FOREST BIOSPHERE RESERVES IN THE SHIRAKAMI MOUNTAIN AREA

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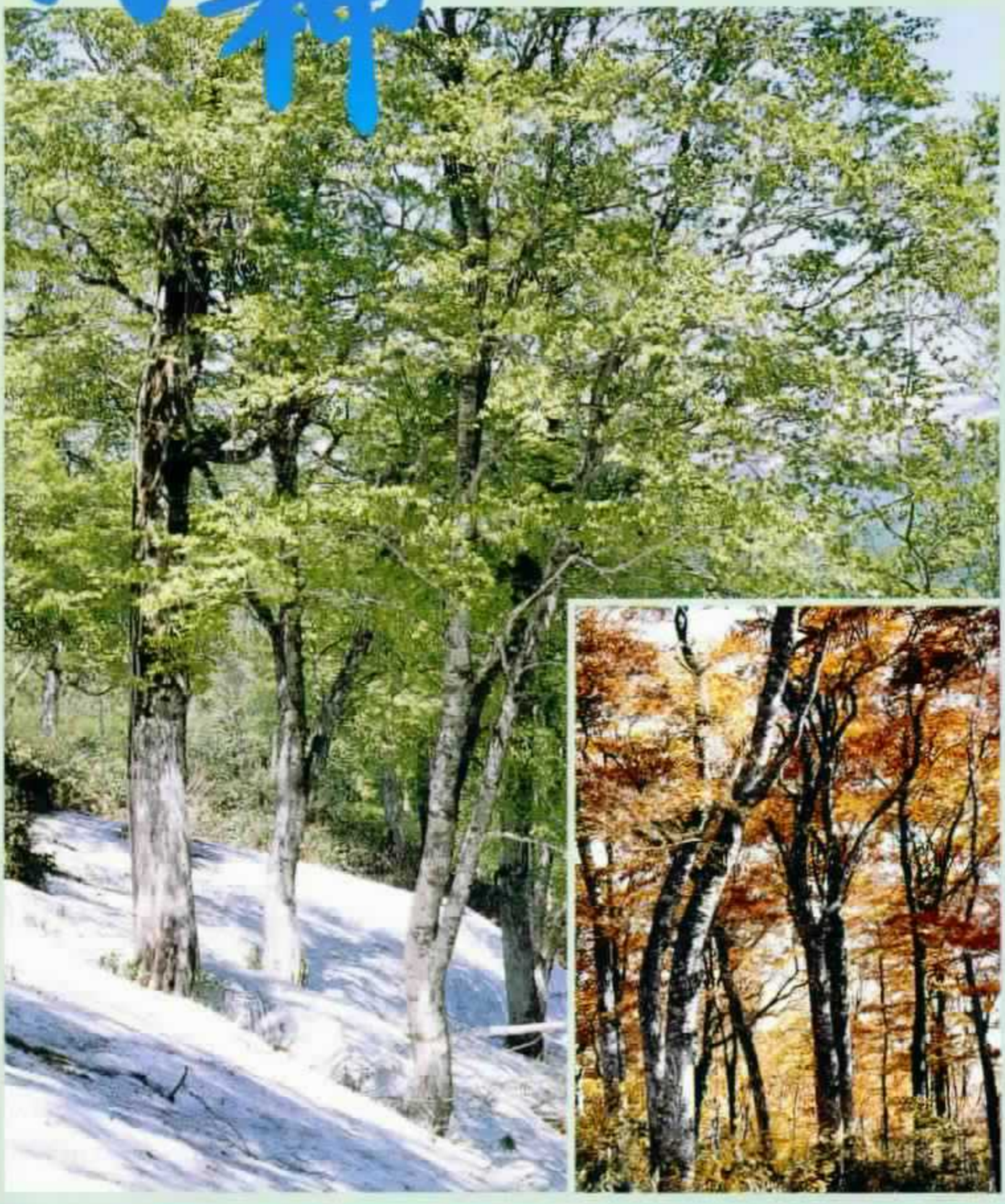
VISITORS' GUIDE TO SHIRAKAMI



AOMORI REGIONAL FORESTRY OFFICE

FOREWORD

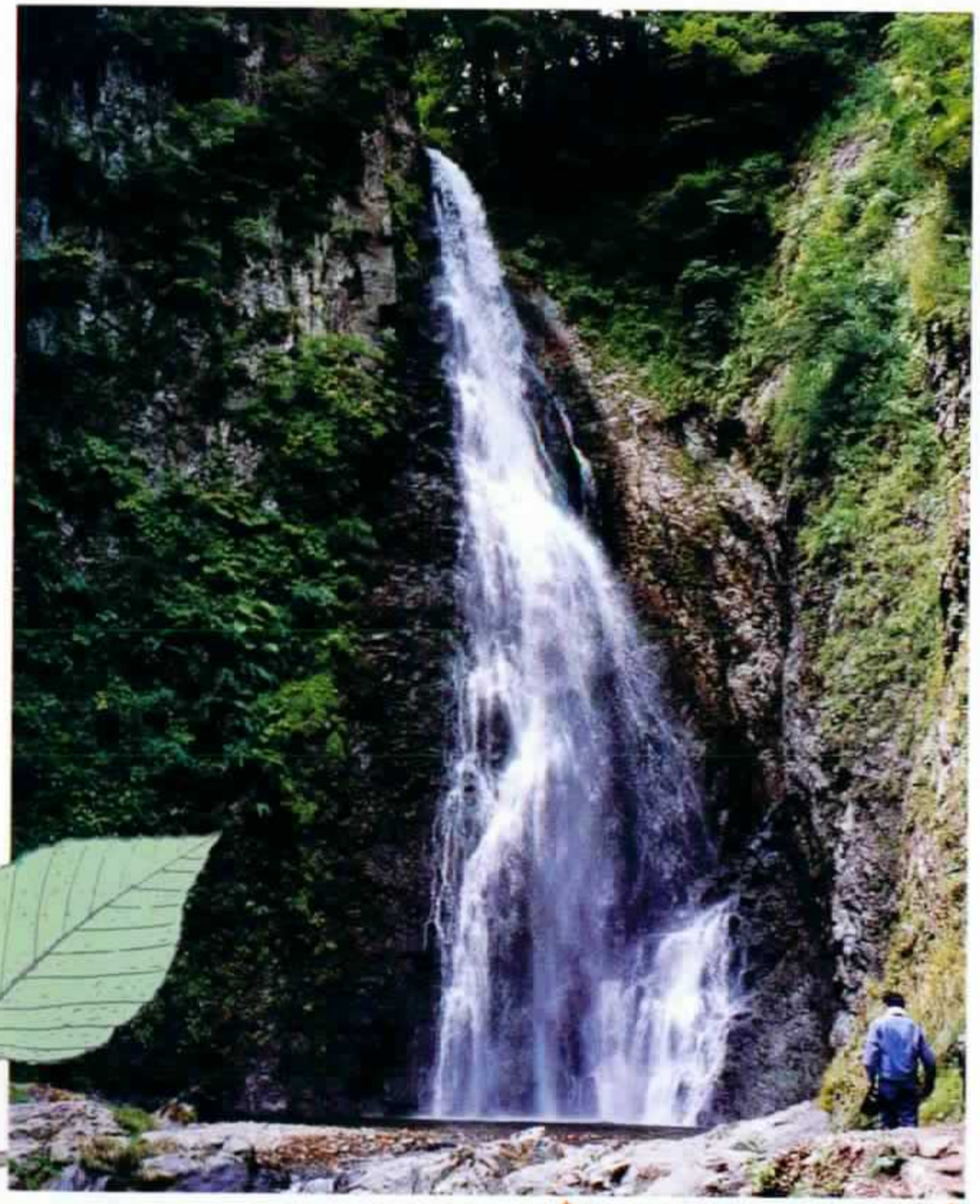
National forests in the Shirakami mountain area are very precious from the global and Japanese point of view as cold-temperature deciduous broad-leaved trees, primarily Buna (*Fagus crenata*), spread over a huge area up the hillsides to near the summits of the mountains.

The grandiose mountain landscape accompanied by rich wildlife with diverse species of fauna and flora in large populations is truly impressive to any visitor.

In 1990, the Aomori Regional Forestry Office designated these national forests "a Forest Biosphere Reserve" so that this precious area can be inherited by future generations. These national forests were later designated a Nature Conservation Area by the Environment Agency and were also registered as Natural Heritage under the Convention Concerning the Protection of World Cultural and Natural Heritage.

This booklet briefly explains the historical background of national forests in the Shirakami mountain area and describes how natural Buna forests work and the functions they serve in the environment.

◆Leaves and fruit of Buna◆



◆Anmon Falls (Second Fall)◆

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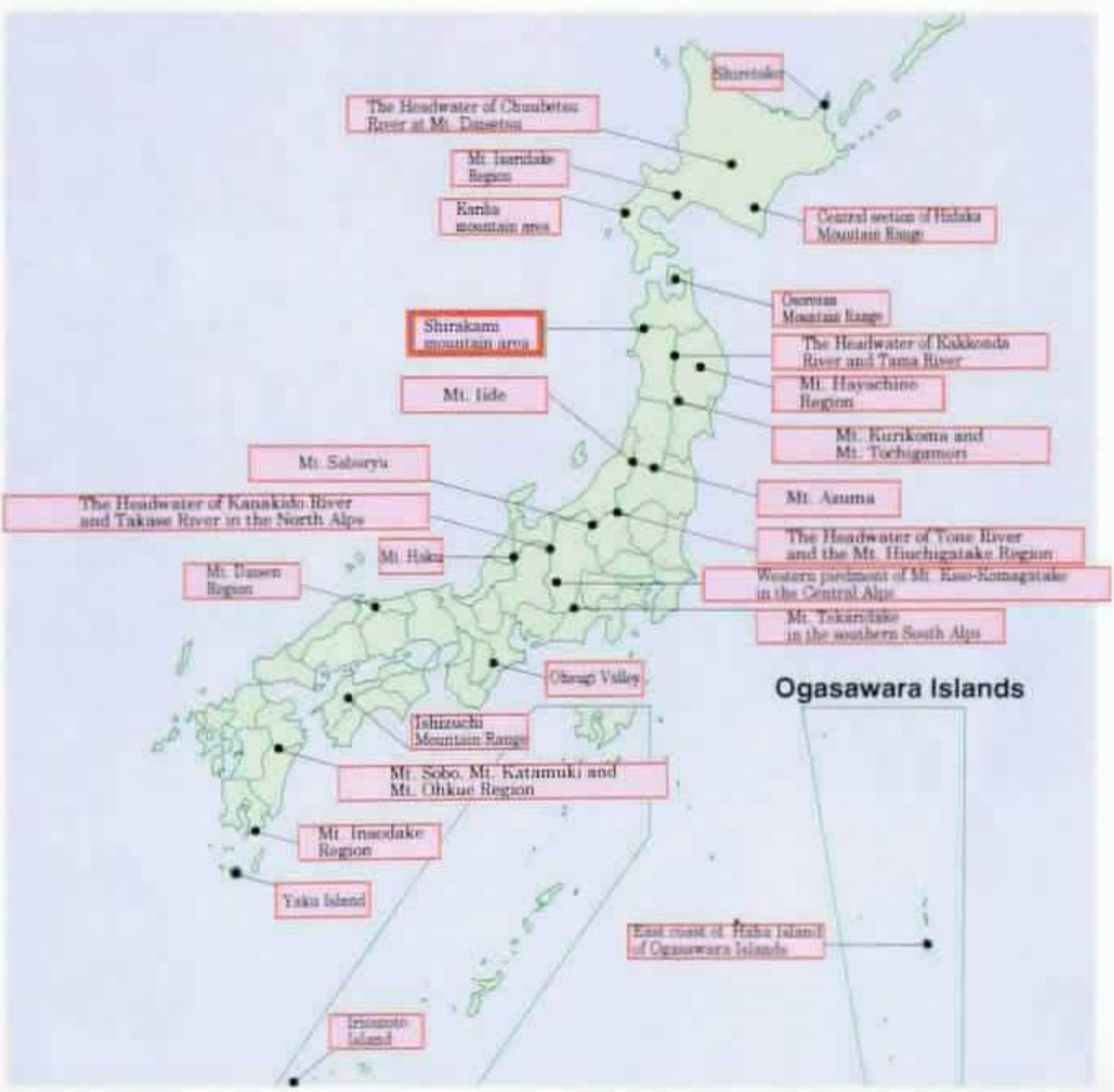
THE PROTECTED FOREST SYSTEM AND FOREST BIOSPHERE RESERVE

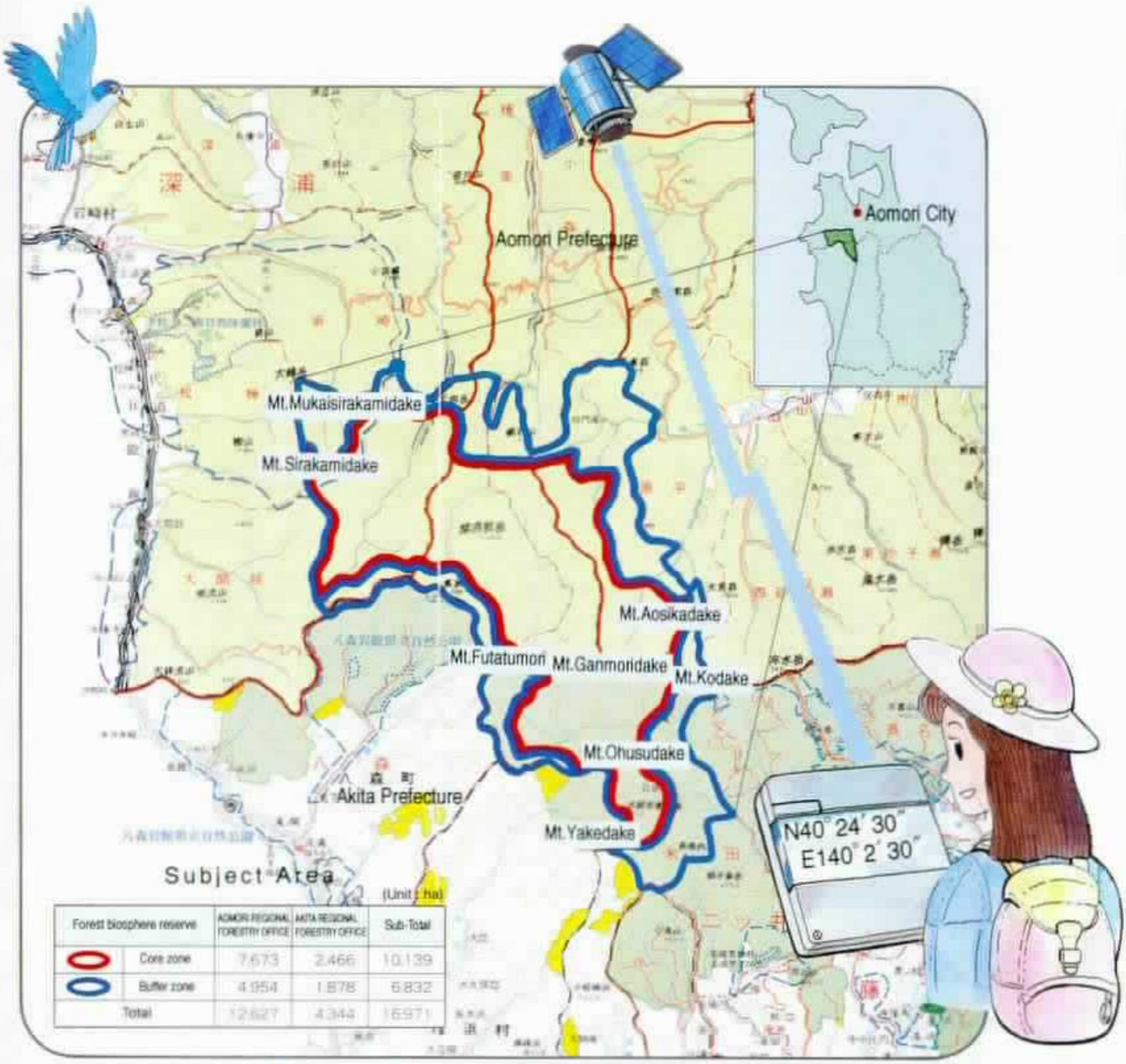
In 1988, the Forestry Agency reorganized and expanded the existing protected forest system in response to the public demand for nature conservation and established the following seven types of protected forests throughout Japan.

- Forest biosphere reserve
- Forest tree genetic resources preservation forest
- Specific animal habitat protected forest
- Home town forest
- Forest bio-genetic resources preservation forest
- Plant community protected forest
- Specific topography protected forest



◆Locations of Forest Biosphere◆

Of these seven types of protected forests, a Forest Biosphere Reserve is established to ensure maintenance of the natural environment, to protect wildlife, to preserve genetic resources and to promote academic research, by means of preserving primeval natural forests and is considered to be the most important type of protected forest with the largest coverage. Each Forest Biosphere Reserve consists of dual zones: a core zone where the forest ecosystem is strictly preserved with a buffer zone around it.



Forest biosphere reserve		AOMORI REGIONAL FORESTRY OFFICE	AKITA REGIONAL FORESTRY OFFICE	Sub-Total
	Core zone	7,673	2,466	10,139
	Buffer zone	4,954	1,878	6,832
Total		12,627	4,344	16,971

◆Forest Biosphere Reserve in Shirakami Mountain Area◆

THE HISTORY OF THE SHIRAKAMI MOUNTAIN AREA AND NEIGHBOURING AREAS

(1) Edo Period to Second World

◆Female Meya doll carrying a charcoal sack◆

During the Edo Period, national forests in the Shirakami mountain area and neighboring areas in present-day Aomori Prefecture were managed by the Tsugaru Clan while those in present-day Akita Prefecture were managed by the Akita Clan as clan forests.

Following the return of land and people from being the domains of feudal lords to being the domain of the Emperor as a result of the Meiji Restoration, clan forests were incorporated into state-controlled forests (national forests) the jurisdiction of which was successively transferred from the Ministry of Civilian Affairs to the Ministry of Finance, to the Ministry of Internal Affairs and finally to the Ministry of Agriculture and Commerce. With the establishment of the Large Area and Small Area Forestry Offices system in 1886, the Aomori Large Area Forestry Office was assigned the management of national forests in Aomori Prefecture while the Akita Large Area Forestry Office was assigned the management of national forests in Akita Prefecture. The establishment of the regional forestry office system in 1924 changed the Aomori Large Area Forestry Office and Akita Large Area Forestry Office to the Aomori Regional Forestry Office and the Akita Regional Forestry Office as they are today.

It is believed that forests in the watersheds of the Oh River and the Anmon River located in the upper reaches of Iwaki River in Aomori Prefecture used to be major sources of firewood for the castle town of Hirosaki. The fact that all minor as well as major valleys in the headwater area of Iwaki River in the prefectural border area had Buna given names and that the Tsugaru Clan had conducted a detailed tree count survey in each valley suggests the importance of these forests.

Forests in the watershed of the Kasuge River (a tributary of the Yoneshiro River) on the Akita Prefecture side were important as sources of timber which was required for the Chojozan Mine and other local mines. These forests were also sources of charcoal for copper refining in charcoal kilns traces of which have Buna found in the area. It appears that forests in the watershed of Kasuge River also supplied mine timber for the Mizusawa Mine (producing silver and copper) in Minehama Village, which is in the Yamamoto District, Akita Prefecture.

As described earlier, these forests had Buna reclassified as national forests in the Meiji Period which led to their systematic management as of 1899 with the launch of the National Forests Special Management Project. The enforcement of the Forest Law in 1897 inaugurated the protected forest system, commencing erosion control projects with a view to protecting human lives and assets in watersheds across the country.

(2) After Second World War

In the post-Second World War period, one of the most important government priorities was to ensure adequate supplies of charcoal, which was a daily necessity for the people at the time, and timber for the rebuilding of war damaged area. Extensive felling was conducted in natural forests in and around the Shirakami mountain area, mainly focusing on the lower reaches, and large-scale forest railway systems were constructed.

The local population peaked in the late 1940's, suggesting the need for an active forestry industry at that time. In the late 1950's, the so-called fuel revolution led to the decline in demand for firewood and charcoal while increasing the demand for building timber and pulp wood. As a result, remote forests were subject to expansive afforestation turning many natural forests into plantation forests of Sugi (Japanese cedar) and other species.

While forest development took place in the Shirakami mountain and neighboring areas to meet the demand for an improved standard of living, the demands for natural forest protection and forest recreation were also gradually increasing.

In the late 1980's, the Shirakami mountain area was central in a heated on the issue of the construction of the Seishuu (Aomori-Akita) Forest Road with various arguments put forward from different viewpoints and the importance of utilizing forests in harmony with nature was highlighted.

Against this background, the Shirakami Mountain Area Forest Biosphere Reserve which is designed to conserve the central area of the Shirakami mountain area and to facilitate its academic use was established in an effort to protect an area up to 17,000 ha. In 1992, areas, except those belonging to national parks, were designed Nature Conservation Areas by the Environment Agency. Moreover, these Nature Conservation Areas entered the limelight when they were registered as Natural Heritage under the Convention Concerning the Protection of World Cultural and Natural Heritage.

◆Forest railway transporting lumber◆

THE SHIRAKAMI MOUNTAIN AREA FOREST BIOSPHERE RESERVE

Forest Biosphere Reserves are established by the Forestry Agency throughout Japan for the purposes of maintaining the forest ecosystem, protecting wildlife and preserving genetic resources, by conserving primeval natural forests. 26 reserves had Buna established as of 1995.

The primary characteristic of the Shirakami Mountain Area Forest Biosphere Reserve is the presence of natural Buna forests over an extremely large area relative to the other Forest Biosphere reserves.

The Shirakami mountain area faces severe meteorological conditions, such as a mean annual temperature of less than 9° C even in areas at a lower elevation and snow cover of 250 cm or more in winter.

The local geology is characterized by base sedimentary rock, formed in the Paleogene Era (some 50 million years ago), and granite, formed in the Cretaceous Era, topped by widely distributed green-tuff, formed in the Neogene Era (some five million years ago).

There is a wide distribution of cold-temperate deciduous broad-leaved trees, mainly Buna, found on the hillsides almost up to the summits and there are also scattered minor forests of Miyama-nara, Hime-yashabushi, Kita-goyo and Sawagurumi. These forests are rich in terms of the diversity and density of the populations of animals living within them. In fact, more than half of the mammals and birds inhabiting Aomori and Akita Prefectures are found in these forests. The diversity of the local birds is particularly impressive. The Kumagera (Black Woodpecker) which is designated a Precious Natural Creature by the central government, raptores such as the Inuwashi (Golden Eagle) and the Kumataka (Hodgson's Hawk Eagle), forest birds such as the Higara (Coal Tit) and the Kogara (Willow Tit), torrent birds such as Kisekirei (*Motacilla cinerea*) and the Kawagarasu (Water Ouzel) and highland birds, including Binzui(Anthus hodgsoni) can all be found in these forests.

The natural landscape is truly magnificent with many places of beauty, including the Anmon Falls and the Akashi Torrent. At the 17th Ordinary Session of the World Heritage Committee, it was decided to register the Shirakami mountain area as World Natural Heritage because areas such as this, where primeval natural Buna forests are preserved in an undisturbed state are very rare.

The Shirakami Mountain Area Forest Biosphere Reserve covers a total area of 16,971 ha (approximately 170 km2), consisting of areas under the jurisdiction of the Aomori Regional Forestry Office (Aomori Prefecture) and those under the jurisdiction of the Akita Regional Forestry Office (Akita Prefecture).

The Reserve is classified into the "core zone", where the utilization of forests is strictly prohibited to conserve the forest ecosystem, and the "buffer zone", where the utilization of forests is permitted with special care taken in regard to the forest ecosystem. The former area covers 10,139 ha while the latter covers 6,832 ha.

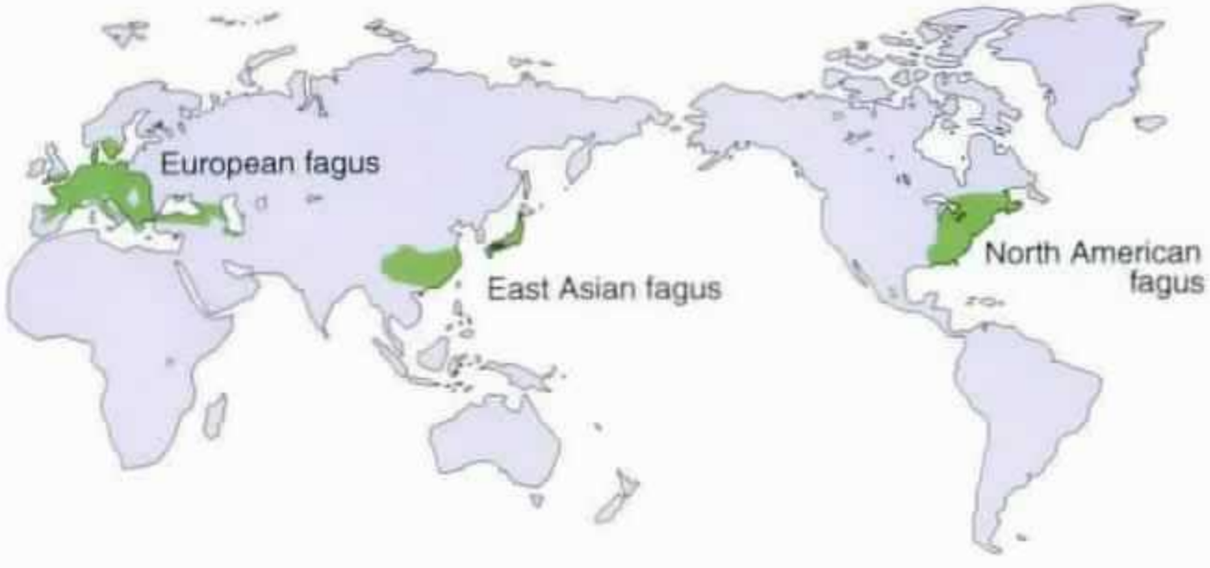
Entry to the core zone is, in general, prohibited although entry for academic research or other special purposes is permitted with the permission of the head of a regional Forestry Office or district Forestry Office. The buffer zone is used for educational and forest recreation purposes as a place for nature observation.

NATURAL BUNA FORESTS

The Shirakami mountain area is dominated by natural forests, mainly Buna forests which perform an important role in the conservation of the abundant wildlife which they host.

(1) Distribution of Buna Forests

There are eight Buna genera in the world today, all of which, excepting the Antarctic Buna genus, are widely distributed in the cold-temperature zone of the northern hemisphere. Two Buna genera are found in Japan, they are the Buna (*Fagus crenata*) and Inubuna (*Fagus japonica*).



◆Distribution of Buna Genera (Fagus) in the World◆

In Japan, Buna could be found mainly in areas of heavy snowfall south of the 39° N or 40° N parallels at around the time of the late ice age some 12,000 years ago. As global temperatures rose Buna forests gradually disappeared in the lowlands of western and southern Japan but began to establish themselves in areas north of the 40° N parallel. At present, they are widely seen from Mt. Takasumi in Kagoshima Prefecture in the south, to Kuromatsunai in Hokkaido in the north with major Buna forests being located in the Tohoku Region.

◆Distribution of Buna Forests in Japan◆

(2) Flora in Buna Forests

In most cases, a Buna forest is a mix of dominantly Buna and various other deciduous broad-leaved species. The flora of a Buna forest is closely related to the snowfall it experiences. Hence the characteristics of these forests greatly differ between high snowfall regions of Japan which face the Sea of Japan and the low snowfall region which lie along the Pacific Ocean.

The main plant species found in Buna forests in both regions are shown in the table. Buna forests on the Pacific Ocean side tend to show diverse vegetation, including needle-leaved trees such as the Momi (Fir) and Tsuga (Japanese Hemlock). In contrast, Buna forests on the Sea of Japan side are characterized by a relative uniformity with less diversity of species mixed in with the Buna.

◆Flora of Buna Forests◆

	Sea of Japan Side	Pacific Ocean Side
High Trees	- Buna (*Fagus crenata*) - Hauchiwa-kaede (*Acer japonicum*) - Itaya- kaede (*Acer mono*) - Mizunara (*Quercus crispula*)	- Buna (*Fagus crenata*) - Mizunara (*Quercus crispula*) - Hauchiwa-kaede (*Acer japonicum*) - Urajiro-momi (*Abies homolepis*)
Low Trees - Shrubs	- Oh-kamenoki (*Viburnum furcatum*) - Ohba-kamenoki (*Lindera umbellata f. membranacea*) - Koshi-abura (*Acanthopanax sciadophylloides*) - Ezo-yamatsuba (*Daphniphyllum macropodum var. humile*) - Tamashiba (*Magnolia salicifolia*) - Yama-urushi (*Rhus trichocarpa*) - Uwamizu-zakura (*Prunus grayana*)	- Ryoba (*Clethra barvinervis*) - Togoku-mitsubatsutsuji (*Rhododendron wadanum*) - Oh-kamenoki (*Viburnum furcatum*) - Aodamo (*Fraxinus lanuginosa var. serrata*) - Kuromoji (*Lindera umbellata*) - Goyo-tsutsuji (*Rhododendron quinquefolium*) - Tannasawa-futagi (*Betula corylana*) - Asebi (*Pieris japonica*) - Urihada-kaede (*Acer rufinerve*) - Komine-kaede (*Acer macranthum*) - Kamatsuka (*Pourthiaea villosa var. laevis*)
Low Shrubs Herbs - Sasa	- Chishima-zasa (*Sasa kurilensis*) - Tsumari-doshi (*Mitchella undulata*) - Shinobukagamia (*Arachnioides mutica*) - Iwa-kagami (*Schizocodon soldanelloides*) - Yama-soetsu (*Plagiogyria matsumureana*) - Hime-aoki (*Aucuba japonica var. borealis*) - Hime-mochi (*Ilex leucoclada*) - Tsuta-urushi (*Rhus ambigua*) - Shinobu-watabi (*Dryopteris expansa*)	- Suzutake (*Sasamorpha purpurascens*) - Yama-tsutsuji (*Rhododendron kaempferi*) - Shishigashira (*Blechnum nipponicum*) - Akano-kirimo (*Solidago virgaurea*) - Iwa-kagami (*Schizocodon soldanelloides*)

◆Fauna of Buna Forests◆

(3) Fauna in Buna Forests

Buna forests are home to a large variety of fauna. Their food chains support large creatures, birds and animals, down to small soil organisms.

Some 150 bird species are known to breed in Japan's forests and plains. Seventy-nine of these species are found within Buna forests. The density and variety of species of birds per unit area in Buna forests is similar to that in other natural forests. What is crucial for birds in any ecosystem appears to be the diversity of flora.

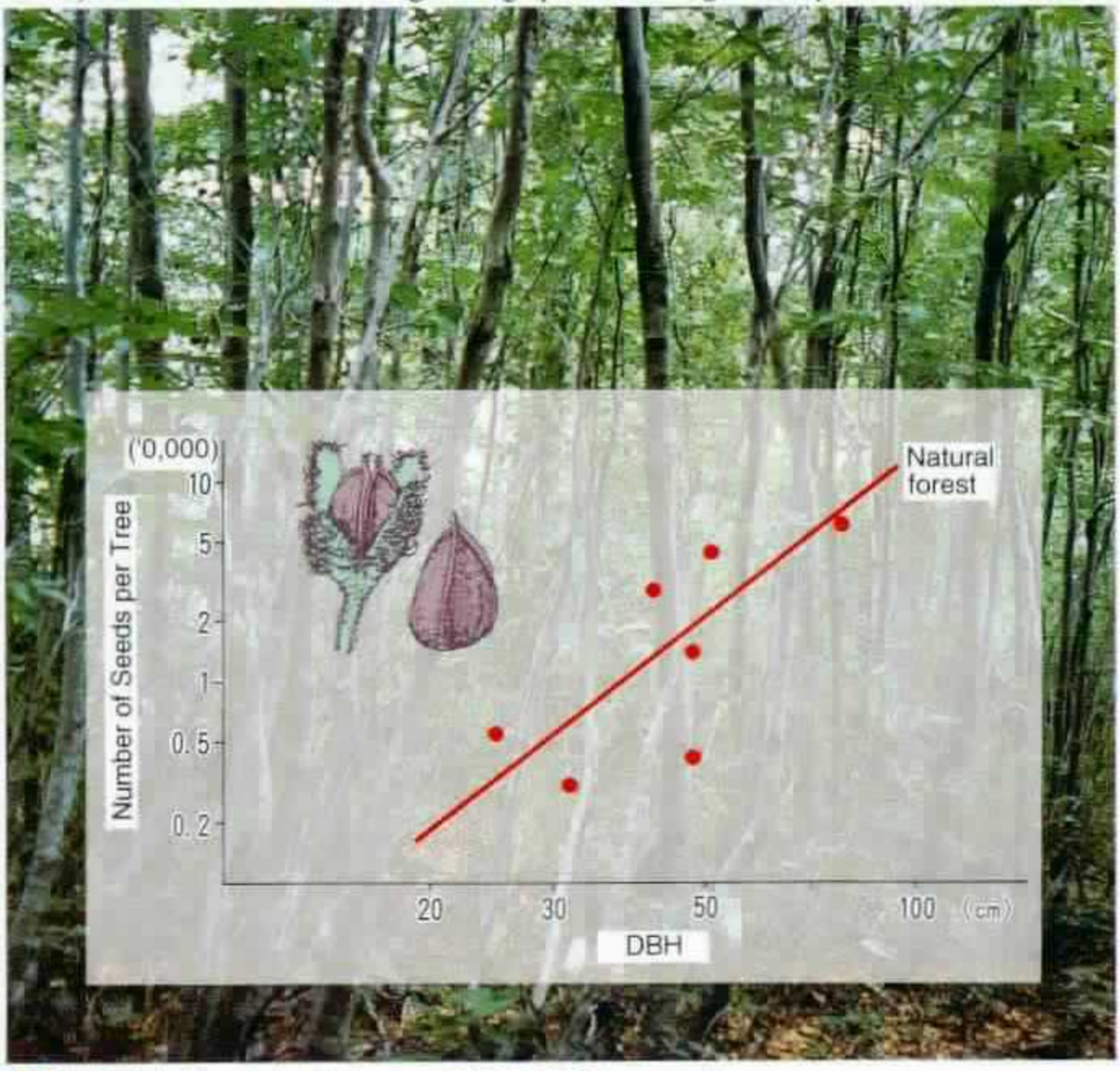
The Kumagera(Black Woodpecker) is the largest woodpecker in Japan. It is designated a Precious Natural Creature and an Endangered Species in the Red Data Book of the Environment Agency. Sightings of this rare bird in the Tohoku region have occurred almost exclusively in either Buna forests perhaps because these are the most abundant natural forests in the region.

Japan has some 110 mammal species, excluding marine animals, of which 56 species inhabit Buna forests. The nuts from Buna and Mizunara (*Quercus crispula*), are excellent food for herbivores such as hare, squirrel, deer and Japanese serow, while cavities in the trees provide dens and nests for bear and bat.

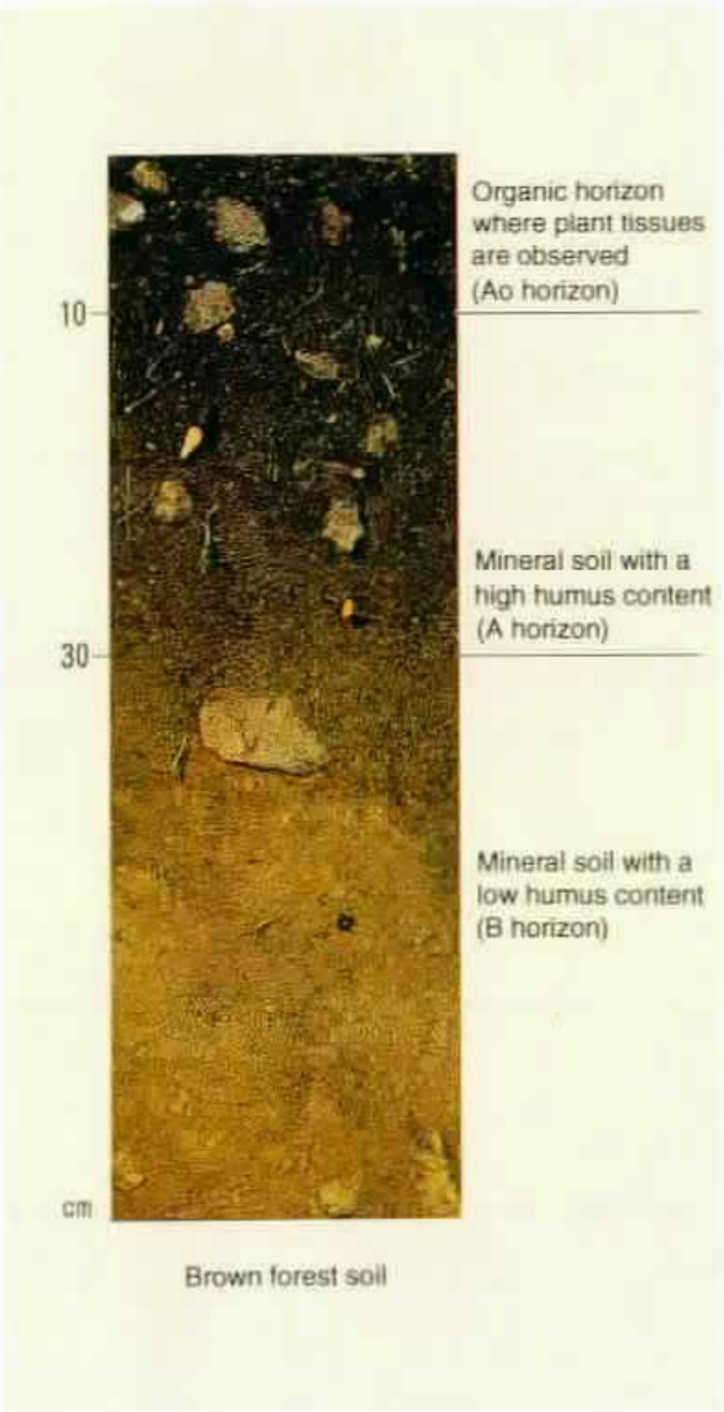
(4) Physiological Characteristics of Buna

Buna starts flowering and producing seeds when it is 40 - 50 years old (Diameter at Breast Height (DBH) of approximately 15 - 20 cm). Seeds are not necessarily produced every year and the number of seeds produced fluctuates from one year to another. A good year normally returns every 5 - 7 years. The diagram below gives seed production data for natural Buna forests. It shows that some 3,000 - 5,000 seeds are produced for a DBH of 25 - 30 cm, 15,000 - 43,000 seeds for a DBH of 40 - 50 cm and 60,000 seeds for a DBH of 75 cm.

Many of the seeds which fall onto the forest bed are eaten by animals from autumn to winter while some decay. The remaining seeds germinate the following spring. However most of these naturally regenerated Buna seedlings on the forest bed die within the next few years due to lack of sunlight or the harsh meteorological conditions. The growth of Buna seedlings is extremely slow compared to the seedlings of trees such as the Mizunara (*Quercus crispula*) and the Itaya-kaede (*Acer mono*). It is one of the slowest growing species among trees up until it reaches some



◆The Relationship Between DBH of Buna and Number of Seeds Produced◆



◆Typical Soil Section of Buna Forest◆

10 years of age. The speed of growth then accelerates with age and it overtakes other species when it about 25 years old. Growth is said to peak at an age of 50 - 120 years. While one Buna tree with an estimated age of 700 years has Buna found, the normal life expectancy for these trees is said to be around 300 years.

(5) Soil of Buna Forests

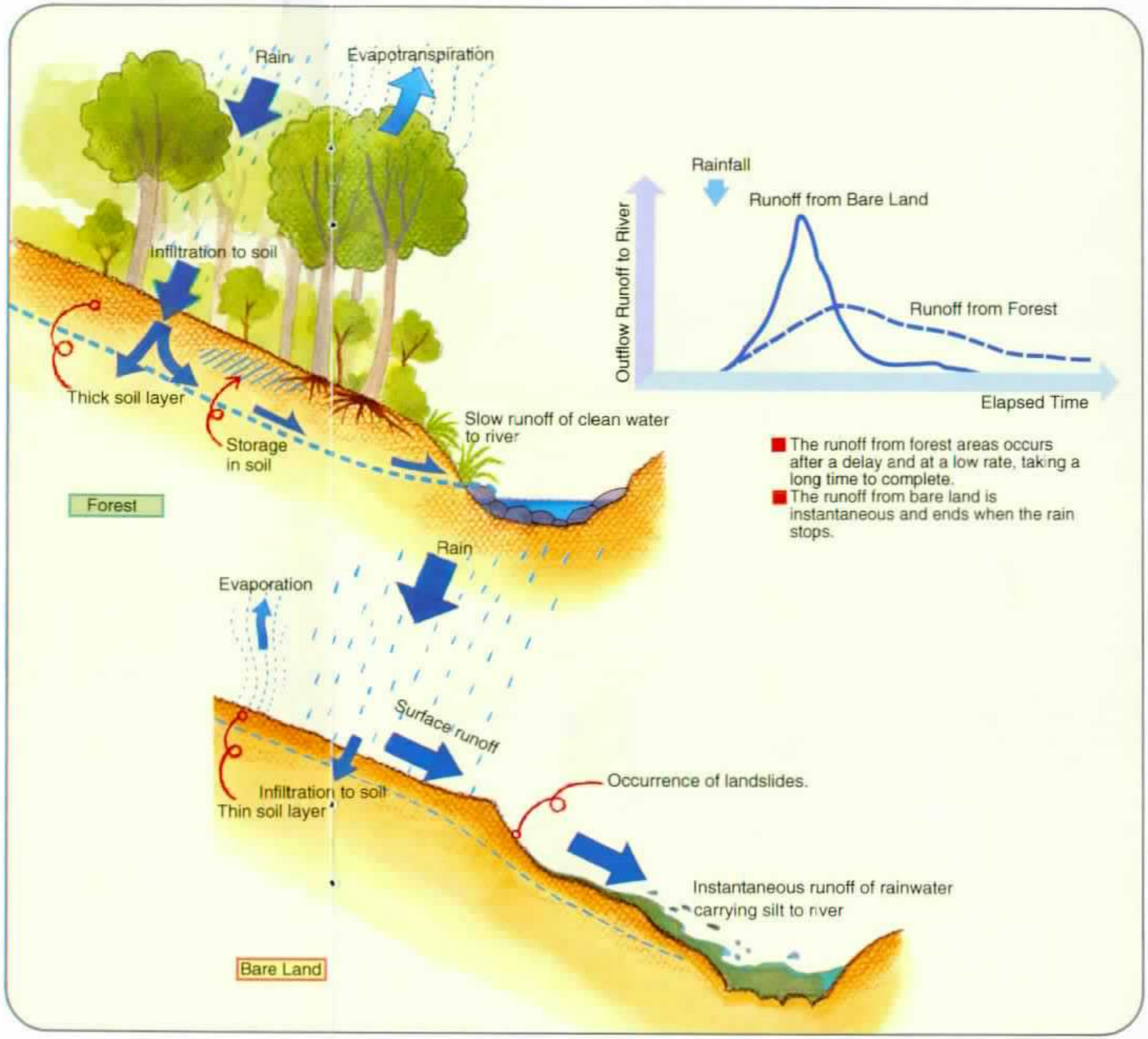
Forest soil is a mixture of weathered rocks and decayed trees and plants (humus). The activities of the tree roots and small soil animals then form pores of various sizes in the soil (compound structure). Added to this is organic matter from dead organisms which have decomposed and have been incorporated into the soil, becoming one of its constituents. The forest soil created through these processes is essential for both plant and animal life.

Each forest develops its own specific type of soil depending on the types of parent rocks, topography, temperature, rainfall and various biological factors. Accordingly, the soil of a Buna forest reflects the particular conditions that led to its formation. In general, the leaves of deciduous broad-leaved trees like the Buna decompose quickly and their high sodium and magnesium content prevents the soil from becoming acidic even in cold districts where this tends to occur. A well-developed root system together with the rich presence of small soil organisms help to produce soil with good physical properties.

(6) The Soil and Water Conservation Functions of Buna Forests

Forests help prevent the occurrence of both floods and drought while simultaneously purifying muddy water to provide a stable supply of clean, tasty water. This is because rainwater and melted snow temporarily remain in the soil and its subsequent gradual discharge levels the flow rate mean while harmful matter, such as colon bacilli, is decomposed by microbes such as bacteria that is found in the forest soil. This water conservation function is not unique to Buna forests but is shared by all forests.

Why then is the water conservation function of Buna forests said to be particularly significant? Firstly, many of the Buna forests in Japan are "multi-story forest" containing a healthy population of older ,taller trees. Multi-storied forests contain trees, shrubs and grasses of varying height. The crowns of the vegetation at the various levels trap a large amount of rain slowing its onto the forests floor and to its eventual discharge. Also Buna forests with larger, older trees, soil contain a layer of top which has grown deeper over a long period of time while their complicated root systems have enhanced the compound structure of this soil, resulting in a relatively large water storage capacity. Lastly, Buna prefers a gently sloping terrain with a deep layer of soil and areas with high rainfall which the large water holding capacity of these forests. In other words, a Buna forest tends to form on land with a large water holding capacity. In the case of the Shirakami mountain area for example, Buna forests have formed on relatively gently sloping terrain with a deep soil layer while the needle-leaved forests of Kita-goyo (*Pinus pentaphylla*) and others can be seen along ridgelines or on steeply sloping terrain.



◆Water Circulation in Forests◆

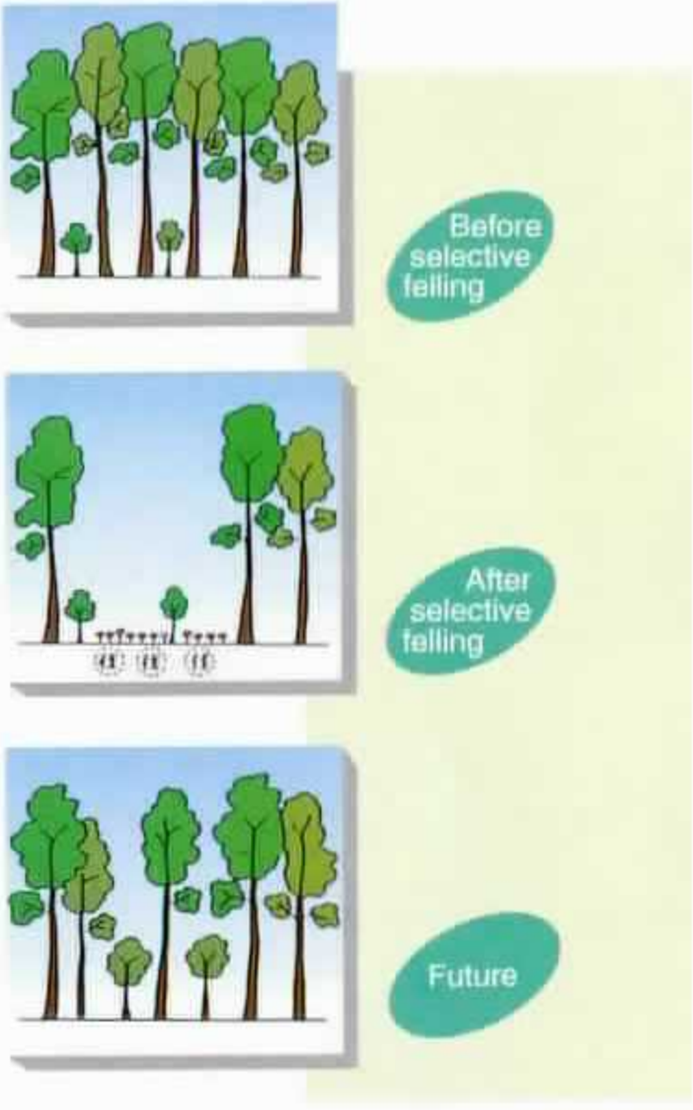
(7) Buna Forest Management for Sustained Yield

In the period from the end of the Second World War to the late 1960's, many Buna forests were felled to supplement the timber shortage and were replaced by forests of Sugi and other species. In present national forests, however, large-scale replantation of forests seldom takes place because of the possible negative impact on the environment. The current management of Buna forests gives priority to the utilization of natural processes, introducing measures designed to encourage the natural germination of fallen seeds and the subsequent healthy growth of seedlings. This type of forest management is called "the Selection System" and "the Pre-regeneration System".

The Selection System involves the selective cutting of over-mature trees to facilitate the growth of lower story trees. This is done so that forest may more efficiently perform its role in the conservation of soil and water.

The Pre-regeneration System leaves seed trees as well as small immature trees with a view to facilitating the production of seeds to ensure a new generation of young trees. As sufficient sunlight is essential for the germination of seeds which have fallen from seed trees and for their subsequent healthy growth, Sasa and other ground vegetation are cleared.

Even though it is sometimes necessary to fell trees in a Buna forest to supply wood, which is a beneficial forest product, various measures are employed to leave rich Buna forests for subsequent generations.



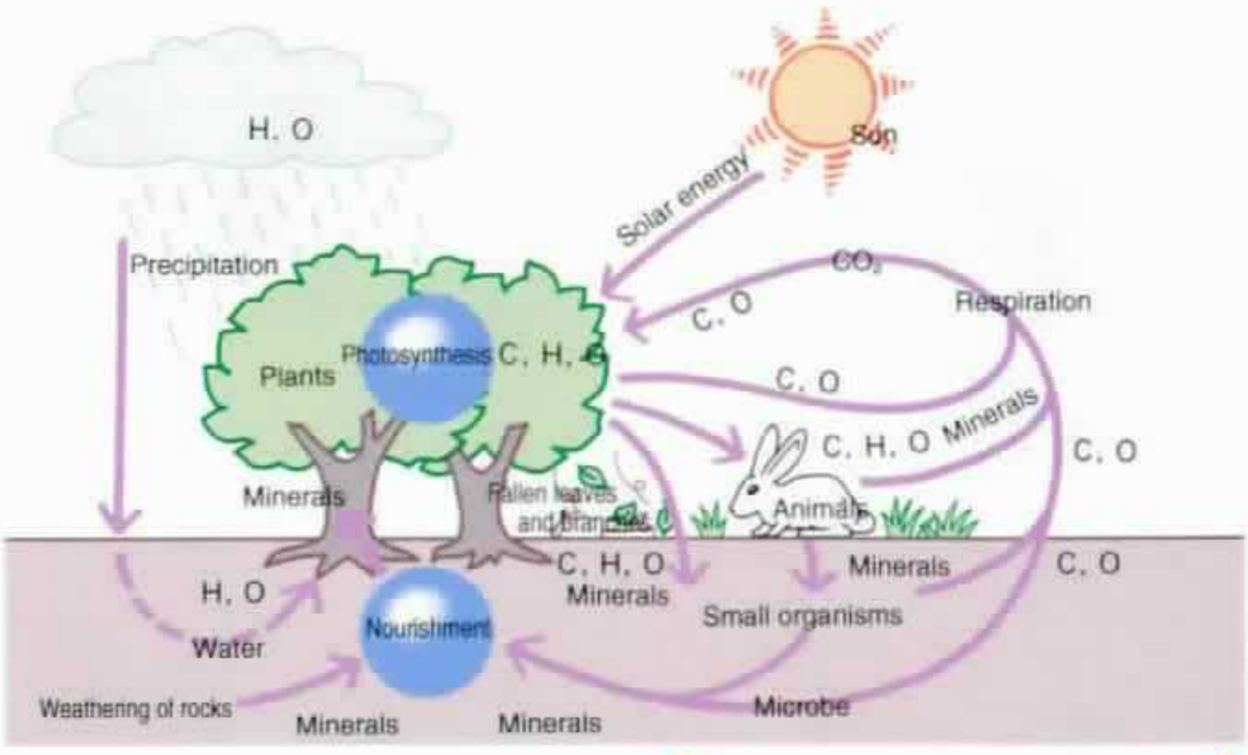
◆Regeneration of Buna Forest Through Selective Felling◆

FOREST ECOSYSTEM

Every forest has diverse flora and fauna which interact creating an ecosystem.

(1) The chemical Cycle of Forests

Plants contain chlorophyll which absorbs solar energy. Then through the process of photosynthesis, they convert this energy, together with CO_2 from the atmosphere, water and nutritive minerals, into elements which they need to grow. The growing plants act as food for animals. In turn, the dead bodies and excreta of animals which have grown by eating the plants are decomposed by small organisms and bacteria in the soil, becoming minerals once again and acting as plant nutrients. In the forest ecosystem, the cycle of materials going through the bodies of plants, animals and microbes using solar energy is called "the chemical cycle".

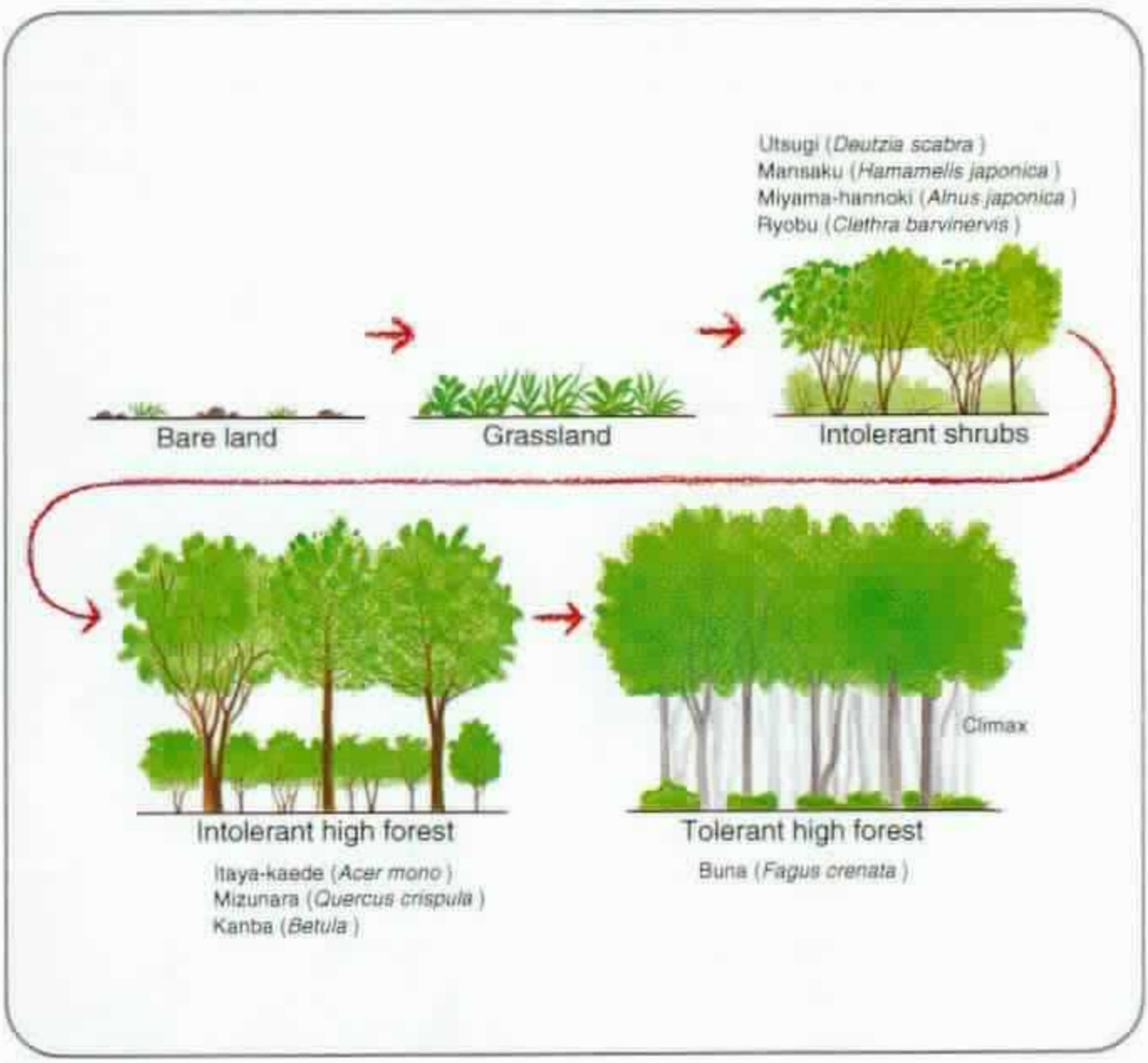


◆The Chemical Cycle of Forests◆

(2) Succession and Climax of Forests

After a forest becomes bare open land due to a forest fire or other reasons, various plants gradually being to invade it. The first wave of this invasion is made by lichen and moss, followed by annual herbs, perennial herbs, shrubs, intolerant trees (light demanding trees) and tolerant trees in this order. Such changes in the plant communities on the same site with the passing of time is called "succession" and the final vegetation in this succession is called "the Climax". In areas with much rainfall, such as Japan, the climax is almost always a forest.

A Climax forest is composed of many different species of various sizes, where taller trees eventually die at the end of their natural life and are replaced by lower story trees.

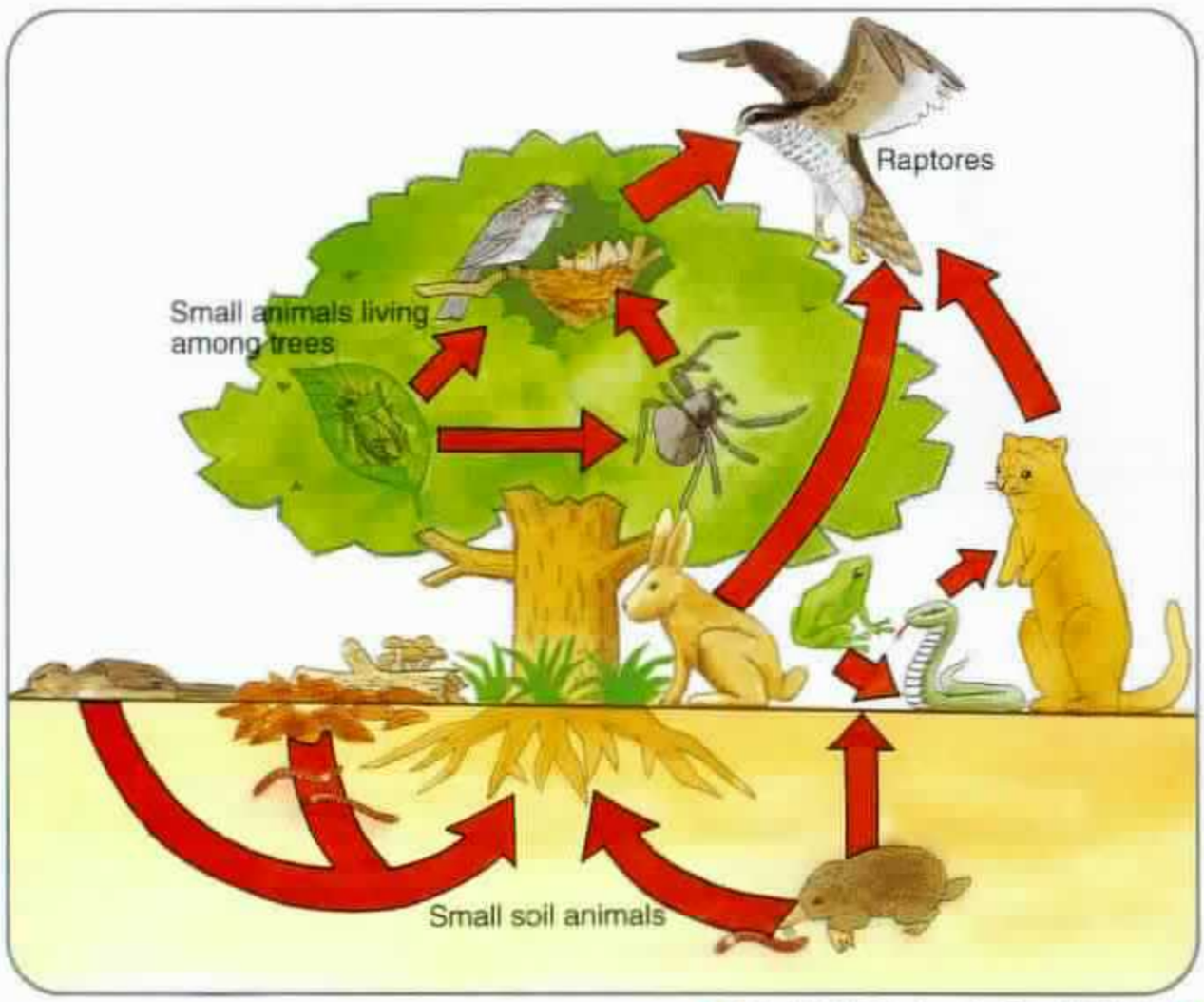


◆Plant Succession◆

(3) The Wild Animal Food Chain

A forest is a source of a variety of animal feed, such as fruit and nuts. In addition, the cavities and in the high reaches of the trees constitute relative safe nests for animals, resulting in a rich variety of fauna in dense populations.

The large variety of animals living in a forest, ranging from large mammals to minute soil organisms, interact with one another, constituting an ecosystem. Small soil animals and insects feed on plants but are prey for small birds and snakes. Meanwhile, raptores like the Inuwashi (Golden Eagle) and the Kumataka (Hodgson's Hawk Eagle) feed on small birds, snakes and hares. This hierarchical order where animals of the upper orders prey on animals of the lower orders is called "the food chain" or "the food pyramid" this is an important natural law in the understanding of an animal's ecosystem. Because of this inter-relationship between various animals, a rapid increase or decrease of a particular animal could destabilise the balance of the ecosystem.



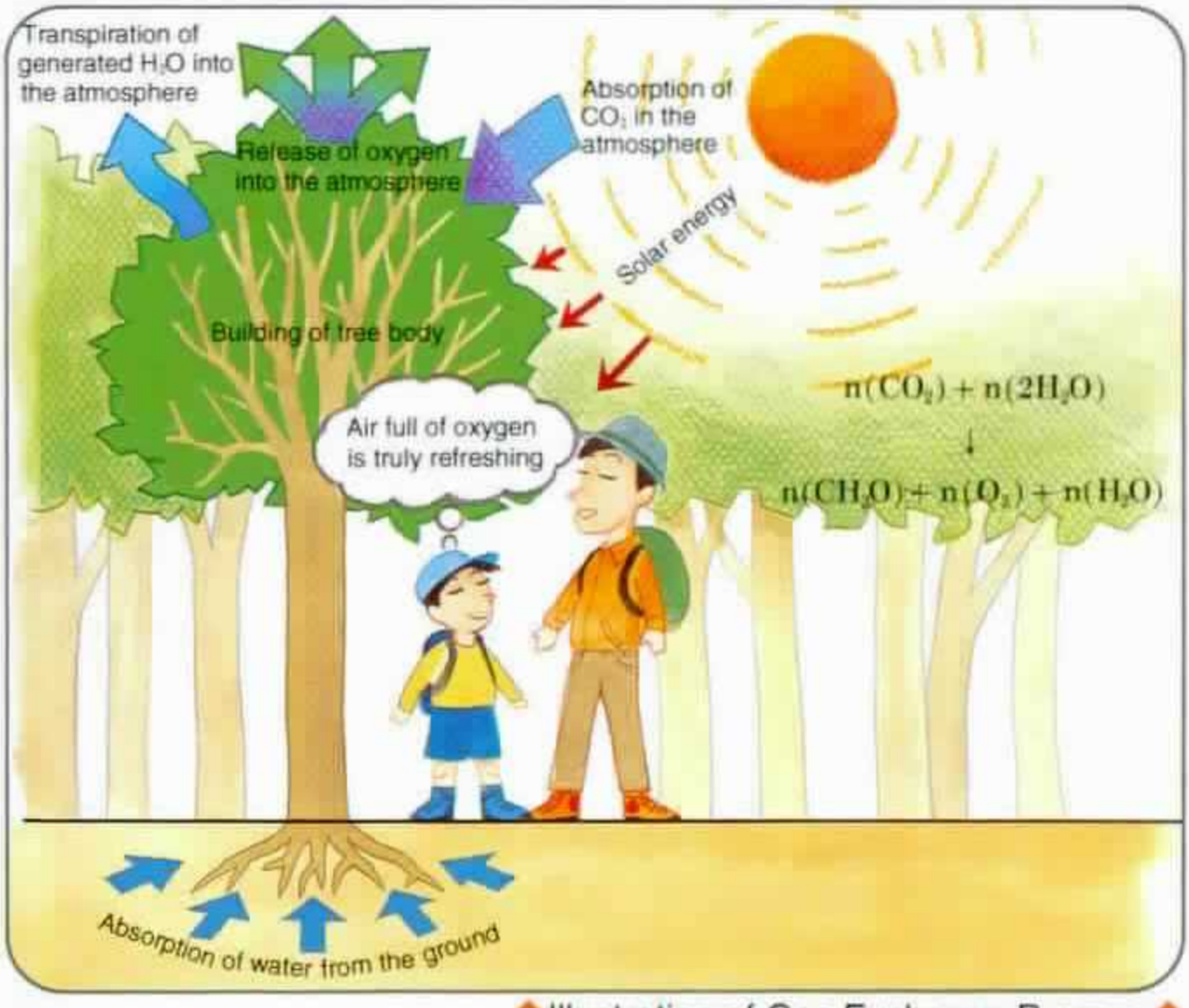
◆The Wild Animals Food Chain◆

THE WONDERS OF FORESTS

Forests have many wonders, some of which are described below.

(1) Forests as Huge Gas Exchangers

The growth of a tree occurs through photosynthesis, which is a process which fixates CO_2 from the air into the tree body in the form of carbohydrates and releases O_2. In a very mature forest, the quantity of CO_2 fixation is equal to the quantity of CO_2 returned to the air as a result of decay.



◆Illustration of Gas Exchange Process◆

Using the chemical reaction formula for photosynthesis, it has been calculated that some 1.6 kg of CO_2 is absorbed in the production of a 1 kg plant, while some 1.2 kg of O_2 is released. This translates into 1 ha of forest absorbing 15 - 30 tons of CO_2 a year, releasing 11 - 23 tons of O_2 which is enough to meet the annual O_2 demand of 40 - 80 people. If the O_2 demand of Tokyo's 23 wards were to be supported by forests, the required forest area would need to be approximately 20 times larger than the Shirakami Mountain area is at present.

The real importance of forests as gas exchangers, in fact, lies elsewhere. At present, there is strong concern that the global increase of CO_2 in the atmosphere is accelerating the processes of global warming and desertification. It is said that the continued consumption of coal and oil, which had until recently been confined in the ground, will double the CO_2 concentration in the atmosphere by the mid-21st century. As forests fix CO_2 from the atmosphere to form tree trunks and branches, the conservation of forests has important implications for not only the preservation of rich greenery, but also for biological survival and the environment on a global scale which are all sensitive to adjustments in the CO_2 concentration in the atmosphere.

(2) Colorful Autumn Tints and Defoliation

One of the most spectacular events in Japan's four seasons is the coming of the tints of autumn, ranging from many shades of red to yellow. The shortening of the sunshine hours and lowering of the temperature from summer to autumn dismantle the chlorophyll responsible for photosynthesis, weakening the activities of leaves in general. Green leaves have a large quantity of chlorophyll and a small quantity of a yellow pigment called carotinoid. In autumn, the chlorophyll disintegrates and the carotinoid alone remains to turn the leaves yellow. This situation is somewhat different in the case of leaves which turn red. This is a phenomena resulting from the fresh synthesis and accumulation of a red pigment called anthocyan following the aging of the leaves. This anthocyan is believed to be synthesized through the complex reactions of a type of amino acid which is produced by the decomposition of the protein contained in the leaves.

◆Colorful Autumn Tints◆

(3) Wood Bathing: A Source of Health

The popularity of wood bathing, which involves walking in forests to improve one's health in a pleasant forest environment, is currently increasing. When we enter a forest, we relax and our accumulated fatigue disappears to refresh the body. Several reasons can be cited to explain why wood bathing is good for one's health.

For one, there is almost total silence in forests. The innumerable leaves absorb sound, creating a tranquil environment. Tired bodies due to noisy and stressful urban lives find a place to rest in calm forests and to relax. The green of the trees also contributes to the eradication of stress as it is kind to our eyes, giving them rest.

Compared to urban air which is full of car emissions and smoke from factories, the air in forests is refreshing and clean tasting. The multitude of leaves purify the air by absorbing air pollutants, making forest air truly clean.

Forest air also contains phytoncide (a substance released by plants and animals with impacts on the lives of other living creatures) which also helps to create fresh and clean tasting forest air to improve our health.

(4) Birdsong Announcing the Arrival of Spring

In spring, the season of new greenery with plants and trees shooting out new buds, forests are filled with birdsong. Walking while listening to the songs of birds is extremely pleasant. The sounds of birds can largely be classified into calling notes and chirping. Calling notes are a peculiar sound to each species and are used by both sexes all year round to signal the approach of a dangerous enemy, to call each other together and for other purposes. Compared to chirping, calling notes are softer and may escape our ears unless we listen carefully.

In contrast, the chirping of the Bush Warbler and the Cuckoo are very familiar and differ according to the sex of the bird. The period from spring to early summer is the breeding season for birds and the lengthening daytime stimulates the secretion of a male hormone which in turn induces chirping. Compared to the female, the syrinx (i.e. vocal chords of a bird) of the male is well developed as a female hormone hinders the development of the syrinx. As a result, chirping is restricted to the male of many small birds. The basic modes of chirping are genetically determined but the details are said to be learned from the father or other males encountered during the breeding season.

< Little Cuckoo >
Male chirps "kyokkyokkyo,kyokyokyo"

< Oriental Scops Owl >
Hoots "bookyokko"

< Ruddy Kingfisher >
Chirps "kyorororo .."
in a clear voice Chirps

< Artic Warbler >
"dzeet,dzeet,dzeet,..... "

Flora Along the Observation Path in the Natural Buna Forest Near Anmon Falls

Shinanoki
(*Tilia japonica*)

Ezo-ajisai
(*Hydrangea macrophylla var. megacarpa*)

Ohkamenoki (*Viburnum furcatum*)

Mizuki (*Cornus controversa*)

Buna (*Fagus crenata*)

Tamushiba
(*Magnolia salicifolia*)

Murasaki-yashiotsutsuji
(*Rhododendron albrechtii*)

Uwamizu-zakura
(*Prunus grayana*)

Nanakamado
(*Sorbus commixtra*)

Tochinoki
(*Aesculus turbinata*)

View of Mt. Masugadake from Mt. Tengudake

Masugadake