Okayama Prefecture. Plant ecologist. Graduated from the Department of Biology at Hiroshima University of Literature and Science, then became a researcher at the Federal Institute for Vegetation Mapping in Germany. Appointed a Lecturer at Yokohama National University and elected President of the International Association for Ecology. Emeritus Professor at Yokohama National University and Honorary Director of the IGES Japanese Center for International Studies in Ecology. From the beginning of the 1970s, he promoted the planting of trees around the world. Awarded the Asahi Prize in 1991, Medal of Honor with Purple Ribbon in 1992, Order of the Sacred Treasure, Gold and Silver Star in 2000, and the Blue Planet Prize in 2006. Authored numerous books, including *Plants and People [Shokubutsu to ningen]*, (NHK Books, Mainichi Publishing Culture Award); *Plant Trees! [Ki o ueyo!]*, (Shincho Sensho); and *Shrine Forests [Chinju-no-mori]*, (Shincho Bunko). He passed away in 2021.

About the translator

Tony Atkinson is a freelance Japanese-English translator based in Western Australia, working mainly in the areas of medicine and drug

development. He also translates science texts for the general reader, and a recent translation includes *The Winding Road to Discovering iPS Cells: The Life of Yamanaka Shinya* (Japan Publishing Industry Foundation for Culture). He is a former president of the Japan Association of Translators (JAT).