Traditional WASABI Cultivation in Shizuoka

Shizuoka WASABI Association
for Important Agricultural Heritage Systems Promotion

Application for GIAHS Designation

Ⅰ. SUMMARY INFORMATION

Name/Title of the Agricultural Heritage System: Traditional WASABI Cultivation in Shizuoka

Requesting Agency: Shizuoka Wasabi Cultivating Region (the cities of Shizuoka, Izu, and Shimoda, and Kamo District towns of Higashiizu, Kawazu, Matsuzaki, and Nishiizu; 3 cities, 4 towns in Japan)

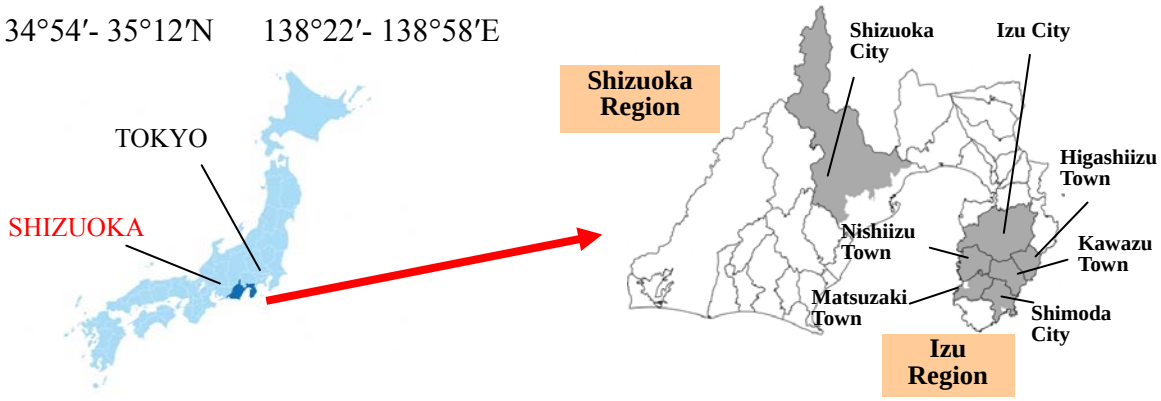
Requesting Organization: Shizuoka WASABI Association for Important Agricultural Heritage Systems Promotion

Member of Organization: Shizuoka Prefecture, Shizuoka City, Izu City, Shimoda City, Higashiizu Town, Kawazu Town, Matsuzaki Town, Nishiizu Town, Hamamatsu City, Fujinomiya City, Gotenba City, Oyama Town, Shizuoka Prefectural Economic Federation of Agricultural Cooperatives, Japan Agricultural Cooperative(JA) Izu Taiyo, JA Izunokuni, JA Shizuoka-shi, JA Shimizu, JA Gotemba, JA Fujinomiya, Shizuoka Wasabi Union Federation

Responsible Ministry: Ministry of Agriculture, Forestry and Fisheries

Location of the Site

34°54′- 35°12′N　138°22′- 138°58′E



Accessibility of the Site to Capital City or Major Cities:

To Shizuoka City from Tokyo: by rail, approximately 1 hour on bullet train; by car, approximately 2.5 hours on expressway

To Izu City from Tokyo: by rail, approximately 2 hours on bullet train and private railway; by car, approximately 3 hours on expressway

Area of Coverage: 1,978.46 km^2

Agro-Ecological Zone: Mountainous region with abundant rainfall

Topographic Features: Steep mountains, surrounded by the Pacific Ocean, heavy rainfall, and plentiful spring water

Climate Type: Temperate humid climate

Approximate Population (Beneficiaries): 118,383 (569) (wasabi producers) (2015 national census, 2016 Shizuoka Prefecture survey)

Ethnicity/Indigenous Population: Not applicable

Main Source of Livelihoods: Manufacturing, agriculture, tourism

Executive Summary:

Cultivation System Using Spring Water in Terraced Wasabi Fields

Wasabi (*Eutrema japonicum* [Sieb.] Maxim.) is a native Japanese plant of the Brassicaceae family that has been highly prized in Japan since ancient times for the sharp flavor produced when its stems are grated. Since the 19th century, it has become an essential ingredient in Japanese cuisine, used in sushi, and gained worldwide attention after "Washoku" (Japanese cuisine) was registered as a UNESCO intangible cultural heritage in 2013.

The proposed region faces the Pacific Ocean, and has steep terrain, including Mt. Amagi range, formed on the Fossa Magna rift and the Southern Japanese Alps. Overall, it receives large amount of rain and has repeatedly experienced heavy rainfall disasters. The abundant rain nourishes dense forests and yields cool spring water throughout the year. Wasabi cultivation of this region was developed in these unique conditions.

This region is the origin of worldwide wasabi cultivation, and is believed to have begun approximately 400 years ago, during the Keicho era (1596-1615), in the village of Utogi in the Aoi district of Shizuoka City. Afterwards, cultivation spread to the Izu Peninsula, and its unique development occurred in the proposed region.

Traditional cultivation method which utilizing spring water produces high quality wasabi. This cultivation method results in the production of large stems, little crop damage from disease, and little danger of nutrient depletion from repeated cultivation that is so often seen in agriculture; as such, it is a cultivation system with an extremely high degree of suitability for wasabi production. Furthermore, wasabi fields in steep mountainous areas currently possess a structure that is resilient to natural disasters because these fields have high water-holding capacity, and they also function to protect downstream areas from flooding disasters.

There exceedingly few examples of this type of area in the world, where wasabi cultivation is conducted in a systematized way using abundant spring water. It is important to consider the preservation of these mountainous districts and the development of similar mountainous regions around the world.

Sustainable Wasabi Cultivation in Harmony with Natural Ecosystems

Many diverse organisms inhabit wasabi fields, where the water flows gently, and birds and fish that eat them also inhabit the area. These fields not only preserve nature itself, but are the foundation of a rich ecosystem.

Furthermore, wasabi fields that optimize their use of nature are primarily run on manual labor, and because fertilizers and agricultural chemicals are used as little as possible, they are not a burden on the environment. The swamp and forest environments around the wasabi fields are preserved, contributing to the conservation of biodiversity.

Moreover, this type of sustainable wasabi cultivation creates beautiful village-vicinity mountainous scenery that is representative of Japan and is expected to be utilized for environmental education and as tourist attractions.

Wasabi Industry that Supports Life in Mountainous Districts

Wasabi grown in mountainous districts is greatly affected by changes in atmospheric temperature, sunlight, and the weather, as well as by water quality and the surrounding environment. Accordingly, producers develop cultivars and strains that are suited to each wasabi field. In this way, high-quality wasabi production is made possible through the persistent efforts and technological innovation of producers, and it is a valuable industry for

mountainous areas.

Furthermore, processed wasabi goods have not only been a source of additional income for farmers since ancient times, but they have also led to the establishment of many industries affiliated with wasabi processing in the surrounding area, creating workplaces for local residents.

In the proposed region, local people have a deep faith in the water, and there are many shrines related to water there. Wasabi is used as an offering at harvest festivals, and wasabi is deeply rooted in the resident's lifestyle and culture.

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Ⅱ. DESCRIPTION OF THE AGRICULTURAL HERITAGE SYSTEM

1. Significance of the Proposed GIAHS Site

a. System Overview

The proposed region receives over 3,000 mm of rainfall annually, particularly in the mountains, which percolates underground, and is stored therein. This results in the formation of numerous springs, and wasabi cultivation has expanded by using these headsprings and narrow terrain alongside of mountain streams.

Spring water is rich in nutrients and dissolved oxygen, and as it flows over the wasabi fields, it percolates into the fields, thereby, filtering out impurities; then, it is reused in the lower-level wasabi fields. Furthermore, this water is used for downstream rice cultivation, and farming of freshwater fish (red-spotted masu trout (*Oncorhynchus masou ishikawae*), and so on) that prefer clear streams. The water supports fish that eventually flow into rivers, creating a circulation that drains into the Pacific Ocean (Fig. 1). Furthermore, the wasabi fields decelerate the flow of water, and become breeding grounds for a variety of organisms. Along with the surrounding forests that replenish river sources, the wasabi fields form the foundation of a rich ecosystem.

In the mountainous district of the proposed region, people cultivate a farm adapted to the environment. In addition to wasabi, shiitake mushrooms are cultivated under shade of the forests, and tea and wetland rice are cultivated in the sunny place out of the forests. In this way, people have used the narrow and inclined land effectively and constructed resilient infrastructure for a long time. Then they have been able to secure various income source and stable income. Establishment of such land use has enable people to settle in these mountainous districts, where had suffered from repeated floods and in where other industries had been hard to develop. The sustainable production in this region using natural topography and energy has created beautiful landscapes over the course of time.

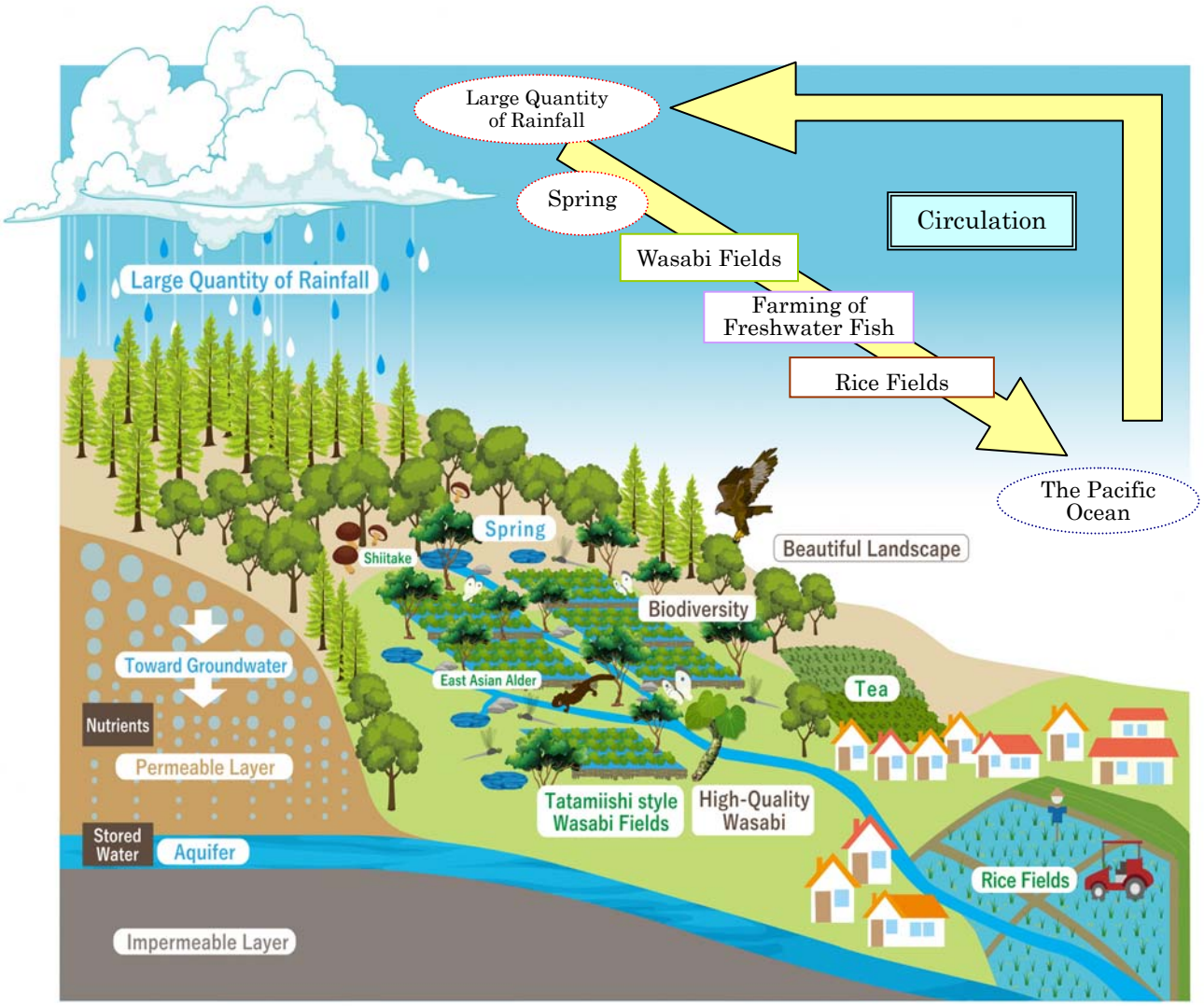


Fig. 1　Wasabi Cultivation System

b. Overview of Traditional Wasabi Cultivation Regions

Wasabi (*Eutrema japonicum* [Sieb.] Maxim.) is a native Japanese plant in the Brassicaceae family whose stem is grated to produce a sharp tasting product that is used as a condiment mainly for sushi and sashimi (Photo 1,Fig 2).

Furthermore, the leaves, petioles, and floral axis have a similar pungent taste, and are used to prepare pickles, tempura, and other dishes.

Photo 1　Wasabi

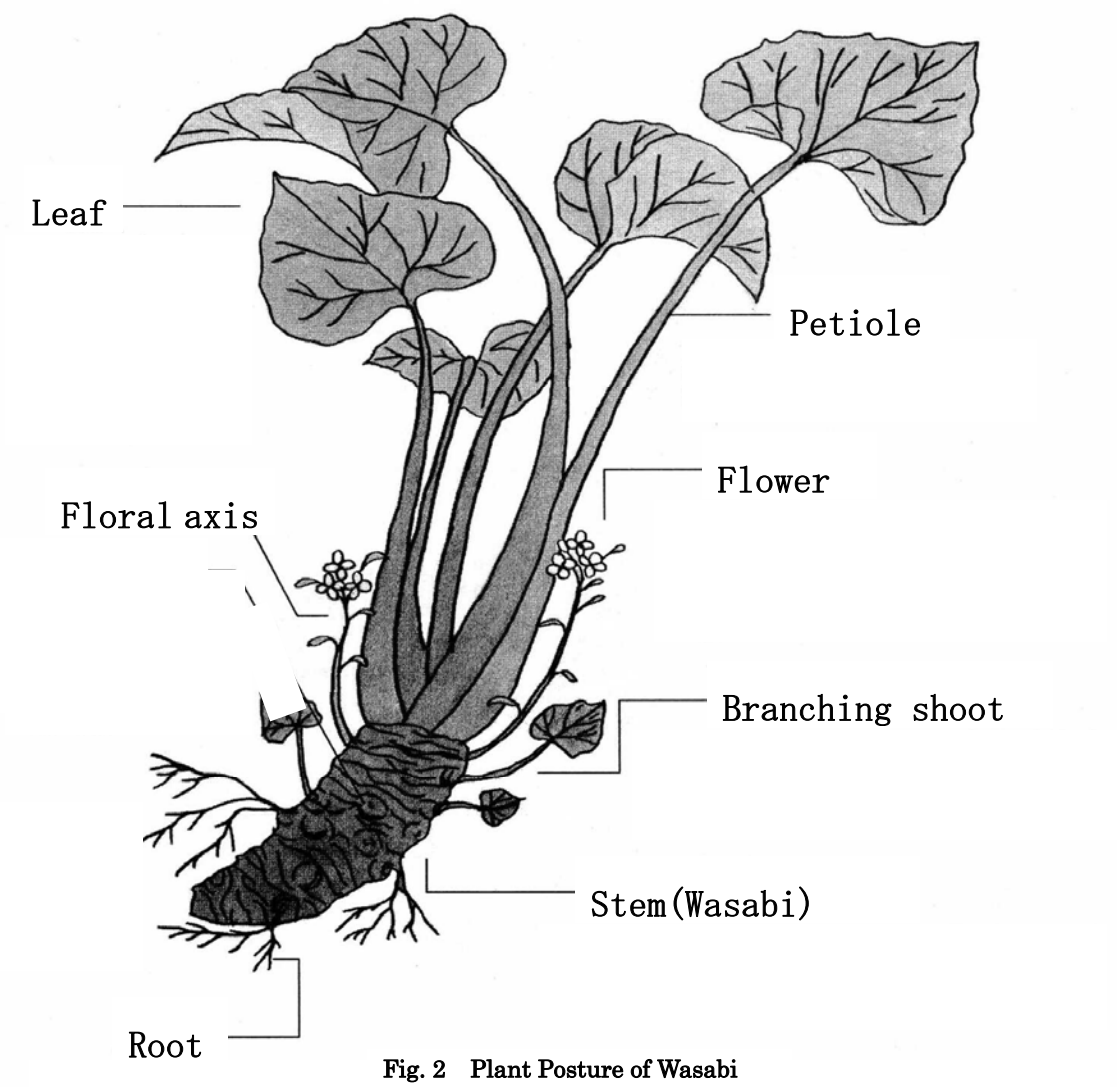


Fig. 2　Plant Posture of Wasabi

Traditional wasabi cultivation in this region is spread throughout mountainous districts in the Shizuoka region in the Japanese Southern Alps range (Shizuoka City, Shizuoka Prefecture), and the Izu region in the Mt. Amagi range (Izu City, Shimoda City, Higashiizu Town, Kawazu Town, Matuzaki Town, Nishiizu Town, all in Shizuoka Prefecture).

This region is the origin of wasabi cultivation worldwide, which was considered to have begun in the Utogi district of the Shizuoka region 400 years ago, during the Keicho era (1596-1615); after which it spread to the Izu region. Around 1892, when the "Tatamiishi style" of cultivation was developed in Izu City, that method spread throughout the Izu region and was also adopted in the Shizuoka region (Fig. 3).

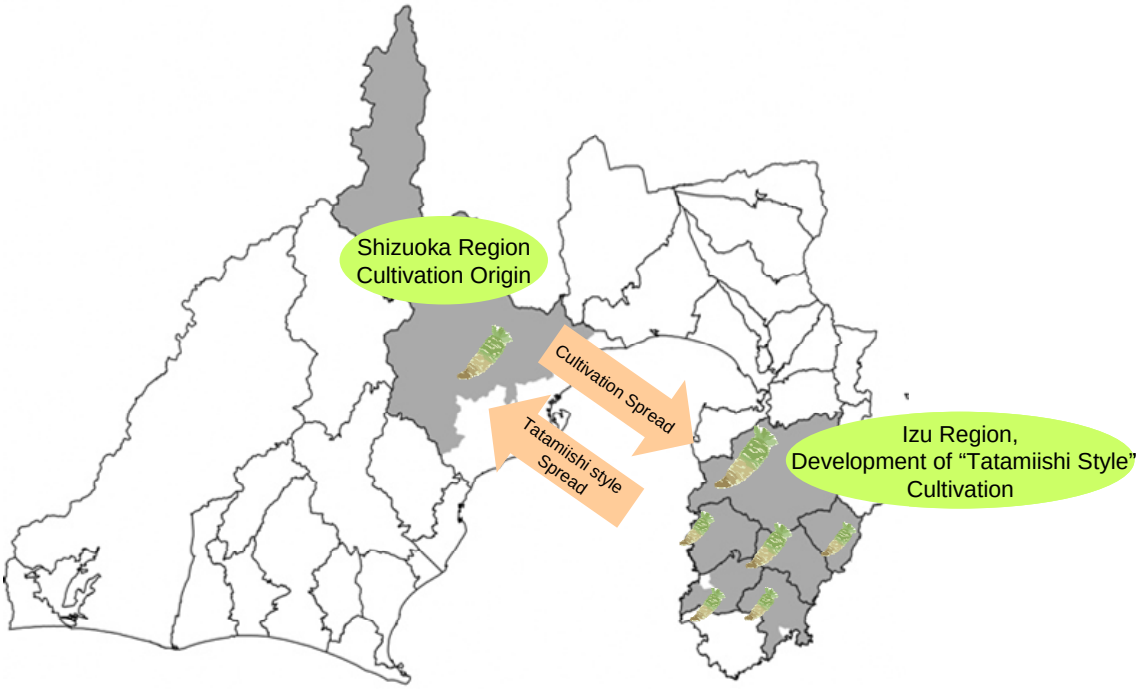


Fig. 3 Connections between the Shizuoka Region and the Izu Region

Presently, wasabi is cultivated in each part of the Shizuoka Prefecture; however, the regions which utilize traditional cultivation methods have an area of 113.8 ha, and the quantity produced (stem) is 227.5 t; both account for over 90% of the total share in the prefecture, making these the primary cultivation regions (Table 1).

Table 1　Summary of Proposed Region

Region Name	Population	Wasabi Producers (Households)	Cultivation Area	Production Quantity (stem)
Shizuoka Region	29,152	155	19.1 ha	27.6 t
Izu Region	89,231	414	94.7 ha	199.9 t
Total	118,383	569	113.8 ha	227.5 t
Percentage of Prefectural Total	—	95.0%	94.3%	95.6%

Population: 2015 National Census.
Number of Producers, Area: 2016 Shizuoka Prefecture Survey

c. Geographic Situation

The Shizuoka and Izu regions are located on top of the Fossa Magna (a great rift valley), where mountains formed by upheavals and volcanic eruptions are battered by the wet climate brought in by the Pacific Ocean's Kuroshio Current; the ascending air current brings over 3,000 mm of rainfall every year. In the mountainous terrain, rainwater easily permeates underground because of rifts and lapilli, and this unique region also has an excellent structure for water storage (Fig. 4, 5).

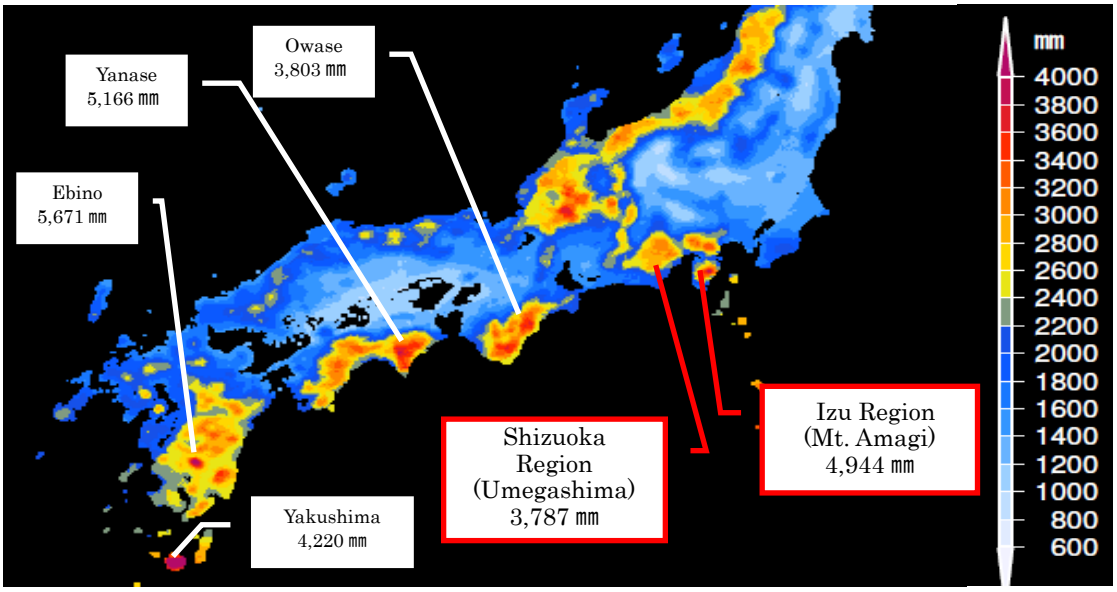


Fig. 4　Top Regions for Yearly Rainfall in Japan (2010 Japanese Meteorological Agency)

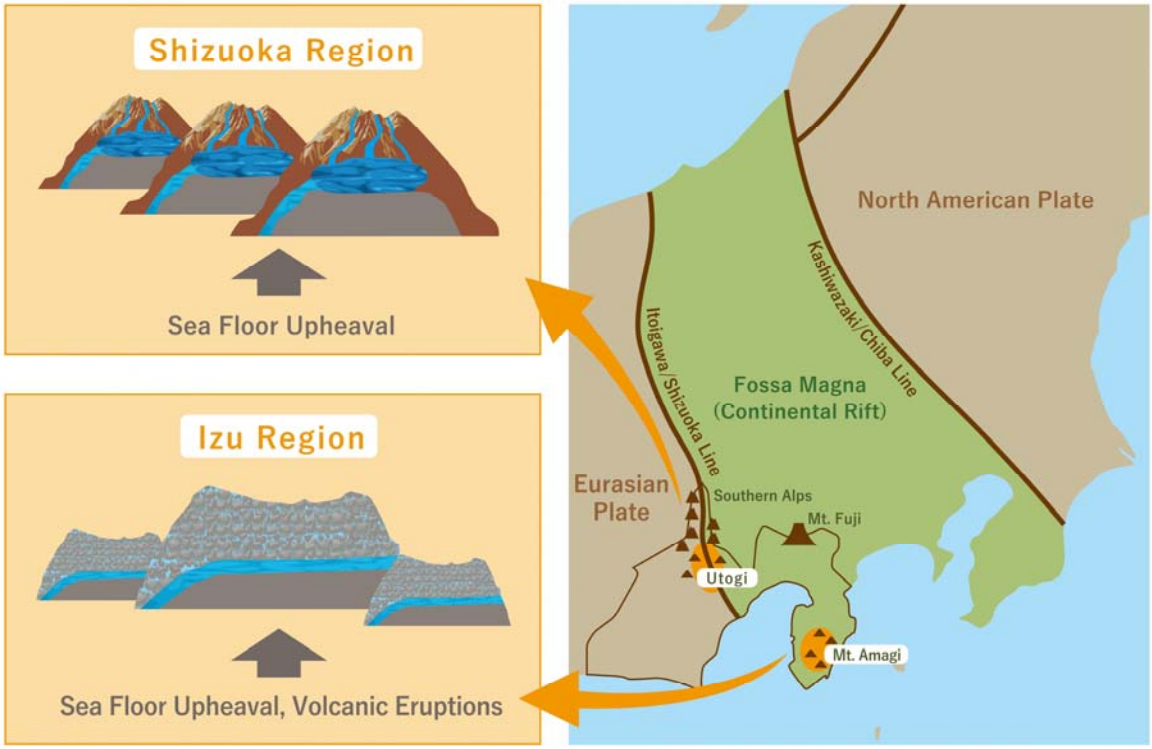


Fig. 5　Geological Formation and Groundwater Mechanisms

As a result, the mountains located upstream from the wasabi fields are covered in dense forests. The soil and geology of forests around wasabi fields store a large amount of rainwater, and have the function of adjusting the amount of water released to the fields. By filtering the water, these forests create clean spring water. It also maintains a constant water temperature.

The function of these forests is to protect the wasabi fields and the whole region from disasters such as floods, and stably provide spring water that is essential to wasabi cultivation, and agricultural and domestic water for regions downstream, throughout the year. Forests around the wasabi fields in fact have the adjustment function of a natural dam.

The wasabi fields are connected to and preserved by the sources of spring water and alongside mountain streams that frequently occur in this type of terrain.

d. Natural Features and Land Use Features

<Shizuoka Region>

In the mountainous parts of the Shizuoka region, mountains exist that rose up because of tectonic movements typical of the Itoigawa-Shizuoka Tectonic Line, which is located on the western edge of the Fossa Magna: Mt. Jumai (1,717 m), Mt. Bukkoku (1,503 m), Mt. Mafuji (1,343 m), and Mt. Nanatsumine (1,533 m). These mountains have many fissures on the surface because of tectonic movement, and the

dolerite bedrock serves as a water storage layer, possessing a structure that allows it to hold large volumes of rainwater.

For this reason, the mountains have numerous sources of spring water, and their formation is such that eventually many mountain streams feed into the Abe River and other rivers, and wasabi fields spread out near these sources of spring water or alongside mountain streams.

The surrounding mountains are covered in forests of coniferous trees, mainly Japanese cedar and Japanese cypress. Tea is grown on farmland with access to direct sunlight, forming a production region for typical Japanese tea, such as the distinctively aromatic “Honyama Tea” (Photo 2, 3).

Photo 2 Utogi District, Model of the Shizuoka Region

Photo 3 Wasabi Fields Extending at a Sharp Incline

<Izu Region>

The Izu region wasabi cultivation area is located in the center of the Izu Peninsula, and extends along mountain streams that flow from the Mt. Amagi range, whose peak is 1406 m above sea level, at Mt.Banzaburodake. The abundant and stable supply of spring water is not only from the plentiful rainfall, but also comes from the unique geological terrain.

When Kawagodaira in the Amagi range erupted approximately 2800 years ago, pumice flow (pyroclastic flow) accumulated on top of andesite, and dacite lava also accumulated. This sediment is very gaseous and has a high water-retaining capacity. In addition to making it easy for water to permeate underground, it also created stable spring water sources. It is also suitable as surface soil for wasabi cultivation and is the single most important factor for wasabi fields accumulating in this area (Photo 4).

Photo 4　Wasabi Fields of the Jizodo District
Which Formed Through Volcanic Eruptions

Because the surrounding mountains are covered with blended forests of evergreen coniferous trees, such as Japanese cedar and Japanese cypress, as well as deciduous broad-leafed trees, such as Japanese beech and tall stewartia, in addition to wasabi, this area has produced a substantial amount of shiitake mushrooms, which have been cultivated on logs since the 18th century.

e. Features of Traditional Wasabi Cultivation

There are two methods of traditional wasabi cultivation in the proposed region: "Jizawa style," which is the world's first wasabi cultivation method, and "Tatamiishi style," which utilizes large volumes of spring water.

Currently, in Japan, apart from the "Jizawa style" and "Tatamiishi style," there is the "Hokusun style" (an improved version of the "Tatamiishi style"), as well as cultivation methods called "Keiryu style" and "Hirachi style."

The"Keiryu style" and "Hirachi style" are systems developed for regions with low rainfall. In the "Keiryu style," plant growth is greatly affected by the volume of water; flat plots of land and large volumes of ground water are required for the "Hirachi style," and the resulting stems are not as large.

The "Jizawa style" of cultivation was established in the proposed region, and has

been used since the beginning of wasabi cultivation. It is the oldest cultivation method, and involves the spreading of pebbles and sand in the wasabi fields with an inclination of 3-4%, on extremely steep terrain. Currently, most of them are replaced by the more profitable "Tatamiishi style;" however, because these types of fields can be established on steep terrain with large fluctuations in water supply, a few "Jizawa style" fields remain in regions unsuitable for "Tatamiishi style" cultivation.

In the "Tatamiishi style," which was developed in the latter half of the 19th century, fields are established with larger rocks in the bottom layer and rocks with gradually reducing sizes in the upper layers. Enormous quantities of spring water flow over these wasabi fields, not only crossing the surface, but also percolating into the soil. Thus, impurities are filtered out, water temperature is stabilized, and nutrients and oxygen are supplied, thereby, enabling stable production (Fig. 6).

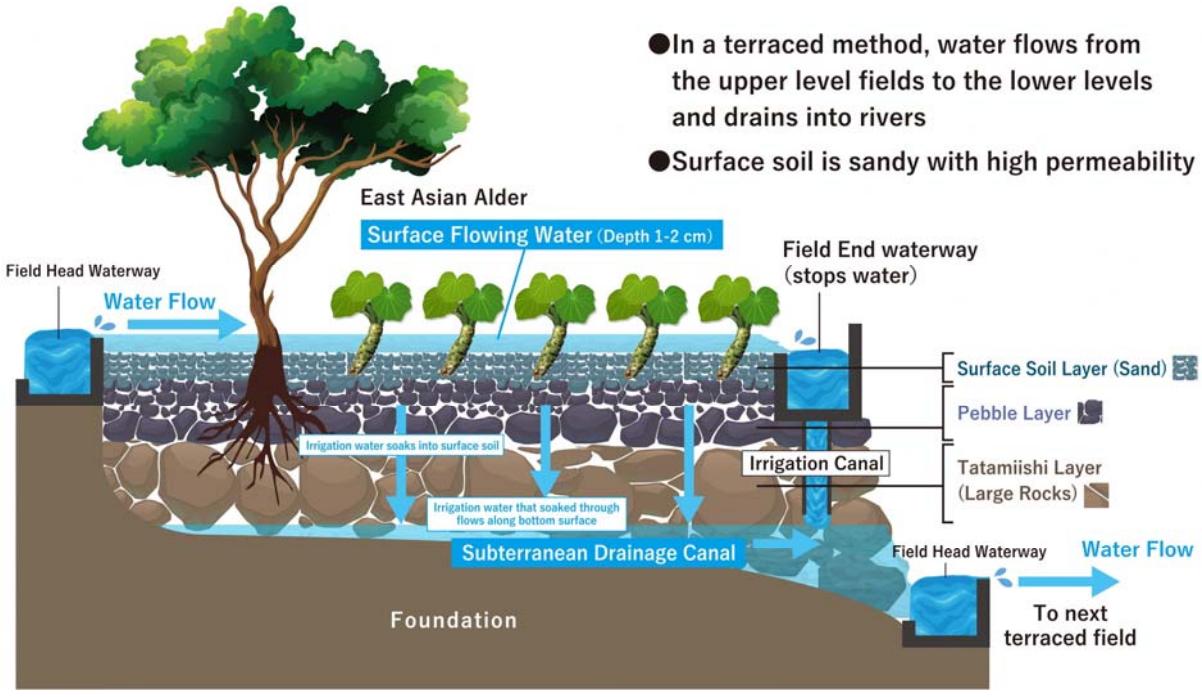


Fig. 6 "Tatamiishi Style" Wasabi Field Mechanism

"Tatamiishi style" wasabi fields are supplied year-round with cool and oxygen-rich water that is important for superior growth of wasabi. As a result, the stems avoid illnesses, such as soft rot, and the cultivation of high-quality wasabi with exceedingly large stems can occur. Therefore, even today, this style is still a mainstream method in the Izu and Shizuoka regions as the ideal cultivation method for producing high-quality stems. Furthermore, it has spread within and outside the prefecture, and

along with the “Jizawa style,” it is globally important for its contributions to the spread of wasabi stem cultivation.

Wasabi fields in steep mountainous areas were often faced with natural disasters. However, the current “Tatamiishi style” and “Jizawa style” wasabi fields store a great deal of water and also slow down the flow of water, curbing river flooding because of large rainfall events. Furthermore, repair work from past natural disasters has reinforced the waterways and strengthened the dikes of rivers that flow through the area. Wasabi fields and the surrounding areas have achieved a construction that is resistant to natural disasters and act to protect the downstream areas from natural disasters as well.

In this way, the wasabi fields of the proposed area play a large role in creating mountainous districts that are disaster-resistant, even in these days in which severe rainfall is frequent because of climate change caused by global warming.

Furthermore, because wasabi is vulnerable to direct sunlight in summer, in open spaces, East Asian Alder (*Alnus hirsuta)* trees are planted in and around the wasabi fields, thus, providing shade. When this approach is rendered difficult by local geological features or water quality, shade cloth is used as a substitute.

In addition to the planting of seedlings and harvest, the daily activity in the wasabi fields involves the removal of fallen leaves accumulated in waterways to ensure uninterrupted flow of water, which is the most important factor for wasabi growth, and survey of the wasabi fields. Since it is difficult to bring machinery to the wasabi fields in mountainous districts, work is carried out mainly through human effort by producers who are aware of the conditions of each wasabi field.

For wasabi cultivation, not only the above-mentioned methods utilizing water and stones from marshes, but also a method of cultivating wasabi in the soil is adopted. This cultivation method simulates natural habitats for cultivating wasabi in forested areas where strong sunlight is blocked out, and this method has been used throughout Japan since the mid-19th century in regions such as the Iwate and Shimane prefectures. However, because the stems do not grow as large as those grown using the methods of wasabi cultivation under swampy conditions, the primary goal is to harvest the leaves and petioles. This is different from the cultivation system of this application, which involves wasabi cultivation in water, primarily for the stems.

f. Contributions to Biodiversity

Wasabi is an endemic species of the Japanese islands that evolved uniquely, and throughout the long course of history, its producers created and cultivated a great number of cultivars and strains that each have their own characteristics suited to the

environment in each region of cultivation.

However, because water flows slowly through wasabi fields, even though they are located near headwaters where the water flow is relatively fast, a unique environment dominated by species that prefer slow streams was formed, contributing to a rise in biodiversity.

Furthermore, the water temperature in wasabi fields is stable at 13°C throughout the year, and the water level is shallow, maintaining conditions with abundant dissolved oxygen. For this reason, the fields are inhabited by numerous aquatic life that prefer clear streams. Among these, although some are harmful insects that damage the wasabi stems, useful dragonflies that prey on the pests that also dwell here, reducing the concentration of harmful insects (Photo 5).

Photo 5 Siebold's Dragonfly Inhabiting the Wasabi Field

Insects that emerge from wasabi fields and those like butterflies that damage wasabi leaves, become prey for frogs and spiders that inhabit the surrounding forests, as well as snakes and birds. In this way, the wasabi fields become the foundation of the food chain in the mountain stream areas.

Wasabi cultivation rarely uses fertilizer or agricultural chemicals and puts a low burden on the environment, which allows it to further contribute to the preservation of biodiversity in the fields and the surrounding area.

In this way, wasabi cultivation in the proposed region has produced a diversity of wasabi cultivars over the course of history. It is also a farming method that is in harmony with forest ecosystems, contributes to biodiversity, and in the future, this will be important when considering global agriculture.

g. Excellent Landscape

The wasabi fields of the proposed area, through the development of a unique cultivation system, have terraces that use the natural sloping terrain, and materials such as large and small stones, pebbles, and sand found in the area. After experiencing many natural disasters, these fields have come to have a structure that is stable and resistant to disasters. Because of this, wasabi fields in this region are surrounded by forests and packed into marshes that run alongside narrow valleys, showing different faces with each change of the seasons, and creating a beautiful landscape (Photo 6).

Photo 6　Wasabi Fields and Autumn Foliage

In some parts of the Izu region, a type of East Asian Alder is planted in wasabi fields to provide shade. Along with characterizing traditional wasabi cultivation, these trees are an important element for maintaining the excellent landscape (Photo 7).

Photo 7　East Asian Alder Trees and Wasabi Fields

Another aspect of wasabi cultivation that is noteworthy is that in forested, sloping land where it is difficult to cultivate grains and vegetables, through distinctive engineering that maximizes spring water, wasabi is meticulously produced over many years. It is akin to creating a work of art primarily using human effort, which then

creates the beautiful landscape of the villages within the mountainous areas.

h. Social Organizations Supporting Cultivation

The wasabi fields in the Shizuoka region were privately owned from the start, but those in the Izu region belonged to the Shogunate* in the Edo period (1603-1868). To cultivate wasabi on this land, producers had to borrow the land jointly (commons), which became the driving force that created unique production organizations.

From the necessity of having to apply to village officials to rent land, organizations that local influential people called "wasabi circles" formed in each settlement and these grew into central organizations for promoting wasabi production.

The wasabi fields that these "wasabi circles" jointly managed were called "Gozawa." Within the group, a basic system was adopted of one vote per house, and various agreements and usage forms existed for the fair utilization of wasabi fields. By jointly managing the fields, these groups mutually monitored access to environmental resources and also took on the role of preserving the surrounding environment.

With the arrival of the Meiji period (1868-1912), existing organizations were reconstructed as producers' associations, which spread to all areas. In particular, they worked to return the control of wasabi fields from the government to civilians from 1889 to 1890, and they were a great driving force that positioned wasabi fields as farmland.

In 1925, the Shizuoka Prefecture Wasabi Association was formed, which would later be succeeded by the Shizuoka Wasabi Union Federation. This led to the innovation of stronger producer organizations and drove the wasabi industry in Japan by contributing to the launch of the National Wasabi Producers' Association, founded in 1967.

i. Historical Importance

Wasabi, which originated in Japan, grows naturally in the mountainous districts all throughout the country. Mt. Bukkoku in the Utogi district of the Shizuoka region is additionally known as the "Wasabi Mountain," and wild wasabi can be observed on its forest floors. The planting of this wild wasabi near a spring-water source in Utogi called "Idogashira" approximately 400 years ago is considered to be the beginning of wasabi cultivation in the world (Photo 8).

Photo 8 Wasabi Cultivation Origin Monument

* The last feudal Japanese military government

At the beginning of wasabi cultivation, the “Jizawa style” was used. Cultivation was possible in the regions where the plowed soil was shallow, and securing rocks was difficult; this style became established in the area, and in the mid-18th century, it spread with the propagation of wasabi cultivation to the Izu Peninsula.

In the latter half of the 19th century, engineers in the Izu region developed “Tatamiishi style” wasabi fields that could fully utilize the abundant water supply. Later, this method spread to other parts of the Izu and Shizuoka regions, as well as other parts of Japan.

Thus, the proposed region is the cradle of wasabi cultivation in the world. Moreover, it is a historically important region, wherein the current mainstream cultivation system was developed, and traditional wasabi cultivation has been bequeathed by the local people for over 400 years.

j. Global and Modern Significance

<Conservation of Sustainable Wasabi Cultivation Systems>

For agriculture in mountainous areas, arable land is typically limited and mechanization is difficult. It is also easily affected by natural disasters. As such, there are few agricultural products that can be stably produced year-round.

The wasabi fields of the proposed area maximize the use of spring water and use only natural energy. Because water flows naturally from the upstream wasabi fields to those that are downstream, there is no environmental burden from elements such as carbon dioxide emissions. Furthermore, through the use of cultivars and strains that producers have created over many years, an agricultural system has been established that is high-quality, stable, and sustainable throughout the year.

However, suitable land for wasabi fields is extremely limited, and it is difficult to create new fields. Because the population of producers is aging, the cultivation area decreases yearly. Furthermore, there are fears that the forest vegetation that nourishes the abundant water will change because of climate fluctuations and increased wildlife.

Therefore, according to government officials and people involved in the wasabi industry, in the future, it will be essential to plan for the conservation and effective utilization of existing wasabi fields and the areas around them.

<Use of Superb Landscape>

In recent years, there has been a rapid increase in foreign visitors to Japan. Their destinations center on Tokyo, Kyoto, and other urban areas, but it is said that their needs will eventually shift from the cities to the provinces, toward Japanese food culture and traditional culture.

The sight of wasabi fields and Japan’s natural scenery that changes with each of the four seasons is one of the best landscapes in Japan’s mountainous areas. It is essential

to use this landscape and the surrounding areas as sites for agritourism.

<Diverse Participants in Wasabi Cultivation>

Wasabi fields are maintained and preserved through the agricultural activities of farmers, but the human-powered work that takes place primarily in water is labor intensive, and management is getting increasingly difficult. This is a fact of wasabi production sites that is not widely known.

To promote an appreciation for wasabi cultivation among ordinary citizens, it is necessary to promote wasabi planting and harvesting lessons targeting local children and students, as well as research surveys of the biodiversity of wasabi fields. Going forward, it will also be necessary to have more diverse constituents involved in wasabi cultivation, through guided tours of wasabi fields and other activities, to create opportunities for conservation activities.

<Preservation and Revitalization of Mountainous Areas>

In Japan, the population is decreasing simultaneously with a striking concentration of people in the Tokyo area. In mountainous areas, where there are marked population decreases, the decline in settlement and the appearance of marginal settlements are becoming major social issues.

The proposed region is also confronting the same types of issues, and it is essential to preserve the foundations of agriculture and support environmental conservation by weeding the waterways and repairing drainage channels.

Furthermore, in the future, it will be important for not only wasabi producers, but also industry leaders and government officials to come together to leverage the diverse charms of the wasabi fields as a resource, and to further promote the revitalization of mountainous districts with little industry.

Furthermore, regions where wasabi is cultivated are rich in agriculture, forestry, and fisheries, and boast beautiful scenery and natural resources such as hot springs. GIAHS designation must be used as an opportunity to combine wasabi and the attractive latent possibilities of the region into new business ideas, helping to create jobs and discourage young people from leaving the region.

<Contributions to World Food Culture>

"Washoku" or Japanese cuisine was registered by UNESCO as an intangible cultural heritage in 2013, and interest in Japanese cuisine is rising around the world. Wasabi, as an essential ingredient in Japanese cuisine, is seeing its cultivation scenery made by producers being introduced. Chefs are spreading

Photo 9 "White Fish and Wasabi Risotto" Distributed at the Milan Expo

information about cooking methods in Japan and abroad, and wasabi is contributing to the global expansion of Japanese food culture.

At the Milan Expo held in Italy in 2015, Italian food made using wasabi was provided and gained popularity. In the future, wasabi can be expected to contribute not only to Japanese cuisine, but also to food culture around the world (Photo 9).

<Use of Food Products with Functional Components>

The pungent component of wasabi, isothiocyanate, has been reported as showing effectiveness in suppressing the proliferation of bacteria that causes food poisoning (Masda and Kinae, 2010). In terms of other functions, it also has such effects as anti-cancer effects, prevention of blood clots, strengthening of bones, and antifungal properties, and is starting to be used in fields and industries such as food products and medicine. Furthermore, it is being used for purposes and products not seen in other food product materials, such as anti-mite medicines, deodorizers, and antibacterial agents. Wasabi is expected to have uses in many industries and fields (Table 2).

Table 2 Unique Purposes and Uses of Isothiocyanate (Wasabi Mustard Oil)

Usage	Purpose of Wasabi Mustard Oil
Antibacterial sheets and films	Antibacterial and antifungal properties for food products
Antibacterial, antifungal, freshness preservation (for stationary use)	Antibacterial and antifungal agents for preservation of freshness of food products in display cases, breads displayed on shelves, deli corners, etc.
Antibacterial, antifungal agent (for spraying)	Antibacterial and antifungal agents for indoor use, such as kitchens
Deodorizer, antibacterial (spray type)	Deodorizer and antibacterial agent for shoes, clothing, sporting goods, and car interiors
Deodorizer, antibacterial (stationary type)	Deodorizer, and antibacterial and antifungal agents for refrigerators and car interiors
Antifungal agent (washing machine interiors)	Antifungal for washing machine interiors
Detergent, soap	Dishwashers, soap
Anti-periodontal disease agent, oral care agent	Periodontal disease prevention, intraoral antibacterial
Anti-mite agent for pets, antibacterial, deodorizers	Removal of mites and fleas (repellent effect), deodorizer
Garbage bags	Antifungal effects
Ship bottoms, concrete	Anti-adhesive for shellfish and other marine life
Ink	Antibacterial effects
Cosmetics, external medicine for skin, toiletry agents	Prevention of skin sagginess and wrinkles, suppression of pigmentation, anti-UV ray effects, prevention of graying hair
Antiseptic solution (for rice plants)	Suppression of outbreaks of infectious disease and damage to rice seeds

Source: Masuda and Kinae (2010)

2. Characteristics of the Proposed GIAHS Site

(1) Food and Livelihood Security

a. Japan's Top Wasabi Producing Region

Wasabi production in the proposed area has a cultivation area of 113.8 ha, a production quantity (stems) of 227.5 t (2016), and production value of 3.15 billion yen (2015 estimated value). Both the cultivation area and production quantity (stems) are the highest in the country, accounting for 40% of the nationwide production; this forms Japan's largest wasabi-producing region (Fig. 7, 8).

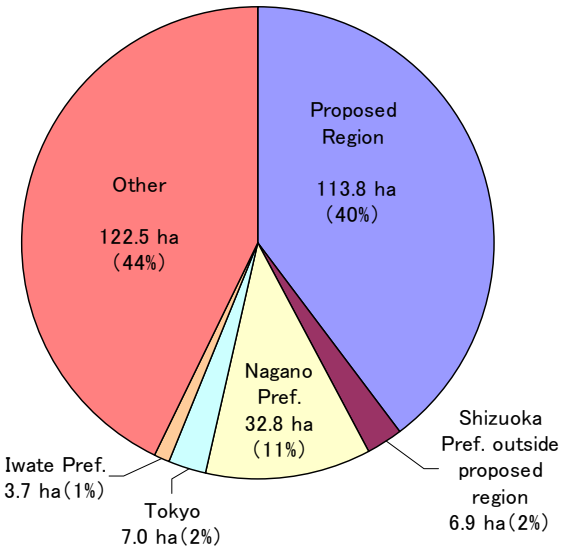


Fig. 7 Cultivation Area (2016 Forestry Agency, Shizuoka Prefecture)

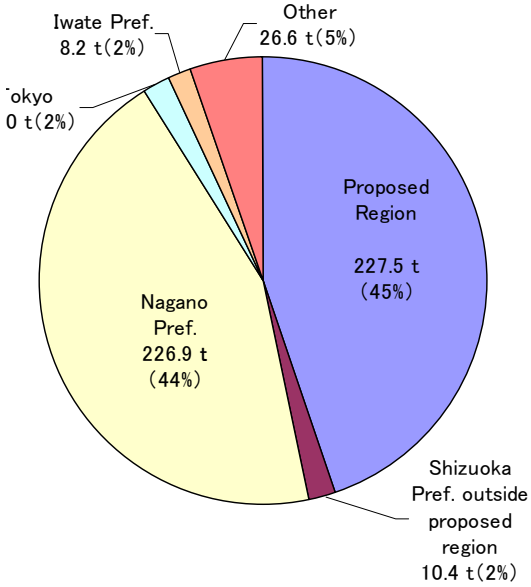


Fig.8 Production Quantity (stems) (2016 Forestry Agency, Shizuoka Prefecture)

However, in recent years, with an aging population of producers and increased damage from wildlife, such as deer, the cultivation area and production quantity are declining, and conservation of wasabi fields is becoming essential for preserving the livelihood of people in mountainous areas (Fig. 9).

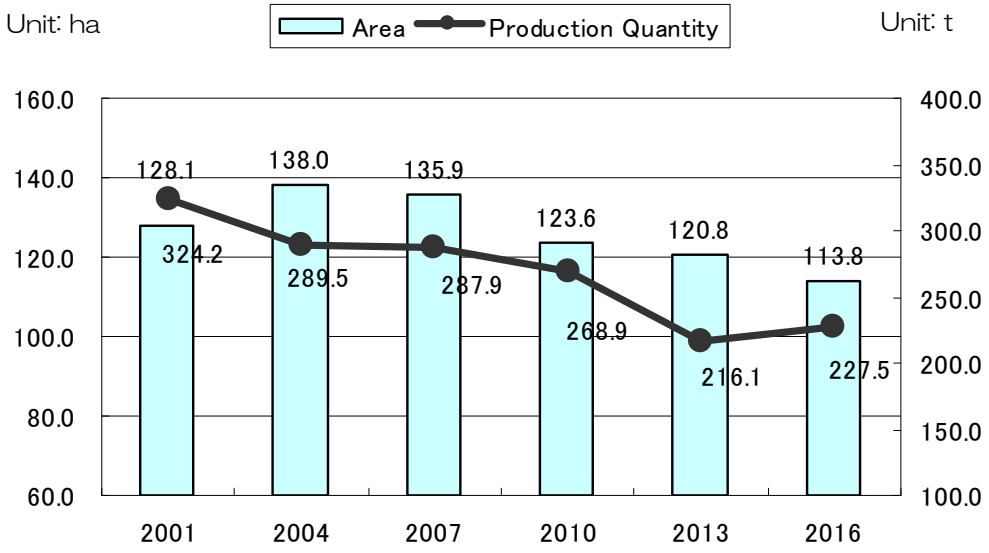


Fig. 9 Changes in Wasabi Cultivation Area and Production Quantity for the Proposed Region

Furthermore, in Izu City and Kawazu Town, there is a high proportion of wasabi producers who serve as the main providers in the production area. Wasabi producers are important providers in the other mountainous regions in the proposed region as well (Table 3).

Table 3 Total Number of Farming Households and Main Providers in the Primary Producing Regions

	Total Farming Households (Households)	Wasabi Producers (%)	Main Providers (Individuals)	Wasabi Producers (%)
Shizuoka City	6,906	160 (2.3%)	615	33 (5.4%)
Izu City	1,960	335 (17.1%)	73	35 (47.9%)
Kawazu Town	415	47 (11.3%)	62	12 (19.4%)

Number of Farming Households (2015 Farming and Forestry Census),
Number of Central Providers (as of September 2016, Shizuoka Prefectural survey)

In Japan, the population continues to concentrate in cities, causing depopulation of rural areas, and many residents of the proposed region have been moving away.

In addition, though wasabi yields a higher income than other crops produced in the region, many wasabi fields are small-scale endeavors by part-time farmers.

Because wasabi cultivation is difficult to mechanize, and new sites suitable for wasabi fields are difficult to find, producers have a strong sense of ownership toward their wasabi fields. This creates difficulty with expanding the scale of cultivation or attracting new farmers into the business, meaning that the number of

producers is decreasing (lack of leading farmers). Therefore, it is vital to create an environment in which young producers, including new participants, feel the attractiveness of the business and can easily expand the scale of their operations.

b. Wasabi Industry Contributing to Local Revitalization

The average wasabi production area for one producer in the proposed region is 0.2ha, but the revenue for 0.1ha is roughly 3 million yen, and the earnings roughly 1.6 million yen. This is extremely intensive compared with other agricultural products grown in mountainous areas and is important to regional agriculture (Table 4).

Table 4 Comparison of Profitability of Chief Agricultural Products Grown in Mountainous Areas (Selected from Shizuoka Prefecture Technology Output Level)

	Revenue (¥10,000/0.1ha)	Expenses (¥10,000/0.1ha)	Income (¥10,000/0.1ha)
Wasabi	301	137	164
Tea	30	15	15
Water-grown rice	11	6	5
Chestnuts	18	10	8

Processed goods, especially wasabi pickles, have been a secondary source of income for farmers for generations, and there are many cases of diversification of income sources efforts that link everything from production to processing and sales.

Wasabi and wasabi processed goods are sold at shops where producers sell directly, as well as at Japan Agricultural Cooperative shops, souvenir shops, stores of processing companies, and major supermarkets within the prefecture.

Pickled product distributors, other affiliated merchants, and food and beverage merchants have gathered in the surrounding areas that serve as important workplaces for local residents.

c. Manufacturing Goods Using Wasabi and diversification of income sources

In the proposed region, there are efforts to make various processed goods, including traditional foods, such as wasabi pickles and pickled wasabi petioles in vinegar,soy sauce and sake, as well as wasabi miso paste and wasabi seaweed(Photo 10). These have been important secondary sources of income for farmers. In recent years, uses for the leaves and petioles, which were often thrown away, are being actively studied not only by farmers, but also in cooperation with related manufacturers. The leaves can be eaten as a wild plant after being run under boiling water, and several other preparation methods have been invented, including being combined with croquette filling and wrapped in a cloth and boiled as “wasabi croquettes,” being added to konnyaku jelly as “wasabi konnyaku.”

Photo 10 Various Wasabi Processed Goods

Recently, it has also been used in a variety of unusual combinations, such as being added to ice cream and red bean paste (Photo 11, 12).

Photo 11 Wasabi Ice Cream

Photo 12 “Anbatawasako” (Wasabi and Red Bean Paste on a Butter Roll)

d. Using Wasabi in Tourism and the Food and Beverage Industry

Series of wasabi fields that extend throughout mountainous areas have been designated in “10 Agricultural Terraces in Shizuoka Prefecture” for their unique scenery, and they are hoped to be used as tourist attractions (Photo 13).

Photo 13　Ikadaba Wasabi Field, Largest in the World (10 Agricultural Terraces in Shizuoka Prefecture)

There are over 50 direct sale shops that deal mainly in wasabi from the proposed region alone, and there are also tourist facilities and experiential attractions; a variety of industry type benefits from wasabi (Table 5).

In the town of Kawazu, there are also initiatives mainly focused on the chamber of commerce with the goal to increase facilities throughout the region that offer wasabi-related cuisine and desserts (Photo 14).

Table 5　Examples of Wasabi-Related Facilities

Region	Facility Name	Characteristics
Aoi District, Shizuoka City	Utsurogi	A wasabi processed goods direct sales shop located in “Utogi,” the origin of wasabi cultivation. Visitors can make their own wasabi pickles and soba noodles (Photo 15).
Aoi District, Shizuoka City	Wasabi Mura	A joint establishment that offers hands-on harvesting experiences in wasabi fields and is used as a site for children to learn about the local natural environment. It is also rented out to university students as a wasabi field for research purposes.
Suruga District, Shizuoka City	STEP IN Tamaruya	Offers observational courses on wasabi pickling, has a display room for truly learning about wasabi, and visitors can try the sharp taste of wasabi.
Izu City	Wasabi no Omiya	A direct sales store run by wasabi producers, visitors can tour a rock garden and wasabi field and make their own wasabi pickles.
Izu City	Amagi Wasabi no Sato	In addition to selling wasabi and wasabi processed goods, visitors can experience harvesting and processing wasabi.
Nishiizu Town	Wasabi no Eki	Sells wasabi and wasabi processed goods, offers wasabi-related meals, and visitors can tour wasabi fields and make their own wasabi pickles.

Photo 14　Wasabi Rice Bowl
(Kawazu Town)

Photo 15　Utsurogi
(Shizuoka City)

(2)Agro-biodiversity

a. Wasabi Cultivation Utilizing Cultivar Diversity

Wasabi is one of 26 species in the *Eutrema* genus of the Brassicaceae family, and is an endemic species that evolved independently in the Japanese islands. Because it grows wild all over Japan, it is thought to have genetic resources that are not found in other countries (Fig. 10).

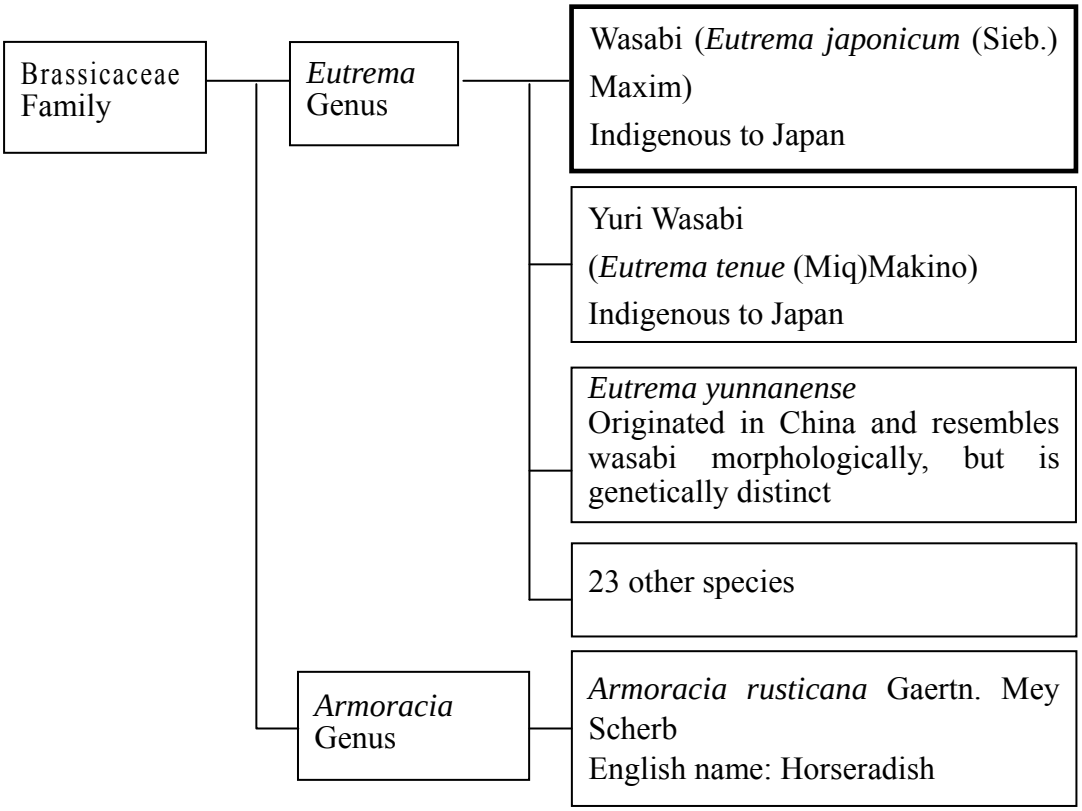


Fig. 10　Classification of the Wasabi Plant

Even the same cultivars and strains of wasabi will show different degrees of growth and unstable quality depending on the quality and amount of water in the cultivation area, as well as the water temperature, surrounding environment, and cultivation season. Therefore, producers have created and used numerous cultivars and strains that have various forms and characteristics suited to each cultivation area over the long course of history. Among these, the producer cooperatives in the proposed region have settled on promoted cultivars and strains that suit the region (Table 6).

Table 6　Promoted Cultivars and Strains of Each Producer Cooperative

Cooperative	Promoted Cultivars and Strains
Amagi Yugashima Wasabi Cooperative	Research Division No. 3, Mazuma, Yamazaki No.4(Photo 16)
Nakaizu Wasabi Cooperative	KM Mazuma, ID-7, Iraka(Photo 17)
Minamiizu Wasabi Production Cooperative	Minamiizu No.1, Mazuma, Umeazuma, Shimoda No.2(Photo 18)
Abe Wasabi Industry Cooperative	Izumo, OS, OG-1(Photo 19), N type, Sugi No.1
Toi Wasabi Cooperative	Mazuma
Shimizu Wasabi Production Cooperative	H No. 3, Marunishi

Photo16　Yamazaki No.4

Photo17　Iraka

Photo18　Shimoda No.2

Photo19　ＯＧ－１

‘Mazuma,’ the main cultivar in the proposed region, has a cultivation period of 18 to 24 months, which is longer than other cultivars. Suitable land for cultivation is limited, but its quality when grated is very high and it is popular with consumers. ‘Mazuma’ was selectively cultivated to fit the proposed region from a strain that was introduced from the Wakayama Prefecture, and it is now widely cultivated in the region (Photo 20).

Photo 20　Mazuma

At the Wasabi Branch ,Izu Agricultural Research Center of the Shizuoka Prefectural Research Institute of Agriculture and Forestry in Izu City, over 100 cultivars and strains are stored that have been grown by wasabi producers. It also acts as a base for wasabi breeding, and it endeavors to develop cultivars and bred the new cultivar ‘Izuma’ in 2015 (Photo 21).

Photo 21　Izuma

b. Farming Methods in Harmony with Natural Ecosystems

Because wasabi fields slow down the flow of water, even when they are located in places with relatively fast flow of the source waters, a unique environment is formed in which species that naturally prefer slow streams dominate, and this effective flow reduction contributes to the increase in biodiversity.

Because wasabi fields are supported by conditions with shallow water that are rich in dissolved oxygen, they are inhabited by aquatic life that prefers clear streams. Some of these species eat and damage the wasabi, including Onashi stoneflies (*Nemoura fulva*), Kakutsutsu caddisflies (*Lepidostomatidae*), and *Semisulcospira libertina* freshwater snails, but the fields are also inhabited by

many dragonfly nymphs and Japanese freshwater crabs that prey on these harmful invertebrates (Table 7,Photo 22,23,24). Insects like the Pieris melete butterfly, emerging from wasabi fields and mountain streams, become prey for frogs, spiders, snakes, and birds that inhabit the surrounding forests. Wasabi fields that are home to diverse lifeforms form the foundation of the food chain in mountain stream areas (Photo 25, Fig. 11).

Furthermore, fly species, hoverflies, and Yotsume caddisflies that inhabit the areas around wasabi fields play an important role in pollinating the wasabi flowers.

Table 7　Aquatic Invertebrates in Wasabi Fields

	Family Name	Collected Population*
Insect	Nemouridae	61
	Limnephilidae	352
	Sericostomatidae	44
	Baetidae	320
	Leptophlebiidae	21
	Ephemerellidae	15
	Tipulidae	111
Snail	Lymnaeidae	181
	Pleuroceridae	18

*Shizuoka Prefecture Agricultural Experiment Station (Survey of 20 samples taken from within a 1 ㎡ frame between June and October)

Photo 22 Onashi Stonefly (Nymph)

Photo 23 Freshwater Snail

Photo 24 Siebold's Dragonfly Nymph

Photo 25 Pieris Melete Butterfly

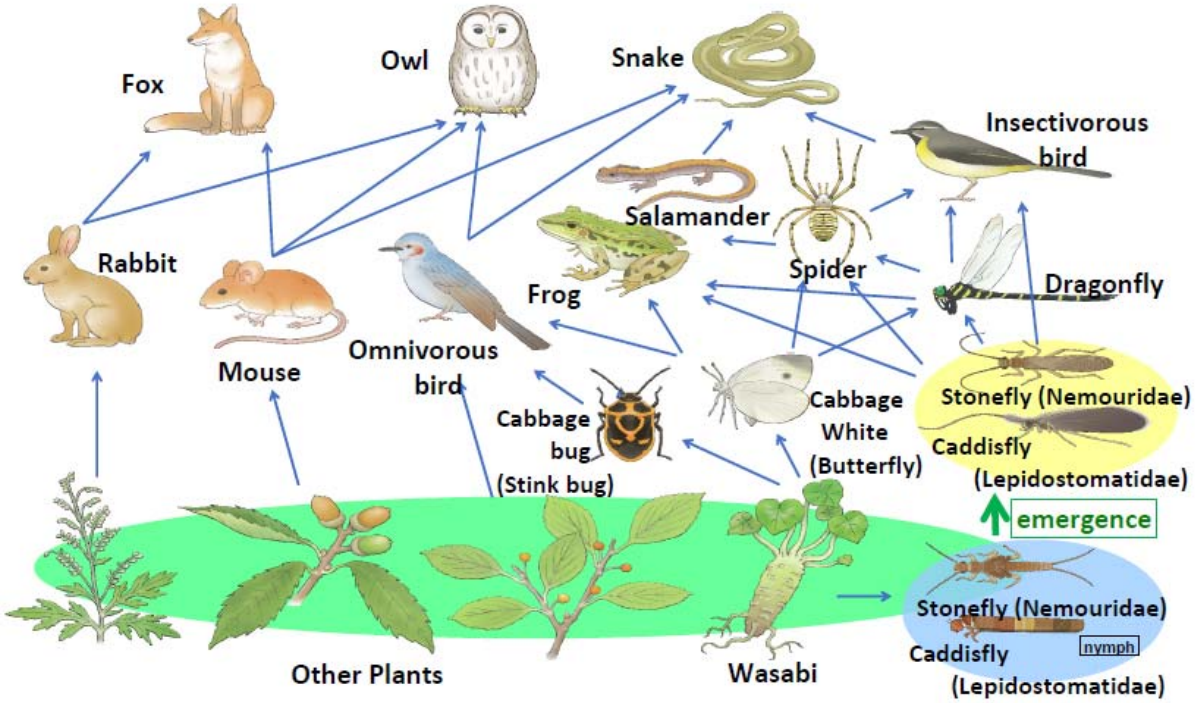


Fig. 11 Food Chain Diagram

However, springs and clear streams that follow and permeate forest soil contain nutrients necessary for the growth of wasabi, and in wasabi cultivation these nutrients circulate, fertilizers are rarely used, and the burden on the environment is small. For that reason, wasabi fields and the surrounding areas have a rich biology.

Furthermore, in wasabi cultivation direct sunlight must be avoided from spring to autumn, and consequently, East Asian Alder trees that naturally grow in the area are planted in wasabi fields to create shade. This is an example of environmental improvement by using native tree species in agricultural production sites.

In this way, wasabi production in the proposed region has a highly sustainable agricultural system and is unique in the world as a farming method that is in harmony with natural ecosystems.

c. Wasabi Fields Nurturing Biodiversity

Wasabi fields and the surrounding areas are home to species in danger of extinction, such as the Japanese clawed salamander (*Onychodactylus japonicus*) (Shizuoka Prefecture Publishing Red Data Book: threatened species type II) (Photo 26). They are also inhabited by many diverse aquatic insects, such as the dragonfly (*Epiophlebia superstes*), the Hirata mayfly (*Heptageniidae*), Japanese firefly (*Luciola cruciata*), and Yotsume caddisfly (*Perissoneura paradoxa*) (Photo 27), as well as freshwater shellfish, such as freshwater snails. The streams that flow nearby are inhabited by fish such as amago trout, Japanese sculpin, and freshwater salmon. In the forests, birds that catch these fish can be found, such as the crested kingfisher (*Megaceryle lugubris*) and the brown dipper (*Cinclus pallasii*).

Photo 26 Japanese Clawed Salamander

In particular, there are numerous types of dragonflies, and in the areas around wasabi fields, one can see them emerging in April, including the dragonfly (*Epiophlebia superstes*) (Photo 28), as well as Gomphidae dragonflies, such as *Lanthus fujiacus* and *Davidius nanus*, and the broad-winged damselfly (*Calopterygidae*). In summer, one can see *Calopteryx cornelia* dragonflies resting their wings on rocks in the rivers, and at the height of summer, Siebold's dragonflies (*Anotogaster sieboldii*) take flight. In this way, wasabi fields located at the sources of rivers are valuable as preservation areas for important species, because of the low levels of environmental change and non-native species.

Photo 27 Yotsume Caddisfly Resting its Wings on a Wasabi Leaf

Photo 28 *Epiophlebia superstes*

Shizuoka WASABI Association for Important Agricultural Heritage Systems Promotion determines the biodiversity of wasabi field areas in the Shizuoka and Izu regions, and sees the value of wasabi fields in a new light. Because of this, the association is conducting surveys of wasabi fields and the surrounding streams starting in 2017.

The results of the aquatic life survey conducted in August 2017 showed that for the wasabi fields and surrounding rivers in the two regions, although the dominant species differed, over half of the aquatic life found in the surrounding rivers was also found in the wasabi fields, and approximately 20% of the total observed species were only found in the wasabi fields. From this, it was concluded that wasabi fields maintained a rich biodiversity similar to that of the surrounding rivers (Fig. 12, Table 8).

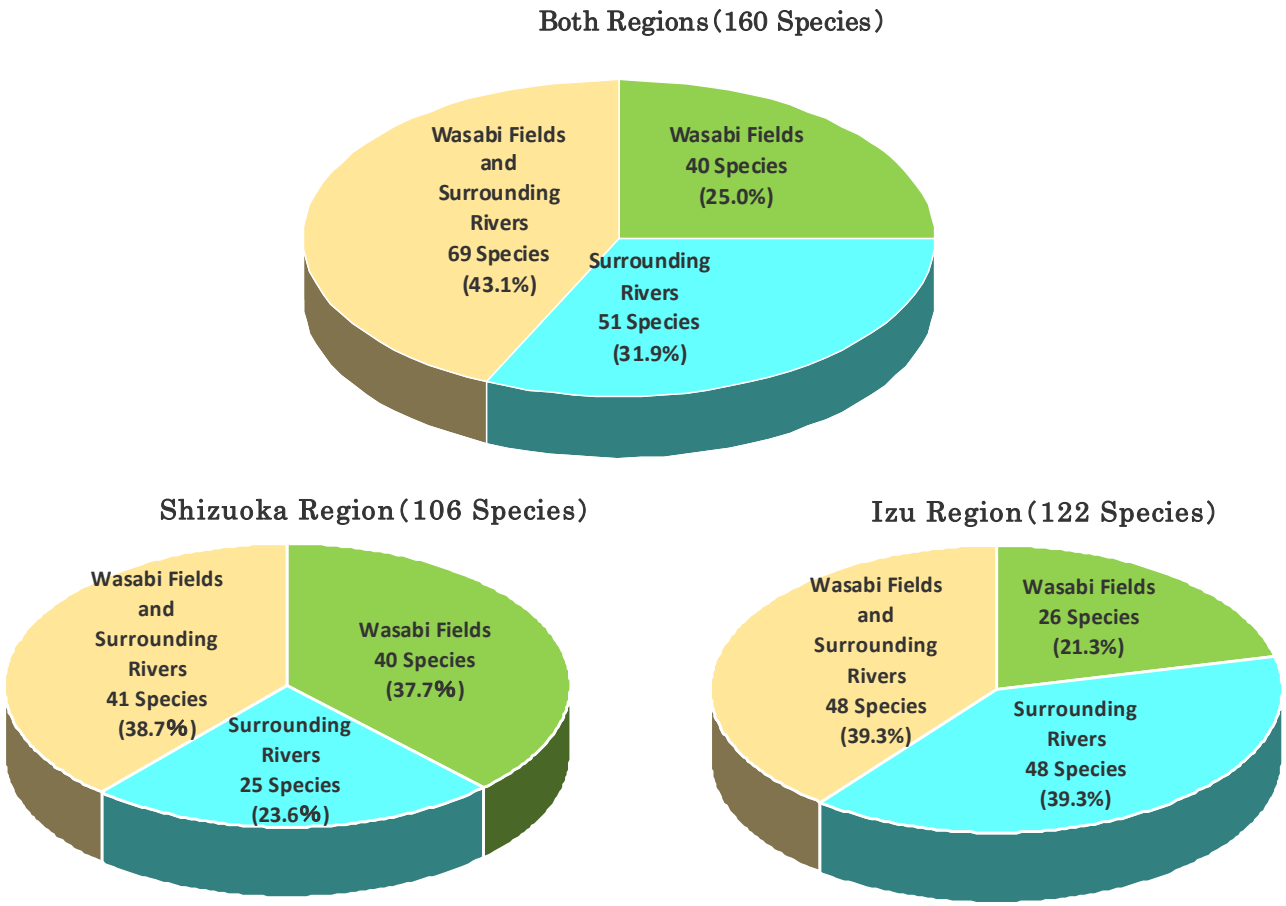


Fig. 12　Confirmed Number and Percentage of Aquatic Species

Table 8 Dominant Aquatic Species of Each Region (Individuals/㎡)

	Shizuoka Region					
	Wasabi Fields			Surrounding Rivers		
Rank	Species Name	Individuals	%	Species Name	Individuals	%
1	*Nemoura*	389	17.3	*Lepidostoma*	1,316	19.7
2	*Lepidostoma*	345	15.3	*Bythinella nipponica*	1,164	17.4
3	*Gyraulus chinensis spirillus*	226	10.1	*Dugesia japonica*	832	12.4
4	*Dugesia japonica*	161	7.2	*Baetis thermicas*	608	9.1
5	*Apatania*	124	5.5	*Polypedilum*	392	5.9
Total		2,251			6,696	

	Izu Region					
	Wasabi Fields			Surrounding Rivers		
Rank	Species Name	Individuals	%	Species Name	Individuals	%
1	*Nemoura*	403	42.3	*Orthopodomyia*	588	6.9
2	*Corixidae*	174	18.3	*Corixidae*	540	6.3
3	*Cladotanytarsus*	60	6.3	*Drunella cryptomeria*	500	5.9
4	*Amphinemura*	45	4.8	*Optioservus nitidus*	472	5.5
5	*Tvetenia calvescens*	29	3.1	*Cladotanytarsus*	448	5.2
Total		954			8,544	

Furthermore, the shellfish *Bythinella nipponica*, selected as a type II threatened species in the Ministry of the Environment's 2017 Red List, was first confirmed in Shizuoka Prefecture. Additionally, *Radix auricularia japonica* and other rare species have been found breeding specifically in the Shizuoka region wasabi fields and surrounding streams (Photo 29, 30, Table 9).

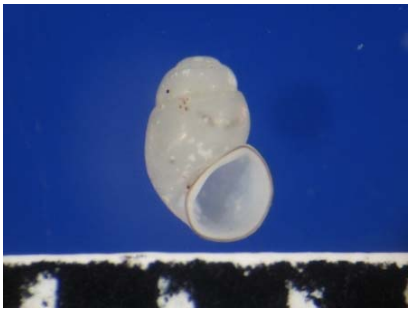


Photo 29 *Bythinella Nipponica*

Photo 30 *Radix Auricularia Japonica*

Table 9 Collected Valuable Species and Quantities (August 2017) (Individuals/㎡)

No.	Family	Latin Name	Japanese Name	Shizuoka Region				Ministry of the Environment	Shizuoka Prefecture
				Wasabi Fields		Surrounding Rivers		RL	RDB
				Upper	Lower	Upper	Lower	2017	2004
1	Hydrobiidae	*Bythinella nipponica*	Horaana mijin nina	6	3	291		VU	
2	Lymnaeidae	*Radix auricularia japonica*	Monoaragai	400	7		1	NT	NT
3	Planorbidae	*Gyraulus chinensis spirillus*	Hiramaki mizumaimai	1,821	215	30	1	DD	NT

*Ministry of the Environment RL: Red List (VU: Vulnerable Species, NT: Near-Threatened Species, DD: Data Deficiency)
Shizuoka Prefecture RDB: Red Data Book (NT: Near-Threatened Species)

On the one hand, wasabi fields and the surrounding areas preserve biodiversity, and important plants are also often observed.

Threatened species often grow along wasabi field stone walls and the slopes of rivers, including endangered species, such as *Diplaziopsis cavaleriana* and *Histiopteris incisa* (both listed as threatened species category II in the Shizuoka Prefecture Red Data Book), and rare ferns like the oriental chain fern (*Woodwardia unigemmata*) (Photo 31) whose easternmost distribution is the Izu Peninsula and has been designated a protected species of the Shizuoka Prefecture. There are also many spermatophytes and plants typical of mountainous areas: *Hydrangea involucrata* (Photo 32), *Chrysosplenium grayanum*, *Impatiens textori*, *Trigonotis brevipes*, and *Mitella pauciflora*. These plants become habitats or food for many animals and support the ecosystem of wasabi field areas.

Photo 31　Oriental Chain Fern

Photo 32　*Hydrangea involucrata*

In recent years, there has been a nationwide problem with deer and wild boar, not only damaging crops, but also natural vegetation. This damage is also enormous in the proposed region, and protective fencing is installed around the areas, including wasabi fields and forests, to protect the wasabi from deer and other animals.

Because of these wildlife damage countermeasures, the areas of wasabi fields, including the surrounding forests, contain naturally existing herbs and trees that survive and stay healthy, and these areas become habitats for important vegetation. Along with the goal of stabilizing the soil with plant roots, the fields also provide an ideal environment for other small animals to live.

d. Systems and Policies for Preserving Ecosystems

In wasabi field areas, there are work roads and monorails set up for wasabi cultivation, and although their goal is to optimize the work, it is very difficult to bring heavy machinery because of the terrain, and the work is mainly centered on manual labor. As a result, the work does not place a burden on the ecosystem and

contributes to sustainable cultivation.

In the Nakaizu District of Izu City, the “Society to Protect and Nurture the Nature of Mt. Amagi” was established mainly by wasabi growers. This society coordinates with the Izu District Forest Office and engages in tree-planting and other activities to preserve their own wasabi cultivation for future generations. This is an example of the profits gained from wasabi production cycling through to maintain the forests (Photo 33).

Photo 33　Tree Planting in Mt. Amagi

The “Forest Maintenance Prefectural Residents’ Tax” was established in Shizuoka Prefecture in 2006, and these tax funds are used to maintain the forests. Despite the great public benefit that this tax has had, it was late being enacted, and for forests that have gone to ruin and need urgent maintenance, the prefecture is making efforts to plant forests and to regenerate bamboo and broadleaf forests.

(3) Local and Traditional Knowledge Systems

a. Wasabi Cultivation Methods

Wasabi is an endemic species of Japan and has grown wild in all parts of Japan since ancient times. It is mentioned in written documents from the Nara period (first half of the 8th century), and mention of it as an edible plant begins to be seen in the Kamakura period (first half of the 13th century), but at the time, it was growing wild in the mountains and people harvested it to use it.

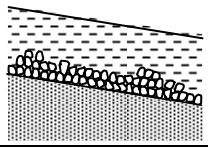
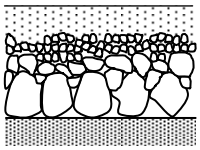
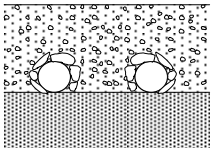
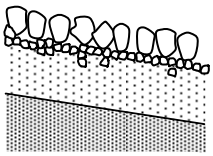
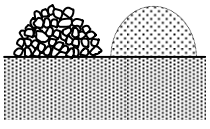
Wasabi cultivation began in Utogi, about 400 years ago, in the early Edo period. Following that, wasabi cultivation was attempted in many parts of the country, including in Shimane, Yamanashi, Tokyo, and Nagano.

At present in Japan, there are cultivation methods called the “Jizawa style,” “Tatamiishi style,” “Hokusun style,” “Keiryu style,” and “Hirachi style” (Table 10).

The“Keiryu style” is a method mostly seen in Tokyo and Shimane, and this style consists of building fields by laying out rocks and small stones along a sloping stream. Although it is relatively easy to build these fields, they are susceptible to natural disasters, and plant growth is affected by the amount of water in the river. The “Hirachi style” is a method seen in the Nagano Prefecture, and it is characterized by digging alongside a level river, spreading the area with sand, making ridges, planting seedlings, and making use of abundant groundwater.

Because this method requires flat land and a great volume of groundwater, very few places are suited to this kind of cultivation, and although the wasabi stumps get large, the stems do not grow large.

Table 10 Wasabi Field Styles in Japan

Cultivation Method (Year of Development)	Schematic Diagram*	Characteristics	Main Cultivation Places
Jizawa Style (Around 1600)		Stones and sand are spread into a wasabi field made on a gradient of 3-4% (developed in the Shizuoka region)	Shizuoka, Miyagi, Saga, etc.
Tatamiishi Style (1892)		Using abundant spring water, sloping land is made into a series of terraces, large rocks, stones, and sand are laid in order from bottom to top (developed in the Izu region)	Shizuoka, Iwate, Tochigi, Yamanashi, Shimane, etc.
Hokusun Style (1897)		An improvement on Tatamiishi style, porous lapilli is used and subterranean drain pipes are laid underneath (developed in the Hokusun region of the Shizuoka Prefecture)	Shizuoka
Keiryu Style (the mid-18th century)		Fields are built alongside a sloping stream, and rocks and small stones are laid; small quantities of water are used effectively	Tokyo, Hyogo, Shimane, Hiroshima, Yamaguchi, etc.
Hirachi Style (1917)		An area next to a flat river is dug, into which sand is laid and ridges are built, seedlings are planted and a great deal of groundwater is used	Nagano

*Adachi Shozo (1987) Partially reorganized.

As for why the Shizuoka Prefecture has been Japan's top producer of wasabi, from the start of cultivation to the present day, a few things bear mentioning. When cultivation first began, it was only allowed to take place in Utogi according to

Tokugawa Ieyasu*. In the first half of the 19th century, it became possible to ship fresh wasabi by boat to Edo, home to a large population of consumers, and development of the "Tatamiishi style" wasabi fields occurred in 1892. The "Tatamiishi style"wasabi fields, in particular, when compared to other cultivation methods, have high stem yields and can also produce wasabi of a very high quality. As such, this type of cultivation was attempted in all parts of Japan. However, suitable cultivation land was limited because of the need for abundant spring water, and even now, the Shizuoka and Izu regions, with their large quantity of rainfall and particular geological features, are Japan's top producing region for wasabi.

b. Features of Wasabi Cultivation Methods Utilizing Permeability

Wasabi is vulnerable to both low and high temperatures, and grows in places with flowing water from 8-18 °C, but growth is fastest and yield is highest when the yearly water temperature difference is small, from 3-4 °C.

Wasabi stems also have a high demand for oxygen, and when the dissolved oxygen in the water feeding them is reduced, they easily develop physical disorders and diseases. Therefore, they need to be in water at a stable low temperature with high levels of dissolved oxygen.

The plentiful spring water in the proposed region is approximately stable at 13°C year-round, and acts as heating or cooling to keep the wasabi at a temperature suitable for growth.

Wasabi fields built as terraces in mountainous areas are similar to terraced rice fields, and they use water that flows over the cultivation surface.

However, in rice fields, clay-like surface soil is used, and water is kept from permeating into the subsoil, flowing on the surface only. Conversely, for wasabi fields, stones are used for the surface soil, and a great deal of water is made to permeate into the subsoil, and this is the fundamental difference between wasabi fields and rice fields. Furthermore, the layer of stones also functions as filtration equipment that removes impurities. Because water that has retained its quality is reused in lower-level wasabi fields, there are few instances of continuous cropping hazards so often seen in ordinary modern agriculture.

The "Jizawa" and "Tatamiishi" styles of cultivation that were created in the proposed region have an especially superb construction for letting water permeate to the subsoil without stagnating. Of the two, the "Tatamiishi style," functions extremely well with influx regulation from source waters and drains out surplus water. It prevents seedlings from being washed away by large volumes of flowing water and allows good growth of the wasabi, which, in turn, reduces the incidence

* The founder of the Tokugawa Shogunate(Edo period)

of disease. For these reasons, the “Tatamiishi style” wasabi fields have greater yields than conventional cultivation methods, allowing for the production of high quality and highly profitable wasabi. Therefore, it is known as the optimal method of wasabi cultivation.

Fields are built using rocks and sand from the area, and unwanted elements that had gathered in the surface soil are washed away during transplanting, but generally the surface soil is not changed out.

With this kind of improvement and development of cultivation technology, there is relatively little difference in growth between the upper and lower levels of terraced wasabi fields, establishing a cultivation style most suited for wasabi stem production.

<“Jizawa Style” Wasabi Fields>

“Jizawa style” wasabi fields are generally set on an incline of 3-4%, in which the mud is washed away, and the field is constructed using the remaining stones and sand.

The thickness of the pebble and sand surface soil is approximately 25-30 cm, and the stem expansion into the surface soils tends to be inferior to that of the “Tatamiishi style,” and the stems tend to have inconsistent growth (Fig. 13).

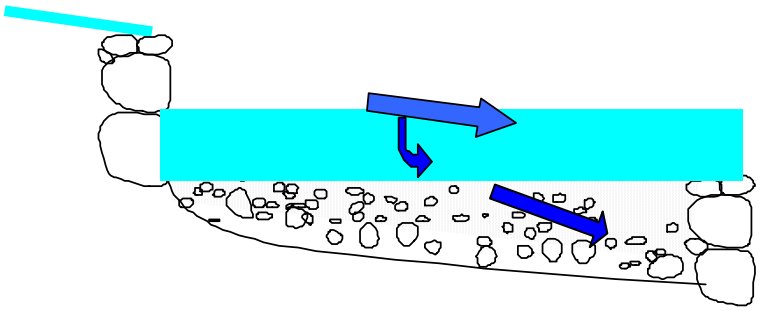


Fig. 13 Jizawa Style Wasabi Field Construction

Currently, most of them have been converted to the “Tatamiishi style;” however, the “Jizawa style” is still adopted in places where the “Tatamiishi style” cannot be used, because the “Jizawa style” fields can be established on sloping land with large fluctuations in water quantity.

<“Tatamiishi Style” Wasabi Fields>

The irrigation water supplied to the surface soil layer of “Tatamiishi style” wasabi fields flows over the top of the surface soil, although some of it permeates that layer and reaches the “tatamiishi” (rock matting) layer at the bottom of the wasabi field. The “tatamiishi” layer, below the surface soil and the rubble layer, is installed with tunnel-type conduits every 2-4 m and are constructed with large

rocks, forming a construction that obstructs the surface soil's permeability as little as possible. This construction makes it easy for the irrigation water in the surface soil to move, and is characterized by its excellent supply of oxygen and nutrients to the stems of the plant (Fig. 14).

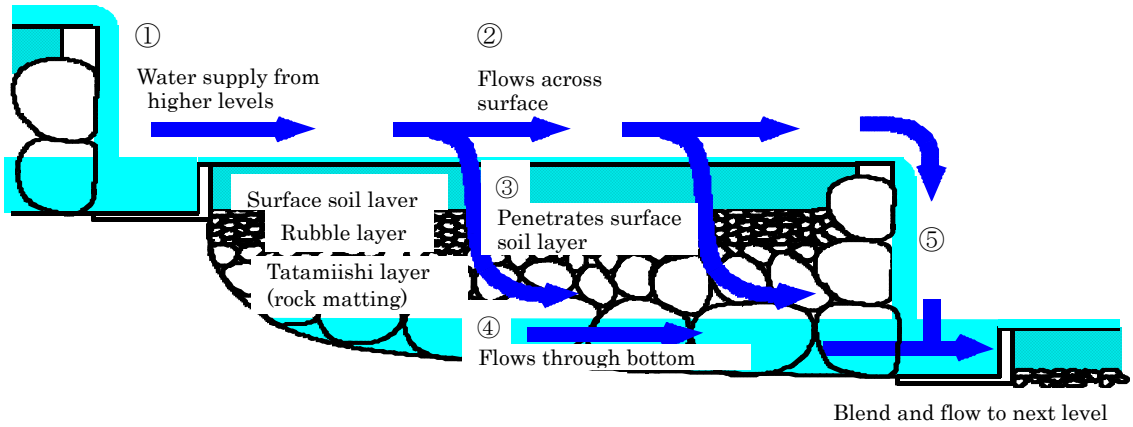


Fig. 14 "Tatamiishi Style" Wasabi Field Construction and Water Flow

1. Water is supplied from the upper level.
2. It flows along the surface while soaking into the surface soil.
3. The water that permeated the surface soil keeps the stems at a stable temperature, while also supplying oxygen and nutrients dissolved in the water.
4. The irrigation water that permeated the surface soil passes through the rubble layer, reaches the bottom of the wasabi field, and flows along the conduits to the next lower level.
5. The irrigation water that flowed along the top of the surface soil without permeating the surface soil flows from the end of that level and drops to the next level, blending with the water that did permeate the surface soil.

c. Diverse Seedling Production Allowing for Year-Round Production

Diverse cultivars and strains that are suited to the cultivation environment are needed to grow wasabi stably throughout the year. At the same time, there is also a need for the stable production of seedlings.

For seedling production, there is vegetative propagation (branching shoot seedlings) that is made from branching shoots of the stem, and seed propagation (true seedlings) that are grown as permanently planted seedings from seeds

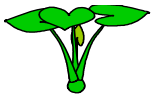
gathered in the spring.

Because branching shoot seedlings allow for the same form, character, and yield as their parent plant, this had been the general propagation method, but these seedlings have the drawback of being likely to retain viruses. In recent years, because of advances in tissue culture techniques, large-quantity propagation has become possible for seedlings (shoot tip culture seedlings) that do not carry pathogens. However, shoot tip culture seedlings are relatively expensive. Therefore, a method has been implemented in which once they have been permanently planted, by pinching the growth point and producing more shoots, the secondary seedling is used (Fig. 15).

<Branching Shoot Seedling>

Harvested wasabi stem separated into main stem and branching shoot

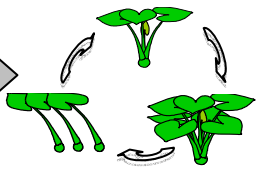
Branching shoot used as planting seedling



Branching Shoot Seedling

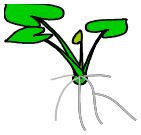
<Shoot Tip Culture Seedling>

Growth point removed from the stem and moved to a sterile culture



In asepsis, splitting and propagation is repeated

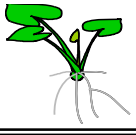
Acclimatization, growing seedlings



Shoot Tip Culture Seedling

Planted in field

Shoot Multiplication



Secondary Seedling

<True Seedling>

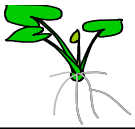
Flowers Bloom

Seed Production

Seed Storage (Low Temp.)

Sowing

Growing Seedling



True Seedling

Fig. 15 Seedling Categories and Propagation

Although there is the issue of lacking fixed individual differences in form and nature for true seedlings, they allow for the avoidance of crop damage and can be mass-produced, and so currently are often used. They are also used for selecting superior strains. The cultivar 'Izuma' was cultivated in the Shizuoka Prefecture and developed to be suited to producing true seedlings. Its characteristics include early growth and uniform character (Photo 34).

Today, what allows for wasabi production throughout the year in the proposed region is the combination of many cultivars and strains producing a variety of seedlings. This ensures a stable supply of seedlings throughout the year and makes a variety of crop types possible.

Photo 34　Izuma

d. Wasabi Field Management Without Burdening the Environment

Wasabi cultivation takes one to two years from planting to harvest, and because of the land conditions, most of the day to day work is done by hand (Photo 35).

Photo 35　Harvest Work in a Wasabi Field

Other than harvesting and planting, the management work of wasabi fields involves important daily tasks, such as removing fallen leaves to ensure good water flow and surveying the farm.

Fertilizers are used as little as possible, and the use of agricultural chemicals for exterminating harmful insects is decided upon by the manager of the entire water system. With the exception of instances of large numbers of pests after planting, producers use the minimum amount of agricultural chemicals. The chemicals that are used are registered agricultural chemicals, such as BT (*Bacillus thuringiensis*) agents (biopesticide), that have a minimal effect on ecosystems, and producers have a keen awareness of and concern for the environment.

Furthermore, because wasabi is vulnerable to direct sunlight in summer, deciduous East Asian Alder trees are planted in and around the wasabi fields to provide shade. Because these trees fall during floods, and can take a long time to regrow, and because originally, in certain places, there is difficulty in growing them, the use of shade cloth as covering material, in recent years, is inevitable, in certain cases (Photo 36).

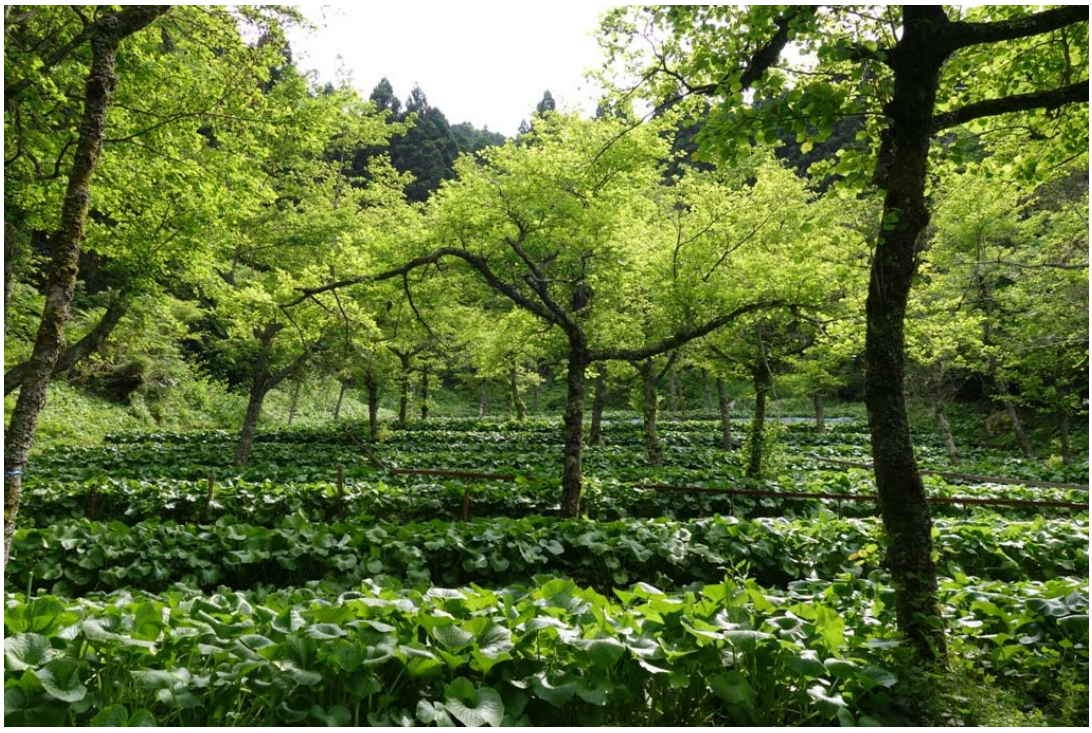


Photo 36 Using East Asian Alder Trees for Shade

e. Spread of Knowledge Systems

Wasabi cultivation in the proposed region began with naturally growing wild wasabi in what is now the Utogi district of Shizuoka City, in the Keicho era (1596-1615). In the mid-18th century, it was also brought to the Izu region, and it spread there throughout the 19th century.

Around 1892, a stonemason engineer in what is now Nakaizu in Izu City focused on using the abundant water produced in the region and developed the "Tatamiishi style" cultivation system in which, when a field is built, a deep foundation is dug, into which large stones, then pebbles, and then fine sand is laid to create a surface soil. This cultivation system allows for cool and oxygen-rich water, so important to the good growth of wasabi, to spread to the underground section where the roots extend. Therefore, growers were able to avoid diseases like soft rot that occurred in the region at the time, as well as cultivate high-quality wasabi. Once these effects were proven, the method spread to each region, starting with Utogi.

In this way, the wasabi fields in the proposed region were split between the Shizuoka region and the Izu region, but because of the distribution of mountainous land that has the same natural conditions and the connections between the people living in each, the traditional cultivation system was handed down, and the regions share the same history.

f. Research Locations in the Region

With strong demands from wasabi producers in the Shizuoka Prefecture, and to promote the production of wasabi as a special regional product, the Shizuoka Prefecture Wasabi Institute was established with its research base in Yugashima, Izu City, in 1934. In 1959, it was moved to its current location in Yugashima of the same city, and in 2010, it became the Wasabi Branch, Izu Agricultural Research Center, the title it holds today.

There are various types of wasabi-related research and experiments being conducted here. These have resulted in the breeding of new cultivars such as 'Fujidaruma,''Amagidori,'and 'Izuma'(Photo 37) as well as the propagation of wasabi seedlings using sterile cultures (Photo 38), and the development of technology that allows year-round production of seedlings with nutrient solutions (Photo 39). Integrated pest management (IPM) technologies have also been developed, and it shares the results of those experiments in the region.

'Amagimidori'

'Izuma'(left), 'Fujidaruma'(middle), 'Mazuma'(right,control)

Photo 37 wasabi cultivar growed by Wasabi Branch, Izu Agricultural Research Center

Photo 38 wasabi seedling propagation by sterile culture

Photo 39 hydroponic wasabi seedling culture

This facility is joined with the offices of the Shizuoka Wasabi Union Federation and acts as a base for the activities of wasabi producers (Photo 40).

Photo 40 Wasabi Branch, Izu Agricultural Research Center Building and Research Facility

There are no other official experimental research organizations dedicated to wasabi in Japan or in the world. This facility is central to wasabi research in Japan and around the globe.

g. Responses to Past Disasters (Sustainability, Resilience)

The gravest damage in mountainous regions is inflicted by landslides that occur after typhoons or severe rainfall, and repeatedly the wasabi fields in the proposed region have been greatly damaged. Frequent floods have washed away wasabi fields in the origin area of Utogi as well, and over 10 ha are said to have been swept away in the great flood of 1876. In recent years, the Kano River typhoon of 1958 washed away nearly all of the wasabi fields in the Nakaizu district of Izu City, and only 5% are said to have escaped damage. The repair works for these disasters were carried out by both government and private citizens. The wasabi fields were improved by being built in the Tatamiishi style, and because waterway reinforcements and river dike solidifications were devised, they were given a new construction that was resilient to flood damage. Since then, no major flood disasters have happened in this region (Photo 41).

Photo 41 Repair Work Following the Kano River Typhoon

Because wasabi fields are generally installed using materials in the area (sand, pebbles, etc.), they have minimal effect on the environment and can be quickly restored.

The techniques for building wasabi fields are passed on from parent to child, as well as through regional cooperative bodies. The producers in this region have become capable of quickly restoring the fields through cooperation, if there is damage from natural disasters.

(4) Cultures, Value Systems, and Social Organizations

a. An Ingredient Supporting Japanese Food Culture

Wasabi is known to have been highly prized by the upper class in the Heian period (794-1185).

In the Kamakura period (1185-1333), Buddhist vegetarian cuisine developed at Zen temples, and “wasabi cold soup” is mentioned in the “Chujiruiki,” a work said to have been written at the end of the Kamakura period. In the Muromachi period (1336-1573), there are records of sashimi topped with wasabi vinegar, and wasabi started to appear in the meals of commoners, but fresh fish at that time was primarily freshwater fish, such as crucian carp and ayu, and these did not pair well with wasabi.

In the Edo period, people started eating soba noodles and sushi, two major types of cuisine that pair well with wasabi, and the use of wasabi spread to the general public. By the 18th century, wasabi's detoxifying effects were already known.

At the start of the 19th century in Edo, it was used in pressed mackerel sushi to eliminate the raw smell, and later vinegared rice was topped with wasabi, and together with sliced gizzard shad or spring, nigirizushi gained popularity with Edo townspeople (Photo 42).

Photo 42　Edo Period Sushi

Since then, wasabi has contributed to the development of Japanese food culture, used with sashimi, tofu, grated yam, tea on rice, and other dishes. Wasabi, with its disinfecting and bacteria-suppressing effects, is an indispensable ingredient in Japanese cuisine, which developed in a hot and humid country. It is especially important for supporting raw food culture.

In Utogi, the origin of wasabi cultivation, farmers made wasabi petioles pickled in bran miso. The model wasabi processed food "wasabi pickles" were invented by merchants who came to Sunpu (present day Shizuoka City) to peddle miso and soy sauce, by processing these pickles in various ways, salting them, and then shredding the wasabi and mixing it with sake lees. Sales of "wasabi pickles" are said to have begun in the mid-18th century (Photo 43). This product was extensively spread with the opening of railways, starting with sales inside Shizuoka Station, when the Tokaido Line opened in 1889. Wasabi pickles packed in wooden cosmetics barrels and sold to customers from train windows were popular and spread around the country as a famous specialty souvenir from the proposed region (Photo 44, 45).

Photo 43
Stone Commemorating the Origin of Wasabi Pickles

Now, from specialty shops to wasabi-producing farmers, wasabi pickles are made in each place using its own unique recipe.

Photo 44 Representative Processed Food "Wasabi Pickles"

Photo 45 Taisho Period (1912-1926) Well-Established Shopfront

Shizuoka City, the largest city in the proposed region, has the highest national per-household consumption of tuna, the most popular topping for sushi. It also has the highest per-household consumption of rice and tea. In addition to wasabi, rice, tea, shiitake mushrooms, marine products, and fish bring prosperity to the city year round.

Because of this, wasabi, a vital ingredient for the preparation of sushi and sashimi, is a particularly important food in the proposed region, and many sushi shops and soba noodle shops use wasabi as a condiment.

In addition, unique foods have been developed which combine wasabi with sake lees, seaweed, and shiitake mushrooms. Traditional Japanese culinary culture has deep roots in the proposed region. Wasabi pickles and other wasabi-based foods invented in the region are also popular as souvenirs, serving as symbols of the region's culinary traditions (Table 11).

Table 11　Foods Incorporating Wasabi

【Common Japanese Foods】

Name	Photo	Content
Sushi, Sashimi		Wasabi is served on the side as a condiment to mask unpleasant raw fish odors and enhance flavor.
Soba Noodles		Wasabi is served on the side as a condiment. Wasabi's aroma and spiciness bring out the savory flavor of the buckwheat.

【Famous Regional Foods】

Name	Photo	Content
Wasabi Pickles		Minced wasabi is thickened with simple syrup and thoroughly mixed with sake lees.
Wasabi Miso Paste		Minced wasabi and sugar are thoroughly mixed into miso paste.
Wasabi Seaweed		Minced wasabi is thoroughly mixed with simple syrup, seaweed, and soy sauce.
Sanbaizu Pickles		Blanched wasabi stems are soaked in sanbaizu (a 1:1:1 mixture of vinegar, sugar, and soy sauce; may be eaten after 2-3 days).
Wasabi Rice Bowl		Grated wasabi and bonito flakes are sprinkled over a rice bowl and eaten mixed with soy sauce drizzled on top.

b. Festivals and Customs in the Region

In Shizuoka City, there are 56 Shirahige shrines said to be dedicated to “water gods” and “farming gods,” accounting for approximately 20% of the nationwide total. The Shirahige shrines in this region are located on high ground at the entrances or in the central parts of village settlements, and the main buildings and torii gates face rivers and swamps. This suggests that beliefs were rooted here as having protector gods for these regions that were so often struck by flood disasters, and these shrines were significant, when considering the culture of the region that placed such importance on the abundant rain, water, and rivers.

There is also a Shirahige shrine in the Utogi settlement, which was the origin of wasabi cultivation, as well as a current center of cultivation. At its spring and autumn festivals, wasabi offerings are made along with Shinto “Kagura” dancing that is designated as a municipal Intangible Folk Culture Asset (Photo 46). “Kagura” dancing is a folk performing art that has been passed down from the ancient Japanese, and is performed in shrines to calm angry gods, and give thanks for rich yields of crops. Passing on the tradition of “Kagura” is important in passing down the regional history and maintaining the community for residents.

Photo 46 Kagura Dance

Water that is essential to not only wasabi but also to people can sometimes become torrential rain, which floods rivers and can destroy residents’ lives. Therefore, by revering the god of water, such god is calmed. With Kagura dancing to pray for stability in water and to show appreciation to the god, crops such as wasabi that are the blessing of such god, are dedicated to the god.

At Tounji Temple located at the center of the Utogi settlement, a Bon Festival dance takes place in August every year, which has a long history and is designated as a national Important Intangible Folk Culture Asset. This temple has its own wasabi field, which allows us to see just how important wasabi is for this settlement (Photo 47, 48).

Wasabi producers also often decorate their bon household altar with wasabi.

Behind the passing down of wasabi cultivation and the protection of wasabi fields in the long history, the connection of people that is nurtured through Kagura and Bon dancing has played an important role.

In the present day, many regional residents other than wasabi producers actively become involved with wasabi as community members, and support the wasabi

industry through harvest, adjustment, and the manufacture of processed goods.

Photo 47 Utogi Bon Festival Dance

Photo 48 To-un-ji Temple
Wasabi Fields

At Kisobo Water Shrine in Izu City, the great volume of water that springs from under the grounds of the shrine is an important source of water for wasabi and rice cultivation, and it forms a source of industry in the area. Wasabi fields extend in the area around the shrine, and the wasabi field adjacent to the shrine grounds belongs to the shrine. The proceeds from that field are used to throw a lavish festival every year to give thanks for divine blessings (Photo 49).

Photo 49　Kisobo Water Shrine in Izu City, and Adjacent Wasabi Field

The Izu region has also been known since ancient times as a health resort that was visited by literary masters like Kawabata Yasunari and Inoue Yasushi, the former of which wrote the famous short story “The Dancing Girl of Izu.” It is now

a sightseeing area only three hours from the Tokyo area, and agricultural, forestry and fisheries products, such as fresh marine products from the Izu coastal waters, wasabi, and shiitake mushrooms are important local resources that give character to the area.

In recent years, the "Wasabi Rice Bowl" has become a popular menu staple at eateries in the town of Kawazu, and the Shuzenji Onsen Cooperative has collaborated with wasabi producers to produce a campaign offering "Wasabi Rice Bowl" and hands-on wasabi harvesting experiences. The significance of wasabi as a regional resource is increasing (Photo 50).

Photo 50 "Wasabi Rice Bowl"

c. Wasabi Field Joint Management Systems

<The Form of Management at the Start of Cultivation>

In addition to having a limited amount of land that is ideal for wasabi cultivation, because there are large differences in earnings caused by site conditions, such as sunlight, there are many different decision-making and usage forms for the fair use of wasabi fields.

In the Izu region in the Edo period, groups centered on powerful people in the village borrowed Mt. Amagi land from the shogunate and cooperated to manage the wasabi fields. These wasabi fields were called "Gozawa," and the "Gozawa" in the Izu City Yugashima area in the first half of the 19th century mainly had the following four management types (Fig. 16).

Type A involved joint management of the entire wasabi field, and cultivators were chosen by bidding. Type B divided the wasabi fields up evenly, and each partial owner had fair exclusive possession of their section. Type C was joint management and operation of relatively small wasabi fields by two or three people. Type D was an unequal split depending on power relationships in the village, in which different portions were divided for wasabi fields with different placements and sizes.

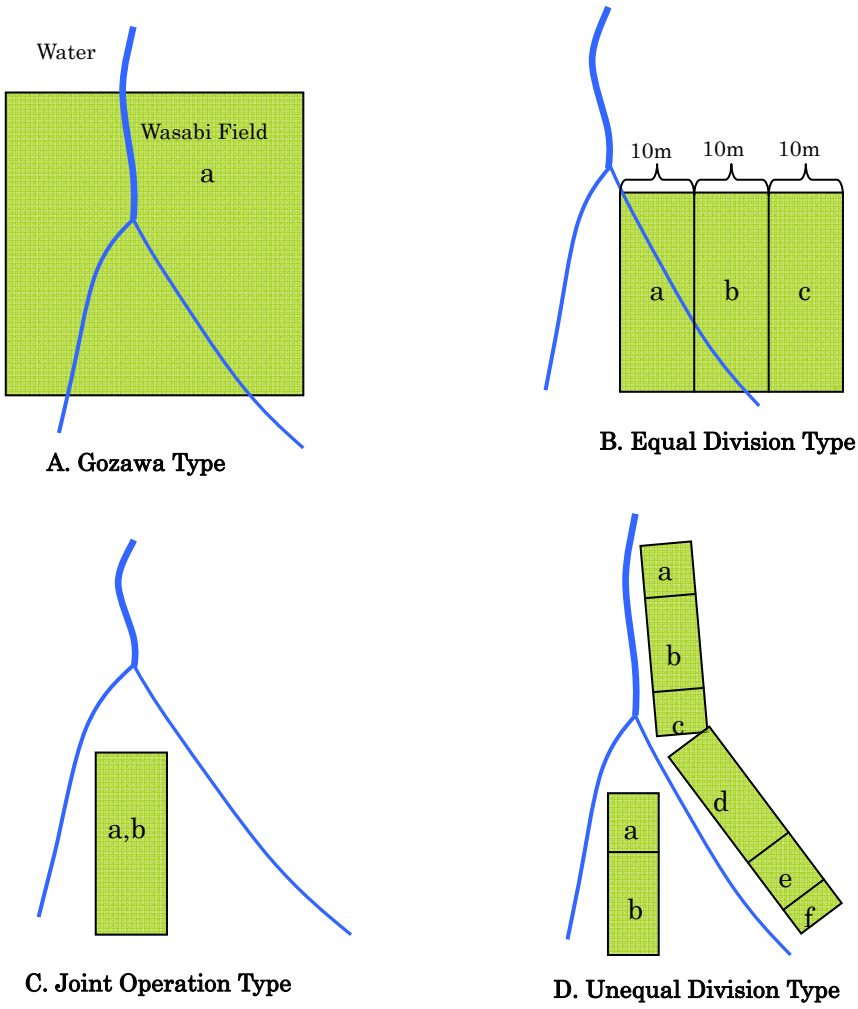


Fig. 16 Wasabi Field Joint Management in the Yugashima Area in the Edo Period (Souce: Wakabayashi (1951))

In the Edo period "Gozawa" generally adopted a "one vote per house" rule, and to evenly distribute earnings, a joint farming system was adopted based on equal qualifications, rights, and obligations.

However, because rights of use were not often subject to sales, "Gozawa" members gradually decreased, and privately managed wasabi fields increased. With the start of the Meiji period, shogunate territory became national forests, and after agrarian reforms, parts were sold to civilians. With these reforms, more wasabi fields were the property of individuals and not shared.

Although "Gozawa" decreased in this historical context, a similar management system is preserved in parts of the Izu region today, and this is retained as "Gozawa."

<The Present Day Gozawa System>

In the existing Gozawa system, there are different methods, including one that uses bidding to decide cultivators of wasabi fields to be shared by several people, and one that manages several wasabi fields through rotations of several groups.

In the bidding system, joint owners participate and make a bid at fixed intervals (about once every 10 years), and the person who makes the highest bid gets the rights to cultivate the plot. The person who became the cultivator can keep all earnings from the wasabi field to him or herself. Wasabi field repair management is also carried out by the cultivator, but if a large natural disaster occurs, all joint owners cooperate to repair the damage. The money that was bid is distributed equally among all joint owners.

For the rotation system, wasabi fields that are shared by a group organized in a village settlement in the region are split into several blocks, and small groups of three to six members rotate the blocks they manage at fixed intervals (Fig. 17). In doing so, the advantages and disadvantages of water, sunlight, and other site conditions are balanced out. Within the groups, water managers, and other responsible roles are decided periodically, but planting and harvesting are carried out jointly, and the earnings are distributed evenly.

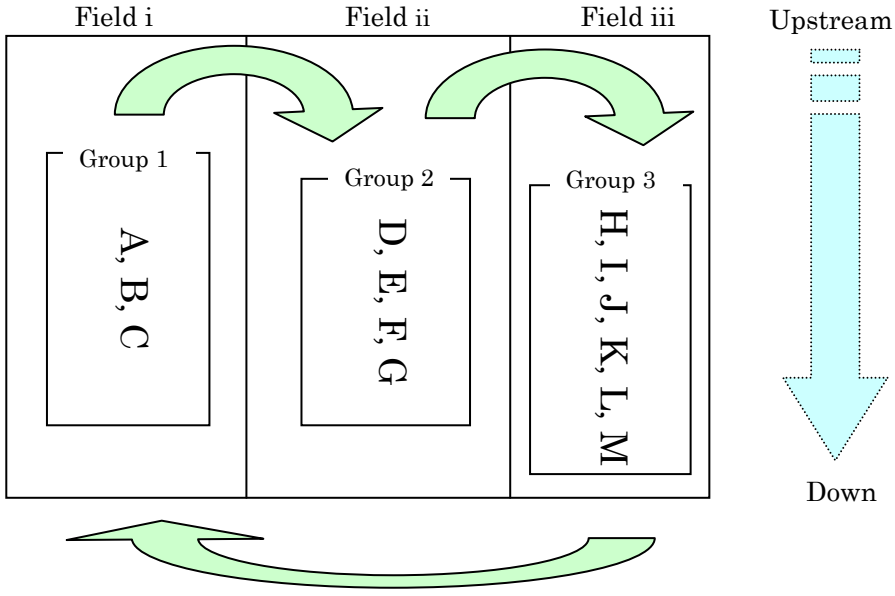


Fig. 17 Schematic Diagram of Rotation System

Because the rotation system has all joint owners doing the work, it is more difficult to maintain the system in comparison with the bidding system, but the reason that the rotation system is still in use in some places, even today, is that a community is formed within the group, making it possible to transmit techniques and knowledge, and to work together to repair damage from disasters. By

managing the group jointly, they protect a limited resource, and the groups also act to preserve the surrounding environment.

<Other Joint Management Systems>

In Higashiizu Town, organizations called "property wards*" continuously manage shared wasabi fields that have been passed down through the generations through group work by local residents and distribute the earnings. This system not only functions to distribute revenue, but also fulfills the social function of keeping the wasabi fields and their surroundings in good condition.

Besides this system, in recent years, the subsidy by national government have been used in low uplands and other areas, and producers work together to repair work roads around the wasabi fields and install monorails for transportation. In this way, joint management systems fit the production conditions of each region.

d. Transmission of Skills

Producers have a strong awareness of the wasabi fields as precious assets that have been passed down from their ancestors. Building and managing techniques for wasabi fields and wasabi production techniques are passed from parent to child or taught to successors through regional cooperative bodies.

In wasabi fields, unwanted substances like leaves and garbage generally build up over the course of approximately 30 years, during which time drainage declines, and it becomes necessary to remove the surface soil and rubble layers and wash off the large stones underneath. On these occasions, field resetting techniques are passed on. However, in recent years, wash water pumps have been used when the wasabi are transplanted, making it possible to clean out unwanted substances that have built up in the surface soil layer. Because of this, there is less of a need for large-scale resetting of fields; however, it has become difficult to pass down the techniques for doing so.

* One of the ownership forms of communal forest in Japan. (Saito,Haruo,2011)

Therefore, when the opportunity arises to repair or reset wasabi fields because of natural disasters, young producers in the region proactively take part in the work, allowing the techniques to be passed on. Additionally, some regions hold workshops for passing on the "Tatamiishi style" wasabi field resetting techniques, and these efforts transmit the techniques (Photo 51).

Photo 51　Wasabi Field Resetting Workshop

In addition, young producers belonging to wasabi producer cooperatives in the region have wasabi fields that they manage jointly called "wasabi research fields," that they use to demonstrate the techniques and grow the cultivars and strains of the region.

Wasabi Branch, Izu Agricultural Research Center also provides technical support.

Furthermore, Izu City producers have been active in spreading Japanese wasabi field creation techniques. Starting in 1965, they have gone out to other parts of the country to coach others and have played an important role in the development of wasabi cultivation in Japan.

e. Establishment and Development of Wasabi Production Organizations

The forests of the Mt. Amagi range that presently hold many wasabi fields of the Izu area were shogunate (government) territory in the Edo period. The impetus for the spread of wasabi cultivation in this region was that the mountain sides (elevation 400 -600 m) became commons for local villages in the first half of the 18th century.

In return for providing the shogunate with a labor force for logging and planting Japanese cedar, the villagers were permitted to cut and keep small trees and undergrowth, as well as build and cultivate wasabi fields.

Because this land was well suited for wasabi cultivation, the cultivation eventually spread, and organizations called "wasabi circles," consisting of influential people in the region, were formed in each settlement. The "wasabi circles" developed wasabi fields and distributed them to villagers and also worked on shipping wasabi to Edo and negotiating sales with merchants. These were organizations that were central to promoting wasabi production.

With the start of the Meiji period, various reforms were advanced by the government, and it became difficult for the existing organizations to respond to

issues, such as the release of wasabi fields and issues related to cultivation and shipping. In 1890, the Omi Wasabi Cooperative was inaugurated in Nakaizu, and in 1926, the Kamikano Wasabi Industry Cooperative was inaugurated in Amagi Yugashima, and along with tackling a variety of problems, they led the way for producer cooperatives in other regions.

These organizations, which worked to liberate the wasabi fields in 1889 and 1890, became a huge driving force positioning wasabi fields as farmland. They developed into each region's producer cooperative that responded to Meiji era reforms, such as the agricultural administration reforms and the industrial revolution.

Furthermore, Shizuoka Wasabi Association was created in 1925, which would later be succeeded by Shizuoka Wasabi Union Federation. This association transformed into a stronger producer cooperative and led the way for the wasabi industry in Japan by contributing to the start of the National Wasabi Producer Association, established in 1967 (Table 12).

Table 12 Establishment of and Changes to Wasabi Production Organizations in the Izu Region

Period	Organization Establishments and Changes
1714	-Part of the shogunate territory in the Mt. Amagi range becomes village commons in Nakaizu District, Izu City (managed by the village)
1744	-Itagaki Kanshiro plants wasabi in Yugashima Village, Izu City -Wasabi cultivation determined possible and cultivation begins in Nakaizu District village commons as well ↓
Early 19th century – 1805, 1807	-"Wasabi circles" form at the village level for the above regions -Official permission granted for wasabi cultivation in Yugashima Village and Nakaizu District villages -"Wasabi circles" apply to borrow shogunate territory, develop wasabi fields, and distribute the fields to villagers ↓ -"Wasabi circles" work on shipping to Edo and negotiate sales with merchants, become central organizations in wasabi production
1889-1890	-Farmland reform by the Meiji government begins⇒Because of pressure by producer groups, some wasabi fields are able to be sold to private citizens
1890	-Omi Wasabi Industry Cooperative established (present day Nakaizu) (147 participants)
1925	- Shizuoka Wasabi Association established
1926	-Kamikarino Wasabi Industry Cooperative Established (present day Amagi Yugashima)
1960	- Shizuoka Wasabi Union Federation established
1967	- Shizuoka Wasabi Union Federation works on the establishment of the National Wasabi Producer Association

f. Associations Working to Promote Production and Expand Consumption

< Shizuoka Wasabi Union Federation >

The Shizuoka Wasabi Union Federation (SWUF) aim to promote wasabi production in the Shizuoka Prefecture, spread techniques and knowledge about wasabi, and contribute to its expansion around the world. It is a private organization that was founded as the Shizuoka Wasabi Association in 1925, and although its activities were temporarily canceled by the war, it resumed after the war, and reorganized in April of 1960, taking on the current title. As of 2017, eight wasabi cooperatives in the prefecture participate in this organization, which has 514 wasabi producer members, roughly 80% of the total number of producers in the prefecture.

In 2001, SWUF created the mascot "Wasabi no Sabi-chan," for promoting Wasabi. The Federation has continuously conducted a campaign using the mascot with the goal of expanding wasabi consumption. The Federation also proposed wasabi for certification by the prefecture for the "Shizuoka Gourmet Selection," products that have value and distinction as points of pride nationally and internationally, from among Shizuoka Prefecture's agricultural, forestry, and fisheries products. Wasabi was certified in 2011, and the federation proactively promoted the branding of this product (Photo 52, 53).

Photo 52 "Wasabi no Sabi-chan" Character Popular at Events

Photo 53 Shizuoka Gourmet Selection Certified Wasabi

SWUF promotes the interaction of producers in the Shizuoka and Izu regions through the following activities, and together, they promote the production of wasabi and distribution of knowledge and technology.

- Information exchange meetings by representatives of each region.
- Mutual observation of production sites.
- Exchange of excellent cultivars and strains.
- Workshops on seedling nursery techniques.

・Mutual exchange of trainees between cultivation regions.
・Joint wasabi Public Relations for consumers by young producers.

It also encouraged wasabi producers around the country to establish the "National Wasabi Producer Association" in 1967. As of 2016, 12 prefectures and 1094 wasabi producers belonged to the association.

Since 1986, the "National Wasabi Competition" has been in place based on a proposal by Shizuoka Wasabi Union Federation, and along with being conducive to raising the quality of wasabi, it leads the way for wasabi production nationwide by promoting wasabi production in Shizuoka Prefecture and the rest of Japan, through the exchange of information and sharing of techniques.

<JA Wasabi Cooperative Sales Committee>

Wasabi sales were conventionally often shipped by individual producers, but with the goal of stable shipping, cooperative sales committees have been organized at Japan Agricultural Cooperatives (JA) in each district in recent years, and they are increasing market competitiveness by shipping together (Table 13).

Table 13　JA Wasabi Cooperative Sales Committee List

Organization Name	Region
JA Izu Taiyo Maruto Wasabi Cooperative Sales Committee	towns of Higashiizu and Kawazu
JA Izu Taiyo Chuseibu Wasabi Cooperative Sales Committee	Shimoda City, towns of Matsuzaki and Nishiizu
JA Izu no Kuni Wasabi Cooperative Sales Committee	Izu City
JA Shizuoka-shi Wasabi Cooperative Sales Committee	Shizuoka City Aoi District

<New Initiatives>

Securing superior seedlings that have not contracted viruses is an important topic for maintaining and improving the production of wasabi. To that end, a sympathetic producer belonging to the Abe Wasabi Industry Cooperative founded a company in 2016 and established a facility for propagating seedlings made by tissue culture. This leading initiative has garnered attention from other regions as well, and is expected to spread in the future.

g. Using Wasabi in School Education

<Food and Agriculture Education at Local Elementary Schools>

Elementary schools in the proposed region used to have their own wasabi fields and in some cases, had wasabi cultivation as a part of education. Today, as a part of

food and agriculture education, wasabi planting and harvesting lessons for local elementary school children are held in cooperation with local agricultural cooperatives and producer cooperatives. These initiatives strive to deepen appreciation for special local products (Photo 54).


Photo 54 Wasabi Planting and Harvesting Lessons for Local Elementary School Students

<Wasabi-Themed High School Education>

Many young wasabi producers are enrolled at the Shizuoka Prefectural Tagata Agricultural High School near the proposed region, and there are many companies for wasabi-related food products in the surrounding cities and towns. Making use of this, training in shoot tip cultures, germination, raising seedlings, and processing for the local special product of wasabi makes for distinctive classes. In "Issue-Based Research," a long-term initiative, continuous activities are carried out, such as conducting research in groups on the biodiversity of wasabi fields and passing the information on to underclassmen. These activities are led by experts such as the Izu Agricultural Center researchers and curators at the Shizuoka Museum of Natural and Environmental History, and collaborations are also cooperatively developed with wasabi producers from the Shizuoka Wasabi Union Federation (Photo 55, 56).

Photo 55 Wasabi Field Environmental Survey Conducted by Agricultural High School Students

Photo 56 Wasabi Culturing Practice at an Agricultural High School

At that school's festival, students present their research results and conduct consumer awareness surveys on wasabi in connection with the Shizuoka Wasabi Union Federation; in this way, the students engage in activities for expanding consumption.

(5) Landscapes and Seascapes Features

a. Landscapes and the Effective Use of Water Resources

The proposed region has abundant rainfall in the mountains, resulting in numerous dense forests and plentiful springs.

For these mountainous areas, which had always been in a heavy rainfall disaster zone, water is both a symbol of nature to be embrace with a sense of reverence, and also a precious resource that is indispensable to the agricultural production of wasabi and tea, as well as wetland rice cultivation in downstream areas.

Aside from wasabi, this region produces shiitake mushrooms, tea, and wetland rice in places with good sunlight. The establishment of this kind of land use made it possible for people to settle in these mountainous areas, where other industries are difficult to start.

The wasabi fields of the proposed region use large and small rocks, pebbles, and sand from the area as materials, and create terraced fields that make use of the natural, sloping terrain. After experiencing numerous natural disasters, they have achieved a construction that is stable and resilient against disaster.

"Tatamiishi style" wasabi fields made in terrace formations slow down the flow of water, and the flowing water is reused as it enters each downstream field in turn. The reuse of water is made possible by the fact that wasabi cultivation uses as little fertilizer and agricultural chemical agents as possible, and the wasabi fields have excellent purifying effects on the water, such that it is possible for the water to stably deliver oxygen and nutrients to the interior of the wasabi field. For this reason, the water that is eventually discharged into rivers is also used downstream for raising freshwater fish and for farming; in the end, the water flows into the Pacific Ocean (Photo 57).

Photo 57 Clear Stream Flowing through a Wasabi Field

Because the water in wasabi fields flows through several fields, management of the water is a joint effort. Water source environment management, such as cutting grass in the surrounding area, water level adjustments during typhoons and heavy rain, and cleaning of waterways are all done by group effort. To prevent forest vegetation changes upstream because of damage by deer that negatively affect the water source, the people protect the forests and plant trees and work to conserve a stable environment for the water.

In this way, people in the proposed area preserve the forests that foster the sources of water so that they can pass down traditional wasabi cultivation and maintain the wasabi fields; surely, the forests cultivate wasabi, and wasabi cultivates the forests.

b. Beautiful Landscape of Wasabi Fields and the Surrounding Areas

Through over 400 years of continuous wasabi cultivation, the wasabi fields extend alongside valleys, surrounded by and merging into the forests. They form villages near mountains together with tea farms and wetland rice in the area, creating superb farm village scenery that shows different expressions with each change of season; this is one of the model scenes of mountainous regions.

Among these, the wasabi fields in the Ikadaba District of Izu city have plentiful water from the Mt. Amagi range and relatively spacious land around the rivers, and the wasabi fields that extend all across the land deep in the mountains produce a magnificent view. This scenery has also been selected as one of the "10 Agricultural Terraces in Shizuoka Prefecture."

East Asian Alder trees planted to give shade in the summer take nothing away from the surrounding wasabi field views, helping the fields blend into nature, and their foliage is exquisite in autumn.

Because wasabi can be permanently planted or harvested in any season, wasabi at different stages of growth intermingle with one another. Because many crops are grown in the same designated season in Japan, wasabi fields with crops at all stages of growth are a unique sight.

In spring, the trees in the mountains start to sprout, white flowers bloom on the wasabi, and their growth is full of vim and vigor. In winter, in a world concealed by silvery mountains covered in snow, only the wasabi fields continue their fresh, lively growth. This sight has a magical beauty that makes one forget even the sound of the flowing water (Photo 58).

Spring

Summer

Autumn

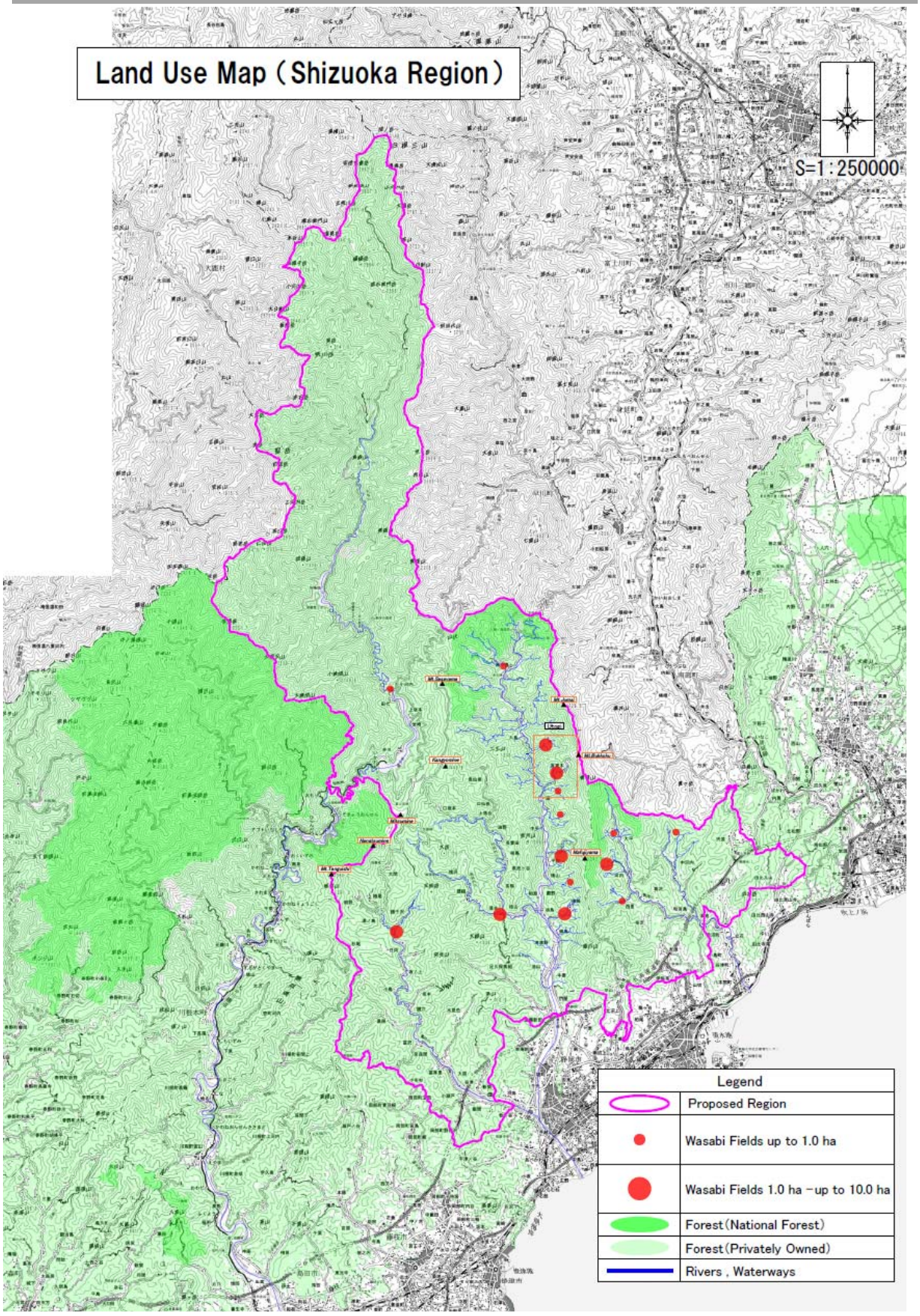
Winter

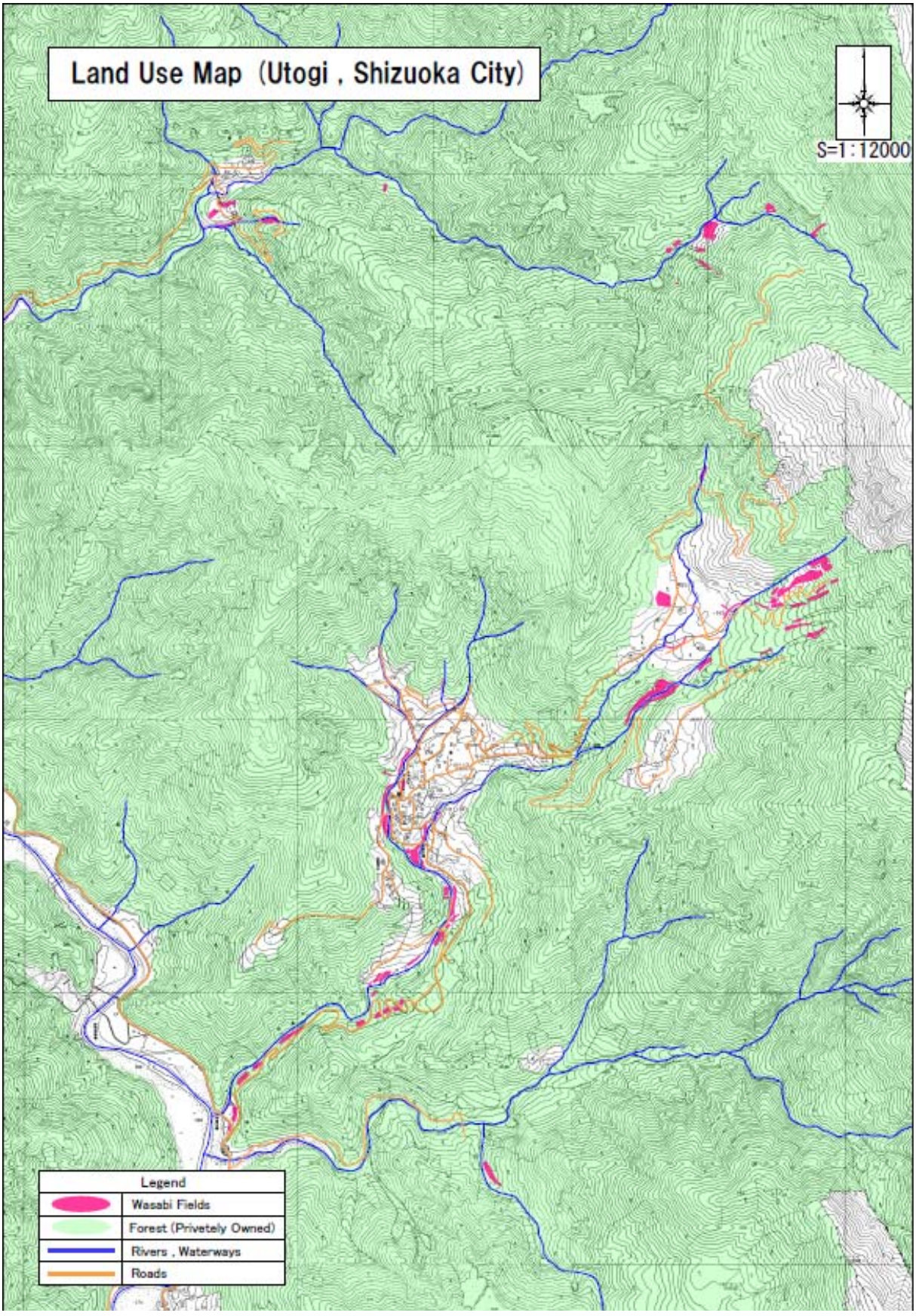
Photo 58　Wasabi Fields Through the Seasons

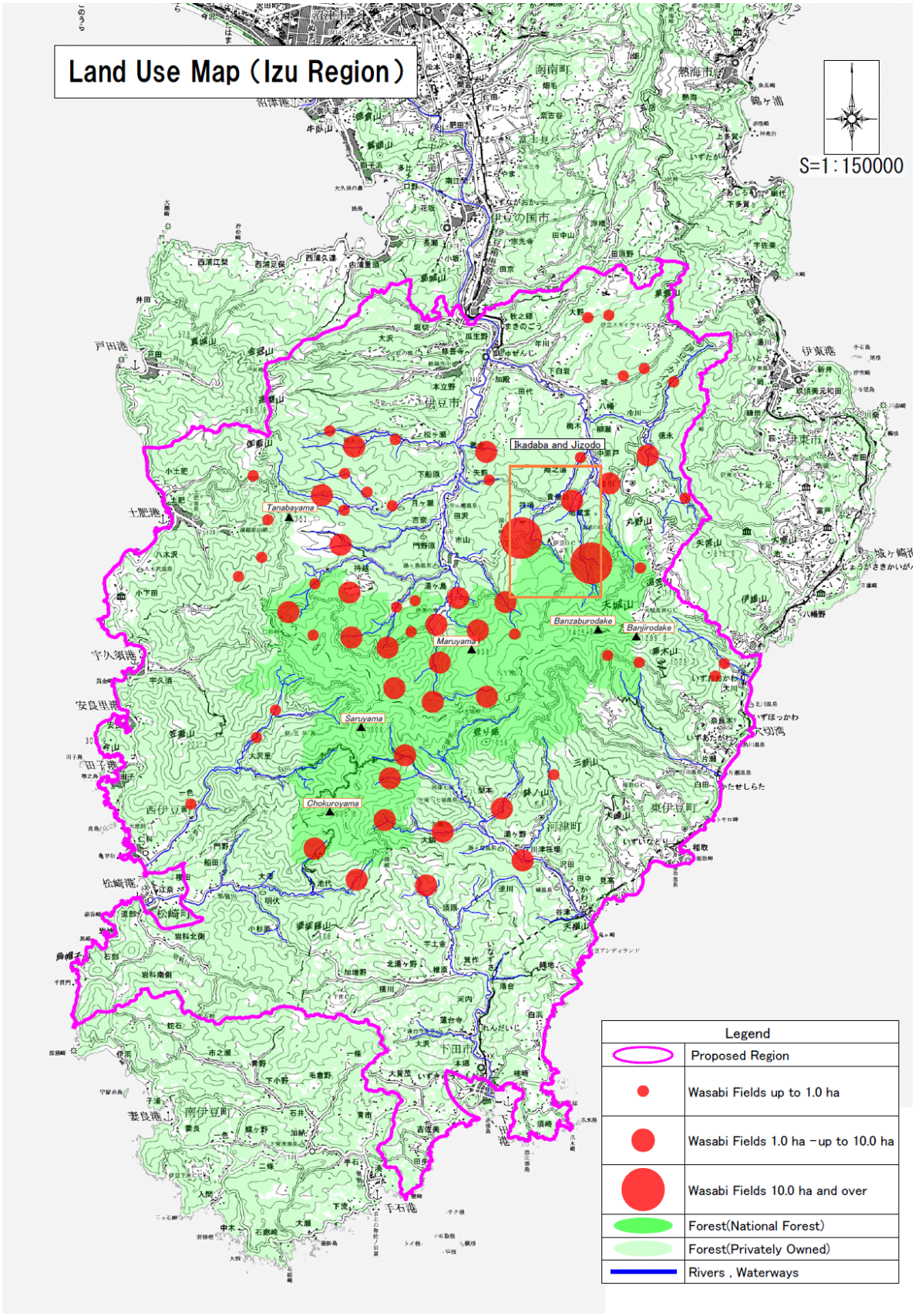
In the wasabi field areas, where biodiversity is preserved, dwell threatened species like the Japanese clawed salamander, as well as fireflies and many types of dragonflies. Ferns and many other plants grow, and all can be seen at the wasabi fields.

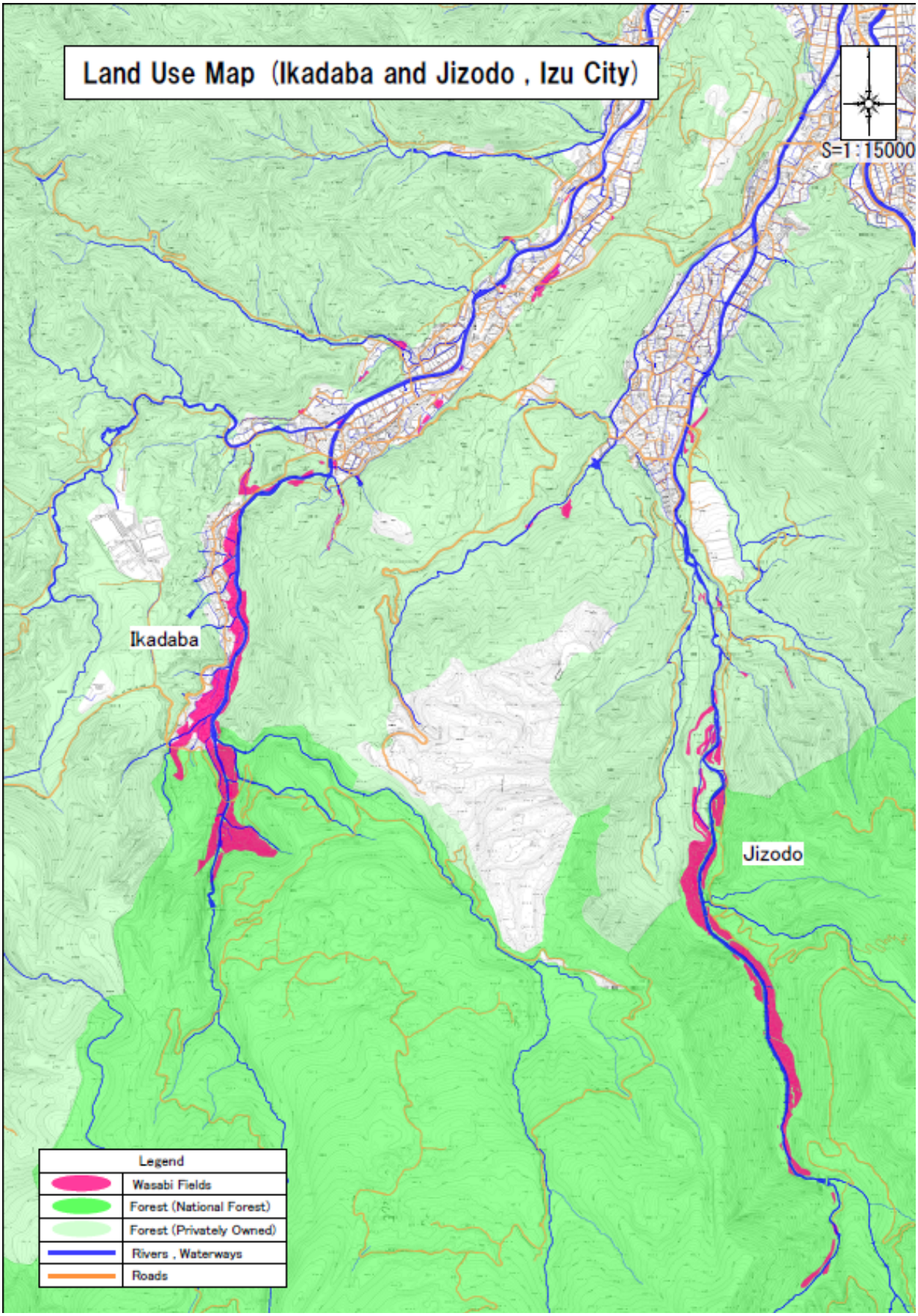
The wasabi fields of Izu City, which have such beautiful scenery, are being noticed as regional tourist attractions, including harvest experiences led by farmers and guided tours led by local volunteers.

Attachments




Land Use Map (Utogi , Shizuoka City)
S=1:12000
Legend
Wasabi Fields
Forest (Privetely Owned)
Rivers , Waterways
Roads


Land Use Map (Izu Region)
S=1:150000
Ikadaba and Jizodo
Tanabayama
Maruyama
Saruyama
Chokuroyama
Banzaburodake
Banjirodake
Legend
Proposed Region
Wasabi Fields up to 1.0 ha
Wasabi Fields 1.0 ha -up to 10.0 ha
Wasabi Fields 10.0 ha and over
Forest(National Forest)
Forest(Privately Owned)
Rivers , Waterways


Land Use Map (Ikadaba and Jizodo , Izu City)
S=1:15000
Ikadaba
Jizodo
Legend
Wasabi Fields
Forest (National Forest)
Forest (Privately Owned)
Rivers , Waterways
Roads

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<Statistical Data>

(1) Wasabi Cultivation Area (Unit: ha)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Proposed Region	136	133	126	124	121	120	121	121	123	114
Japan	300	251	245	245	270	199	229	242	349	287

Data: Forestry Agency Data, Shizuoka Prefecture
(rounded to first decimal place)

(2) Wasabi Stem Production Quantity (Unit: t)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Proposed Region	288	280	280	269	227	228	216	216	216	228
Japan	841	676	692	681	1299	577	529	555	525	510

Data: Forestry Agency Data, Shizuoka Prefecture
(rounded to first decimal place)

(3) Wasabi Production Value (Unit: 100 million yen)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Proposed Region	24	24	25	25	25	26	30	32	36	33
Japan	39	35	34	33	33	34	40	41	49	47

Data: Production Agriculture Income Statistics (Ministry of Agriculture, Forestry and Fisheries) Nationwide produce value does not include prefectures with values under ¥100 million.

(4) Top 10 Cities Handling Quantity (2015) (Unit: t)

	Sapporo	Tokyo	Yokohama	Nagoya	Kanazawa	Kyoto	Osaka Central	Osaka East	Tokyo Growth	Osaka Growth
Proposed Region	1.2	117.5	7.5	9.1	7.4	9.7	33.4	2.7	26.5	5.0
Japan	17.2	123.9	9.4	10.6	8.0	10.9	36.6	2.7	30.0	5.1

Data: Yearly Report for Each City, 2015

(5) Tokyo Central Wholesale Market Value (Unit: ¥/kg)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Produced in Shizuoka	5,399	5,476	5,157	4,335	4,513	5,193	5,865	6,265	7,413	6,555
Excluding Shizuoka Production	2,392	2,367	2,822	2,906	2,988	3,248	3,577	4,929	6,163	5,519
National Average	4,693	4,164	4,697	4,105	4,257	4,847	5,525	6,212	7,353	6,502

Data: Market Statistical Information (Tokyo Central Wholesale Market)

(6) Wasabi Farmer Population (Unit: Households)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Proposed Region	617	616	623	592	611	576	564	593	592	569

Data: Shizuoka Prefecture Survey

<Proposed Region Biodiversity List>

【Plants】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Woodsiaceae	Ruriderainu warabi	*Athyrium wardii (Hook.) Makino var. inadae Tagawa*		Endangered
Dryopteridaceae	Otokoshida	*Arachniodes assamica (Kuhn) Ohwi*		Endangered
Araceae	Shikoku hirohaten nansho	*Arisaema longipedunculatum M. Hotta*		Endangered
Apiaceae	Fukiya mitsuba	*Sanicula tuberculata Maxim.*	Vulnerable	Endangered
Aspleniaceae	Kamigamoshida	*Asplenium oligophlebium Baker*		Endangered
Thelypteridaceae	Tachihime warabi	*Thelypteris bukoensis (Tagawa) Ching*		Endangered
Orchidaceae	Tokiso	*Pogonia japonica Reichb. fil.*	Near Threatened	Endangered
	Nayotenma	*Gastrodia gracilis Blume*		Endangered
	Fugakusu zumushiso	*Liparis fujisanensis F. Maek.*	Vulnerable	Endangered
Iridaceae	Kakitsubata	*Iris laevigata Fisch.*	Near Threatened	Vulnerable
Woodsiaceae	Iyo kujaku	*Diplazium okudairae Makino*		Vulnerable
	Iwa yashida	*Diplazium cavalerianum (Christ) M. Kato*		Vulnerable
	Nisekokumo kujaku	*Diplazium virescens Kunze var. conterminum (Christ) Kurata*		Vulnerable
Aristolochiaceae	Amagikan aoi	*Heterotropa muramatsui (Makino) F. Maek.*	Vulnerable	Vulnerable
Dryopteridaceae	Ibu yabusotetsu	*Cyrtomium fortunei J. Sm. var. atropunctatum (Kurata) K. Iwats.*		Vulnerable
	Tsukushi yabusotetsu	*Cyrtomium macrophyllum (Makino) Tagawa var. tukusicola (Tagawa) Tagawa*		Vulnerable
	Hiroha yabusotetsu	*Cyrtomium macrophyllum (Makino) Tagawa var. macrophyllum*		Vulnerable
Campanulaceae	Kikyo	*Platycodon grandiflorum (Jacq.) A. DC.*	Vulnerable	Vulnerable
Asteraceae	Akino hahakogusa	*Gnaphalium hypoleucum DC.*		Vulnerable
Ranunculaceae	Hakone shirokaneso	*Dichocarpum hakonense (F. Maek. et Tuyama) W. T. Wang et Hsiao*	Near Threatened	Vulnerable
Dennstaedtiaceae	Yunomine shida	*Histiopteris incisa (Thunb.) J. Sm.*		Vulnerable
Scrophulariaceae	Izu kogomegusa	*Euphrasia insignis Wettst. ssp. iinumai (Takeda) Yamazaki var. idzuensis (Takeda) Yamazaki*		Vulnerable
Vittariaceae	Takimi shida	*Antrophyum obovatum Baker*		Vulnerable
	Nakami shishiran	*Vittaria fudzinoi Makino*		Vulnerable
Lamiaceae	Himehakka	*Mentha japonica (Miq.) Makino*	Near Threatened	Vulnerable
Osmundaceae	Shiroyama zenmai	*Osmunda banksiifolia (Pr.) Kuhn*		Vulnerable
Lentibulariaceae	Tanukimo	*Utricularia vulgaris L. var. japonica (Makino) Tamura*	Near Threatened	Vulnerable
	Murasaki mimikakigusa	*Utricularia yakusimensis Masam.*	Near Threatened	Vulnerable
Aspleniaceae	Hinoki shida	*Asplenium prolongatum Hook.*		Vulnerable
Balanophoraceae	Miyama tsuchitorimochi	*Balanophora nipponica Makino*	Vulnerable	Vulnerable
Ericaceae	Kyomaru shakunage	*Rhododendron degronianum Carr. ssp.heptamerum(Maxim.) Hara var. kyomaruense (Yamazaki) Hara*	Vulnerable	Vulnerable
Caryophyllaceae	Obiranji	*Silene keiskei Miq.*	Near Threatened	Vulnerable
Lycopodiaceae	Sugiran	*Lycopodium cryptomerinum Maxim.*	Vulnerable	Vulnerable
Crassulaceae	Matsunoha mannengusa	*Sedum hakonense Makino*	Vulnerable	Vulnerable
Psilotaceae	Matsubaran	*Psilotum nudum (L.) Beauv.*	Near Threatened	Vulnerable
Fabaceae	Miyama tobera	*Euchresta japonica Hook. fil. ex Regel*		Vulnerable
Dioscoreaceae	Izudokoro	*Dioscorea izuensis Akahori*	Vulnerable	Vulnerable
Saxifragaceae	Yashabishaku	*Ribes ambiguum Maxim.*	Near Threatened	Vulnerable
Liliaceae	Chabo hototogisu	*Tricyrtis nana Yatabe*		Vulnerable
Orchidaceae	Onoeran	*Orchis fauriei Finet*		Vulnerable
	Kibanano shokiran	*Yoania amagiensis Nakai et F. Maek.*		Vulnerable
	Kumagaiso	*Cypripedium japonicum Thunb.*	Vulnerable	Vulnerable
	Natsu ebine	*Calanthe reflexa Maxim.*	Vulnerable	Vulnerable
	Mizu chidori	*Platanthera hologlottis Maxim.*		Vulnerable

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Onagraceae	Usuge chojitate	*Ludwigia greatrexii Hara*	Near Threatened	Near Threatened
Aristolochiaceae	Otome aoi	*Heterotropa savatieri (Franch.) F. Maek.*	Near Threatened	Near Threatened
Asclepiadacea	Suzusaiko	*Cynanchum paniculatum (Bunge) Kitag.*	Near Threatened	Near Threatened
Asteraceae	Izu kanikomori	*Cacalia amagiensis Kitam.*	Vulnerable	Near Threatened
	Izu hahako	*Conyza japonica (Thunb.) Less.*		Near Threatened
	Kawara nigana	*Ixeris tamagawaensis (Makino) Kitam.*	Near Threatened	Near Threatened
	Tateyamagiku	*Aster dimorphophyllus Franch. et Savat.*		Near Threatened
Scrophulariaceae	Inuno fuguri	*Veronica didyma Tenore var. lilacina (Hara) Yamazaki*	Vulnerable	Near Threatened
	Ohiki yomogi	*Siphonostegia laeta S. Moore*	Vulnerable	Near Threatened
Thymelaeaceae	Sakura ganpi	*Diplomorpha pauciflora (Franch. et Savat.) Nakai*	Vulnerable	Near Threatened
Nymphaeaceae	Junsai	*Brasenia schreberi J. F. Gmel.*		Near Threatened
Ericaceae	Amagi shankunage	*Rhododendron degronianum Carr. ssp. heptamerum (Maxim.) Hara var. kyomaruense (Yamazaki) Hara f. amagianum (Yamazaki) Hara*		Near Threatened
	Amagi tsutsuji	*Rhododendron amagianum Makino*		Near Threatened
	Hakonekome tsutsuji	*Tsusiophyllum tanakae Maxim.*	Vulnerable	Near Threatened
Solanaceae	Aoho ozuki	*Physaliastrum savatieri (Makino) Makino*		Near Threatened
Rosaceae	Sansho bara	*Rosa hirtula (Regel) Nakai*	Vulnerable	Near Threatened
Crassulaceae	Tsume renge	*Orostachys japonicus (Maxim.) Berger*	Near Threatened	Near Threatened
Paeoniaceae	Yama shakuyaku	*Paeonia japonica (Makino) Miyabe et Takeda*	Near Threatened	Near Threatened
Orchidaceae	Ebine	*Calanthe discolor Lindl.*	Near Threatened	Near Threatened
	Sekkoku	*Dendrobium moniliforme (L.) Sw.*		Near Threatened
	Tashiroran	*Epipogium roseum (D. Don) Lindl.*	Near Threatened	Near Threatened
	Mugiran	*Bulbophyllum inconspicuum Maxim.*	Near Threatened	Near Threatened
Blechnaceae	Haikomochi shida	*Woodwardia unigemmata (Makino) Nakai*		Distribution under observation
Aspleniaceae	Hayama shida	*Asplenium × shikokianum Makino*		Distribution under observation
Ericaceae	Unzen tsutsuji	*Rhododendron serpyllifolium (A. Gray) Miq.*		Distribution under observation
Celastraceae	Mokureishi	*Microtropis japonica (Franch. et Savat.) H. Hallier*		Distribution under observation
Orobanchaceae	Kiyosumi utsubo	*Phacellanthus tubiflorus Sieb. et Zucc.*		Sectional observation
Woodsiaceae	Iwainu warabi	*Athyrium nikkoense Makino*		Sectional observation
	Usubami yamanokogiri shida	*Diplazium mettenianum (Miq.) C. Chr. var. tenuifolium Kurata*		Sectional observation
Polypodiaceae	Aone kazura	*Polypodium niponicum Mett.*		Sectional observation
Dryopteridaceae	Nukaitachi shida modoki	*Dryopteris indusiata (Makino) Makino et Yamam. ex. Yamam.*		Sectional observation
Cyperaceae	Komatsukasa susuki	*Scirpus fuirenoides Maxim.*		Sectional observation
Campanulaceae	Iwa shajin	*Adenophora takedae Makino*		Sectional observation
Lauraceae	Baribari no ki	*Litsea acuminata (Blume) Kurata*		Sectional observation

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Hymenophyllaceae	Ohai horakoge	*Crepidomanes radicans (Sw.) K. Iwats. var. naseanum (Christ) K. Iwats.*		Sectional observation
Araceae	Mitsuba tennansho	*Arisaema ternatipartitum Makino*		Sectional observation
Lamiaceae	Onaga tatsunamiso	*Scutellaria maekawae Hara*		Sectional observation
Aspleniaceae	Kotaniwatari	*Asplenium scolopendrium L.*		Sectional observation
Thelypteridaceae	Mizo shidamodoki	*Thelypteris omeiensis (Bak.) Ching*		Sectional observation
Liliaceae	Amana	*Amana edulis (Miq.) Honda*		Sectional observation
Orchidaceae	Shusuran	*Cymbidium goeringii (Reichb. fil.) Reichb. fil.*		Sectional observation
	Hitotsubokuro	*Tipularia japonica Matsum.*		Sectional observation
	Beni shusuran	*Goodyera macrantha Maxim.*		Sectional observation

【Mammals】

Family	Species		Red List	
	Japanese Name	*Ministry of the Environment*	Ministry of the Environment	Shizuoka Prefecture
Cercopithecidae	Nihon zaru (Atatmi and Izu region population)	*Macaca fuscata (Blyth,1875)*		Threatened Local Population
Ursidae	Tsukinowaguma (Fuji region population)	*Selenarctos thibetanus (Cuvier,1823)*		Threatened Local Population
Vespertilionidae	Yubinaga komori	*Miniopterus fuliginosus (Hodgson,1835)*		Vulnerable
	Momojiro komori	*Myotis macrodactylus (Temminck,1840)*		Vulnerable
Rhinolophidae	Kikugashira komori	*Rhinolophus ferrumequinum (Schreber,1774)*		Near Threatened
	Kokikugashira komori	*Rhinolophus cornutus Temminck,1835*		Near Threatened
Soricidae	Kawa nezumi	*Chimarrogale platycephala (Temminck,1842)*		Near Threatened
Muridae	Kaya nezumi	*Micromys minutus (Pallas,1771)*		Near Threatened
Sciuridae	Musasabi	*Petaurista leucogenys (Temminck,1827)*		Near Threatened
Vespertilionidae	Tengu komori	*Murina leucogaster Milne-Edwards,1872)*		Data Deficient
Gliridae	Yamane	*Glirulus japonicus (Schinz,1845)*		Data Deficient
Sciuridae	Nihon momonga	*Pteromys momonga Temminck,1844*		Data Deficient
Sciuridae	Nihon risu	*Sciurus lis Temminck,1844*		Sectional observation

【Birds】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Accipitridae	Inuwashi	*Aquila chrysaetos (Linnaeus, 1758)*	Endangered	Critically Endangered
Ardeidae	Mizogoi	*Gorsachius goisagi (Temminck, 1835)*	Vulnerable	Endangered
Alcedinidae	Aka shobin	*Halcyon coromanda (Latham, 1790)*		Endangered
Alcedinidae	Yamasemi	*Ceryle lugubris (Temminck, 1834)*		Vulnerable
Accipitridae	Kumataka	*Spizaetus nipalensis (Hodgson, 1836)*	Endangered	Vulnerable
	Haitaka	*Accipiter nisus (Linnaeus, 1758)*	Near Threatened	Vulnerable
	Hachikuma	*Pernis apivorus (Linnaeus, 1758)*	Near Threatened	Vulnerable
	Otaka	*Accipiter gentilis (Linnaeus, 1758)*	Near Threatened	Vulnerable
	Sashiba	*Butastur indicus (Gmelin, 1788)*	Vulnerable	Vulnerable
Strigidae	Aobazuku	*Ninox scutulata (Raffles, 1822)*		Vulnerable
Caprimulgidae	Yotaka	*Caprimulgus indicus Latham, 1790*	Near Threatened	Vulnerable
Falconidae	Hayabusa	*Falco peregrinus Tunstall, 1771*	Vulnerable	Vulnerable
Phasianidae	Yamadori	*Syrmaticus soemmerringii (Temminck, 1830)*		Near Threatened
Charadriidae	Ikaruchidori	*Charadrius placidus J.E. & G.R. Gray, 1863*		Near Threatened
Strigidae	Fukuro	*Strix uralensis Pallas, 1771*		Near Threatened
Monarchidae	Sankocho	*Terpsiphone atrocaudata (Eyton, 1839)*		Near Threatened
Picidae	Oakagera	*Dendrocopos leucotos (Bechstein, 1803)*		Near Threatened
Strigidae	Okonohazuku	*Otus lempiji (Horsfield, 1821)*		Data Deficient
Accipitridae	Misago	*Pandion haliaetus (Linnaeus, 1758)*	Near Threatened	Sectional observation

【Reptiles】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Scincidae	Nihon tokage	*Eumeces japonicus Peters, 1864*		Distribution under observation
	Okada tokage	*Eumeces latiscutatus (Hallowell, 1861)*		Distribution under observation

【Amphibians】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Hynobiidae	Hakone sansho ou	*Eumeces japonicus Peters, 1864*		Vulnerable
	Hida sansho-ou	*Eumeces latiscutatus (Hallowell, 1861)*	Near Threatened	Vulnerable
Rhacophoridae	Kajika gaeru	*Buergeria buergeri (Schlegel, 1838)*		Near Threatened
	Moriao gaeru	*Rhacophorus arboreus (Okada et Kawano, 1924)*		Near Threatened
	Nagaretago gaeru	*Rana sakuraii Matsui et Matsui, 1990*		Data Deficient
	Tonosama gaeru	*Rana nigromaculata Hallowell, 1861*	Near Threatened	Sectional observation
Bufonidae	Azumahiki gaeru	*Bufo japonicus formosus Boulenger, 1883*		Sectional observation

【Freshwater Fish】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Amblycipitidae	Akaza	*Liobagrus reini Hilgendorf, 1878*	Vulnerable	Endangered
Cottidae	Utsusemi kajika	*Cottus reinii Hilgendorf, 1879*		Vulnerable
Oryziatidae	Medaka	*Oryzias latipes latipes (Temminck & Schlegel, 1846)*		Vulnerable
Cottidae	Kajika	*Cottus pollux Günther, 1873*	Endangered	Near Threatened
Gobiidae	Chichibumodoki	*Eleotris acanthopoma Bleeker,1853*		Sectional observation
	Hinahaze	*Redigobius bikolanus (Herre, 1927)*		Sectional observation
Kuhliidae	Okuchi yugoi	*Kuhlia rupestris (Lacepède, 1802)*		Sectional observation
	Yugoi	*Kuhlia marginata (Cuvier, 1829)*		Sectional observation
Gobiidae	Kawa yoshinobori	*Rhinogobius flumineus (Mizuno, 1960)*		Distribution under observation
Cyprinidae	Kawamutsu	*Zacco temminckii (Temminck & Schlegel, 1846)*		Distribution under observation
	Takahaya	*Phoxinus oxycephalus jouyi (Jordan & Snyder, 1901)*		Distribution under observation
Salmonidae	Amago (Freshwater-only variety) Satsukimasu (sea-run variety)	*Oncorhynchus masou ishikawae Jordan & McGregor, 1925*	Near Threatened	Distribution under observation

【Insects】

Family	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Hesperiidae	Chamadara seseri	*Argyronome ruslana (Motschulsky, 1866)*	Endangered	Endangered
Pieridae	Kumomatsu makicho	*Brenthis daphne rabdia (Butler, 1877)*		Vulnerable
Corduliidae	Hanebiroezo tonbo	*Mortonagrion selenion (Ris, 1916)*	Vulnerable	Vulnerable
Lycaenidae	Uranamiaka shijimi	*Lycaeides subsolanus subsolanus (Eversmann, 1851)*		Vulnerable
	Kuro shijimi	*Japonica saepestriata saepestriata (Hewitson, 1865)*	Endangered	Vulnerable
Nymphalidae	Uranami janome	*Maculinea teleius kazamoto (Druce, 1875)*		Vulnerable
Hesperiidae	Ochabane seseri	*Gonepteryx maxima Butler, 1885*		Vulnerable
Papilionidae	Gifucho	*Luehdorfia japonica (Leech, 1889)*	Vulnerable	Near Threatened
Lycaenidae	Miyama shijimi	*Lycaeides argyrognomon praeterinsularis (Verity, 1921)*	Endangered	Near Threatened
Nymphalidae	Kurohikage modoki	*Lethe marginalis (Motschulsky, 1860)*	Endangered	Near Threatened
Nymphalidae	Omisuji	*Neptis alwina (Bremer & Grey, 1853)*		Near Threatened
Acrididae	Yamato batta	*Epacromius japonicus (Shiraki, 1910)*		Near Threatened
Calopterygidae	Aohada tonbo	*Calopteryx japonica Selys, 1869*		Near Threatened
Libellulidae	Yotsuboshi tonbo	*Libellula quadrimaculata asahinai Schmidt, 1957*		Near Threatened
Lampyridae	Heike botaru	*Luciola lateralis Motschulsky, 1860*		Near Threatened
Tettigoniidae	Amagi sasakiri modoki	*Gibbomeconema odoriko Ishikawa, 1999*		Data Deficient
Gryllidae	O-okame ko-orogi	*Loxoblemmus magnatus Matsuura, 1986 ("1985")*		Data Deficient
Curculionoidae	Babasugehime zomushi	*Limnobaris babai Chûjô et Morimoto, 1959*		Data Deficient
Chrysomelidae	Kinutsuya mizukusa hamushi	*Plateumaris (Euplateumaris) sericea (Linnaeus, 1768)*		Data Deficient
Georyssidae	Shiwamune marudoromushi	*Georissus kurosawai Nakane, 1966*		Data Deficient
Noctuidae	Kubigurokenmon	*Viminia digna (Butler, 1881)*		Data Deficient
Nymphalidae	Omurasaki	*Sasakia charonda charonda (Hewitson, 1863)*	Near Threatened	Sectional observation
Zygaenidae	Okinawa rurichirashi	*Eterusia aedea sugitanii Matsumura,1927*		Sectional observation
Coenagrionidae	Ruriito tonbo	*Enallagma boreale circulatum Selys, 1883*		Sectional observation
Cerambycidae	Togemune arake kamikiri	*Aragea mizunoi Hayashi, 1953*		Sectional observation
Lycaenidae	Fujimidori shijimi	*Sibataniozephyrus fujisanus fujisanus (Matsumura, 1910)*		Sectional observation
Lymantriidae	Torasan dokuga	*Euproctis torasan (Holland, 1889)*	Near Threatened	Sectional observation
Lycaenidae	Onaga shijimi	*Araragi enthea enthea (Janson, 1877)*		Distribution under observation
Nymphalidae	Komurasaki	*Apatura metis substituta Butler, 1873*		Distribution under observation
Hesperiidae	Gin ichimonji seseri	*Leptalina unicolor (Bremer & Grey, 1853)*	Near Threatened	Distribution under observation
	Kokimadara seseri	*Ochlodes venatus venatus (Bremer & Grey, 1853)*		Distribution under observation
Nymphalidae	Hoshi misuji	*Neptis pryeri pryeri Butler, 1871*		Distribution under observation

【Terrestrial and Freshwater Shellfish】

Family Name	Species		Red List	
	Japanese Name	Latin Name	Ministry of the Environment	Shizuoka Prefecture
Helicarionidae	Renzugai	*Otesiopsis japonica (Möllendorff,1885)*	Vulnerable	Endangered
Clausiliidae	Shiibotoru kogiseru	*Phaedusa sieboldtii (Pfeiffer,1846)*		Endangered
	Hana kogiseru	*Pictophaedusa euholostoma (Pilsbry,1901)*	Critically Endangered or Endangered	Endangered
Diplommatinidae	Beni gomagai	*Diplommatina pudica Pilsbry,1902*	Critically Endangered or Endangered	Endangered
Clausiliidae	Tsubakuro iwagiseru	*Mundiphaedusa iijimakuniakii Minato & Habe, 1983*	Vulnerable	Vulnerable
Camaenidae	Minobu maimai	*Satsuma moellendorffiana thaanumi (Pilsbry,1924)*	Vulnerable	Vulnerable
Assimineidae	Yoshida kawazanshogai	*Assiminea yoshidayukioi(Kuroda,1959)*		Vulnerable
Clausiliidae	Otonosama giseru	*Mundiphaedusa rex (Pilsbry,1905)*	Near Threatened	Vulnerable
Camaenidae	Merurendorufu maimai	*Satsuma moellendorffiana (Pilsbry & Hirase,1903)*	Critically Endangered or Endangered	Vulnerable
	Yaseananashi maimai	*Satsuma fausta (Pilsbry,1902)*	Vulnerable	Vulnerable
Clausiliidae	Okugata giseru	*Mundiphaedusa dorcas (Pilsbry,1902)*	Near Threatened	Near Threatened
	Hime giseru	*Vitriphaedusa micropeas (Möllendorff,1882)*		Near Threatened
Helicarionidae	Kasaneshi taragai	*Sitalina insignis (Pilsbry & Hirase,1904)*	Near Threatened	Near Threatened
Succineidae	Nagaoka monoaragai	*Oxyloma hirasei (Pilsbry,1901)*	Near Threatened	Near Threatened
Bradybaenidae	Miyama hidarimaki maimai	*Euhadra scaevola scaevola (Martens,1877)*	Vulnerable	Near Threatened
Planorbidae	Tokyo hiramakigai	*Gyraulus tokyoensis (Mori,1938)*	Data Deficient	Near Threatened
	Hiramaki mizumaimai	*Gyraulus chinensis spirillus Gould,1859*	Data Deficient	Near Threatened
Lymnaeidae	Monoaragai	*Radix auricularia japonica (Jay,1857)*	Near Threatened	Near Threatened

<Survey of Wasabi Field Bio-Diversity (Benthic Organism Survey Results) Conducted August 2017>

No.	Phylum	Class	Order	Family	Japanese Name	Latin Name
1	Platyhelminthes	Rhabditophora	Lecithoepitheliata	Prorhynchidae	Maekuchi kokeuzumushika	PRORHYNCHIDAE
2			Planaria	Dugesiidae	Namiuzumushi	*Dugesia japonica*
3				Planariidae	Miyamauzumushi	*Phagocata vivida*
4	Nemertea	Enopla	Hoplonemertea	Tetrastemmatidae	Mimizuhimomushizoku	*Prostoma sp.*
5	Mollusca	Gastropoda	Neogastropoda	Pleuroceridae	Kawanina	*Semisulcospira libertina*
6				Tateidae	Horaanamijin nina	*Bythinella nipponica*
7			Pulmonata	Lymnaeidae	Himemonoaragai	*Fossaria ollula*
8					Monoaragai	*Radix auricularia japonica*
9				Physidae	Sakamakigai	*Physa acuta*
10				Planorbidae	Hiramakimizumaimai	*Gyraulus chinensis spirillus*
11	Annelida	Clitellata	Lumbriculida	Lumbriculidae	Oyogimimizuzoku	*Lumbriculus sp.*
12					Oyogimimizuka	LUMBRICULIDAE
13			Oligochaeta	Enchytraeidae	Hatakehimemimizuzoku	*Fridericia sp.*
14					Nakahimememimizuzoku	*Mesenchytraeus sp.*
15					Himemimizuka	ENCHYTRAEIDAE
16				Naididae	Mitsugemizumimizu	*Nais bretscheri*
17					Namimizumimizu	*Nais communis*
18					Hyasemizumimizu	*Piguetiella denticulata*
19					Yogoremizumimizu	*Slavina appendiculata*
20					Yurimimizu	*Limnodrilus hoffmeisteri*
21					Mizumimizuka	NAIDIDAE
22			Haplotaxida	Lumbricidae	Kuroirotsurimimizuzoku	*Aporrectodea sp.*
23					Tsurimimizuka	LUMBRICIDAE
24				Unknown	Tsurimimizumoku	LUMBRICIDA
25		Hirudinea	Arhynchobdellida	Erpobdellidae	Shimaishibiru	*Dina lineata*
26				Salifidae	Nagarebiruka	SALIFIDAE
27	Arthropoda	Arachnida	Acari	Thyasidae	Ogumadanizoku	*Cyclothyas sp.*
28				Protoziidae	Hyotandanizoku	*Protzia sp.*
29				Lebertiidae	Aoidanizoku	*Lebertia sp.*
30				Sperchonidae	Nagaredanizoku	*Sperchon sp.*
31					Oninagaredanizoku	*Sperchonopsis sp.*
32				Hygrobatidae	Magariashidanizoku	*Atractides sp.*
33					Oyogidanizoku	*Hygrobates sp.*
34		Malacostraca	Isopoda	Asellidae	Mizumushi	*Asellus hilgendorfi*
35			Decapoda	Potamidae	Sawakani	*Geothelphusa dehaani*
36		Insecta	Ephemeroptera	Leptophlebiidae	Weston tobiirokagero	*Paraleptophlebia westoni*
37				Ephemeridae	Futasujimonkagero	*Ephemera japonica*
38					Monkagero	*Ephemera strigata*
39				Ephemerellidae	Toyomadarakagerozoku	*Cincticostella sp.*
40					Yoshinomadarakagero	*Drunella ishiyamana*
41					Hosobamadarakagero	*Ephemerella atagosana*
42					Imanishimadarakagero	*Ephemerella occiprens*
43					Madarakagerozoku	*Ephemerella sp.*
44					Akamadarakagero	*Teleganopsis punctisetae*
45					Erabutamadarakagero	*Torleya japonica*
46				Baetidae	Yoshinokokagero	*Alainites yoshinensis*
47					Futabakokagero	*Baetiella japonica*
48					Sahokokagero	*Baetis sahoensis*
49					Futamonkokagero	*Baetis taiwanensis*
50					Shiroharakokagero	*Baetis thermicus*
51					F Kokagero	*Baetis sp. F*
52					Usuirofutohigekokagero	*Labiobaetis atrebatinus orientalis*
53					Togeeratobiirokokagero	*Nigrobaetis acinaciger*
54					Himeusubakokagerozoku	*Procloeon sp.*
55					Kobanehigetogarikokagero	*Tenuibaetis parvipterus*
56				Heptageniidae	Tanigawakagerozoku	*Ecdyonurus sp.*
57					Erumonhiratakagero	*Epeorus latifolium*
58					Yumimonhiratakagero	*Epeorus nipponicus*
59			Odonata	Aeshnidae	Koshibosoyanma	*Boyeria maclachlani*
60				Gomphidae	Kurosanae	*Davidius fujiama*

No.	Phylum	Class	Order	Family	Japanese Name	Latin Name
61	Arthropoda	Insecta	Odonata	Gomphidae	Dabidosanae	*Davidius nanus*
62					Dabidosanaezoku	*Davidius* sp.
63					Himekurosanae	*Lanthus fujiacus*
64					Sanaetonboka	GOMPHIDAE
65				Cordulegastridae	Oniyanma	*Anotogaster sieboldii*
66			Plecoptera	Nemouridae	Fusaonashikawagerazoku	*Amphinemura* sp.
67					Onashikawagerazoku	*Nemoura* sp.
68					Yubionashikawagerazoku	*Protonemura* sp.
69				Peltoperlidae	Nogikawagera	*Cryptoperla japonica*
70				Perlidae	Kurohigekawagera	*Kamimuria quadrata*
71					Futatsumekawagerazoku	*Neoperla* sp.
72					Kawageraaka	Perlinae
73				Perlodidae	Hirobaneamimekawagera	*Pseudomegarcys japonica*
74					Amimekawageraka	PERLODIDAE
75			Megaloptera	Corydalidae	Tairikukurosujihebitonbo	*Parachauliodes continentalis*
76					Hebitonbo	*Protohermes grandis*
77			Trichoptera	Arctopsychidae	Shirofutsuyatobikerazoku	*Parapsyche* sp.
78				Hydropsychidae	Miyamashimatobikerazoku	*Diplectrona* sp.
79					Urumaashimatobikera	*Hydropsyche orientalis*
80					Seriishimatobikera	*Hydropsyche selysi*
81					Shimatobikerazoku	*Hydropsyche* sp.
82				Philopotamidae	Tanigawatobikerazoku	*Dolophilodes* sp.
83				Stenopsychidae	Higenagakawatobikera	*Stenopsyche marmorata*
84				Xiphocentronidae	Kibunekudatobikerazoku	*Melanotrichia* sp.
85				Glossosomatidae	Inobusuyamatobikera	*Glossosoma ussuricum*
86					Yamatobikerazoku	*Glossosoma* sp.
87				Hydrobiosidae	Tsumenaganagaretobikera	*Apsilochorema sutshanum*
88				Hydroptilidae	Himetobikerazoku	*Hydroptila* sp.
89				Rhyacophilidae	Hiroatamanagaretobikera	*Rhyacophila brevicephala*
90					Munaguronagaretobikera	*Rhyacophila nigrocephala*
91				Rhyacophilidae	Nipponnagaretobikera	*Rhyacophila nipponica*
92					Nagaretobikerazoku	*Rhyacophila* sp.
93				Apataniidae	Koeguritobikerazoku	*Apatania* sp.
94				Brachycentridae	Hanasemarutsutsutobikera	*Micrasema hanasense*
95				Goeridae	Ningyotobikera	*Goera japonica*
96					Kuroningyotobikera	*Goera nigrosoma*
97					Ningyotobikerazoku	*Goera* sp.
98				Lepidostomatidae	Okakutsutsutobikera	*Lepidostoma crassicorne*
99					Kokakutsutsutobikera	*Lepidostoma japonicum*
100					Tsudakakutsutsutobikera	*Lepidostoma tsudai*
101					Kakutsutsutobikerazoku	*Lepidostoma* sp.
102				Leptoceridae	Himesetotobikera	*Trichosetodes japonicus*
103				Limnocentropodidae	Kitagamitobikera	*Limnocentropus insolitus*
104				Molannidae	Hosobatobikera	*Molanna moesta*
105				Odontoceridae	Yotsumetobikera	*Perissoneura paradoxa*
106					Futasujikisotobikera	*Psilotreta kisoensis*
107				Phryganopsychidae	Marubanetobikerazoku	*Phryganopsyche* sp.
108				Sericostomatidae	Gumaga orientalis	*Gumaga orientalis*
109			Diptera	Tipulidae	Gaganbozoku	*Tipula* sp.
110					Shiributogaganbozoku	*Cylindrotoma* sp.
111					Usubagaganbozoku	*Antocha* sp.
112					D cranonyia zoku	*Dicranomyia* sp.
113					D cranota zoku	*Dicranota* sp.
114					Higenagagaganbozoku	*Hexatoma* sp.
115					Molophilus zoku	*Molophilus* sp.
116					Daimyogaganbozoku	*Pedicia* sp.
117				Psychodidae	Hamadarachobaezoku	*Pericoma* sp.
118				Ceratopogonidae	Atricopogon zoku	*Atrichopogon* sp.
119					Nukakaka	CERATOPOGONIDAE
120				Chironomidae	Torafuyusurikazoku	*Conchapelopia* sp.
121					Bokashinumayusurikazoku	*Macropelopia* sp.
122					Usuginuhimeyusurikazoku	*Rheopelopia* sp.

No.	Phylum	Class	Order	Family	Japanese Name	Latin Name
123	Arthropoda	Insecta	Diptera	Chironomidae	Hayasehimeyusurikazoku	*Trissopelopia* sp.
124					Monyusurikaaka	Tanypodinae
125					Oyukiyusurikazoku	*Pagastia* sp.
126					Sawayusurikazoku	*Potthastia* sp.
127					Kebukaeriyusurikazoku	*Brillia* sp.
128					Tsuyayusurikazoku	*Cricotopus* sp.
129					Tenmakueriyusurikazoku	*Eukiefferiella* sp.
130					Niitsumahosokebukaeriyusurika	*Neobrillia longistyla*
131					Kimogurieriyusurika	*Orthocladius lignicola*
132					Eriyusurikazoku	*Orthocladius* sp.
133					Nisetogeashieriyusurikazoku	*Parachaetocladius* sp.
134					Munakuboeriyusurikazoku	*Synorthocladius* sp.
135					Nisetenmakueriyusurikazoku	*Tvetenia* sp.
136					Eriyusurikaaka	Orthocladiinae
137					Edagehigeyusurikazoku	*Cladotanytarsus* sp.
138					Sujikamagatayusurikazoku	*Demicryptochironomus* sp.
139					Nagasuneyusurikazoku	*Micropsectra* sp.
140					Tsuyamuneyusurikazoku	*Microtendipes* sp.
141					Hamonyusurikazoku	*Polypedilum* sp.
142					Nagareyusurikazoku	*Rheotanytarsus* sp.
143					Hamuguriyusurikazoku	*Stenochironomus* sp.
144					Higeyusurikazoku	*Tanytarsus* sp.
145					Yusurikaaka	Chironominae
146				Dixidae	Hosokazoku	*Dixa* sp.
147				Simuliidae	Tsunomayubuyuzoku	*Eusimulium* sp.
148					Ashimadarabuyuzoku	*Simulium* sp.
149				Stratiomyidae	Chorisops zoku	*Chorisops* sp.
150				Empididae	Odoribaeka	EMPIDIDAE
151			Coleoptera	Hydrophilidae	Marugamushi	*Hydrocassis lacustris*
152				Scirtidae	Kuromaruhananomizoku	*Odeles* sp.
153				Elmidae	Hababirodoromushi	*Dryopomorphus extraneus*
154					Tsuyanagaashidoromushi	*Grouvellinus nitidus*
155					Nagaashidoromushizoku	*Grouvellinus* sp.
156					Tsuyahimedoromushi	*Optioservus nitidus*
157					Maruhimedoromushizoku	*Optioservus* sp.
158					Mizotsuyadoromushi	*Zaitzevia rivalis*
159					Himetuyadoromushizoku	*Zaitzeviaria* sp.
160				Psephenidae	Chibihigenagahananomi	*Ectopria opaca opaca*

<Biodiversity List for Agricultural Products in the Proposed Region (Cultivation Type List)>

【Fruit Trees】 (62 Items)

Family	Item
Lardizabalaceae	Five-leaf akebia
Ginkgoaceae	Gingko nut
Anacardiaceae	Mango
Ebenaceae	Persimmon
Lauraceae	Avocado
Juglandaceae	Walnut
Moraceae	Fig
Ericaceae	Blueberry
Musaceae	Banana
Rosaceae	Ume plum, quince, Japanese plum, Asian pear, nectarine, loquat, peach, Nanking cherry
Annonaceae	Papaw
Vitaceae	Grape
Myrtaceae	Feijoa
Fagaceae	Chestnut
Actinidiaceae	Kiwi fruit
Rutaceae	Amakusa, anseikan, iyokan, ogonkan, orangehyuga, kabosu, kara mandarin, kiyomi orange, kumquat, grapefruit, konatsu, sansho, jabara, shiranui, sweet spring orange, sudachi, setoka, Seminole, Seville orange, tachibana, tamami, natsu mikan, navel orange, hassaku orange, hanayu, haruka, haruhi, haruhime, hyuganatsu, Fukuhara orange, pomelo, ponkan, Murcott, mandarin orange, yuzu, lime, reikou, lemon
Myricaceae	Yangmei fruit

【Vegetables】 (135 Items)

Family	Item
Malvaceae	Okra, mulukhiyah
Chenopodiaceae	Chard, spinach
Brassicaceae	Otamana, white radish sprouts, turnip, Chinese mustard, cauliflower, cabbage, watercress, kale, kohlrabi, kodakarana, Japanese mustard spinach, Szechuan vegetables, santona, rosette bok choy, daikon radish, leaf mustard, bok choy, pickled greens, nabana, nozawana, coleseed, Chinese cabbage, pak choi, field wasabi, petit vert, broccoli, purslane, mizukakena, mizuna, Brussels sprout, radish, arugula, wasabi
Poaceae	Sweet corn, Manchurian wild rice, lemongrass
Araliaceae	Japanese spikenard
Cucurbitaceae	Melon, kabocha squash, cucumber, melon cucumber, watermelon, zucchini, winter melon, bitter melon, chayote, sponge gourd, oriental melon, mini kabocha squash, melon
Asteraceae	Artichoke, chamomile, Jerusalem artichoke, burdock, chrysanthemum greens, chicory, red leaf lettuce, Japanese sweet coltsfoot, yacon, mugwort, lettuce
Lauraceae	Bay leaf
Pedaliaceae	Wild sesame
Araceae	Ebi-imo taro, taro
Lamiaceae	Oregano, shiso, sage, thyme, Chinese artichoke, basil, peppermint, red shiso, minto, lavender, lemon balm, rosemary
Zingiberaceae	Ginger, hashoga, hana-myoga, myoga-take
Xanthorrhoeaceae	Aloe

Family	Item
Apiaceae	Angelica keiskei, cilantro, Japanese parsley, celery, carrot, parsley, fennel, mitsuba
Polygonaceae	Rhubarb
Basellaceae	Malabar spinach
Solanaceae	Small sweet green pepper, tomato, eggplant, bell pepper, potato, green pepper, haozuki, cherry tomato
Lamiaceae	Apple mint
Nelumbonaceae	Lotus root
Aizoaceae	Ice plant, Chinese lantern
Rosaceae	Strawberry, edible cherry (leaf)
Amaryllidaceae	Garlic, garlic leaf
Amaranthaceae	Salsola komarovii
Convolvulaceae	Chinese water spinach
Fabaceae	Edamame, string bean, snap pea, fava bean, green pea, bean sprout
Rutaceae	Leaf bud
Dioscoreaceae	Bulbil, Japanese yam
Liliaceae	Asparagus, shallot, onion, garlic chive, wild rocambole, green onion, sprouted green onion, lily bulb, Japanese leek, Welsh onion

【Crops】 (15 Items)

Family	Item
Poaceae	Wheat, wet-land rice, six-rowed barley
Pedaliaceae	Sesame
Araceae	Konnyaku root
Zingiberaceae	Turmeric
Polygonaceae	Buckwheat
Convolvulaceae	Sweet potato
Fabaceae	Adzuki bean, string bean, green pea, black-eyed pea (plant ear seed), fava bean (plant ear seed), soy, peanut

【Tea】 (8 Items)

Item
Oolong tea, kabusecha, kamairicha, black tea, coarse tea, deep-steamed green tea, regular green tea, matcha (tencha)

【Flowers】 (120 Items)

	Item
Cut flowers	Iris, acacia, agapanthus, thistle, asparagus, amacrinum, aloe, violet orchid, ear of rice plant, iberis, Erica, encyclia, Ornithogalum, omocha kabocha, oncidium, carnation, gerbera, cattleya, callistephus chinensis, kangaroo paw, campanula, chrysanthemum, snapdragon, aster hybridus, gladiolus, clematis, plumed cockscomb, sakaki, cherry blossom, Japanese star anise, sweet flag, cymbidium, narcissus, stock, strelitzia, smilax, thermopsis lupinoides, globe amaranth, herba sarcandrae, soridako, dahlia, fragrant orchid, delphinium, telopea, prairie gentian, hydrangea, hibiscus, hanamugi, ornamental kale, rose, banksia, East Asian eurya, sunflower, cucumberleaf sunflower, nipplefruit, bouvardia, bupleurum, freesia, protea, Chinese lantern (stalk), marguerite, evergreen spindle, mamenohana, monstera, eucalyptus, eucharis, lily, Persian buttercup
Potted Plants	Ivy geranium, azalea, aster, anthurium, ipomoea, oncidium, African daisy, cattleya, campanula longistyla, cat's tail, pink rock orchid, guzmania, Christmas rose, firecracker flower, bleeding glory-bower, cyclamen, fern, cymbidium, scotch, senecio, celosia, Japanese silverleaf, daisy, dendrobe, aster microcephalus, hibiscus, rose, moth orchid, ficus pumila, begonia dragon, shrimp plant, poinsettia, lavender, lewisia, lion's tail, rosemary
Flower Beds	Alyssum, Angelonia, eremophila, daffodil, violet, dianthus, chili pepper, nemophila, ornamental kale, pansy, viola, begonia semperflorens, heliotrope, marguerite, mint