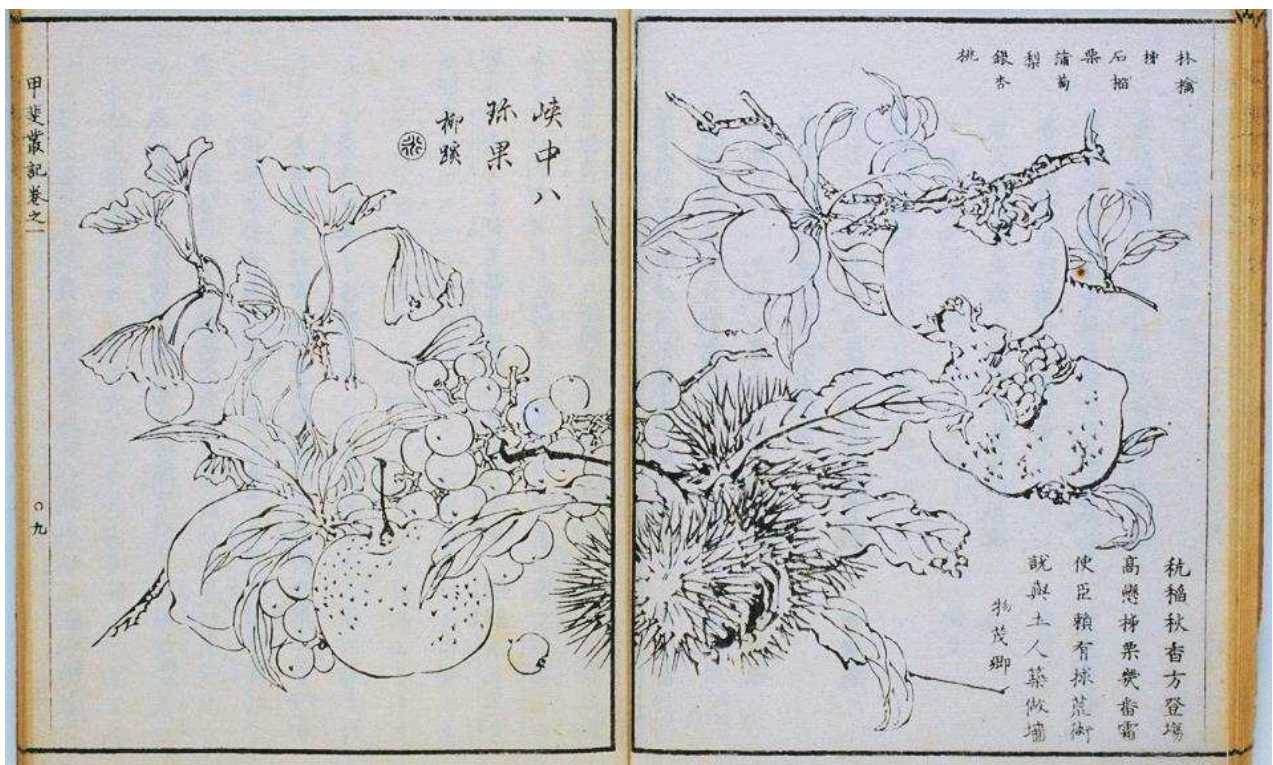


# Fruit Cultivation System in Kyoutou Region, Yamanashi

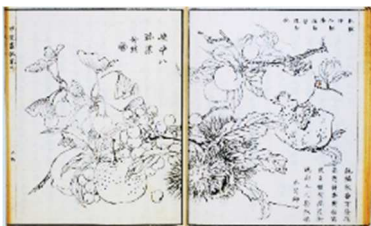
## Proposal for Designation as Globally Important Agricultural Heritage System (GIAHS)



October 2019

(Last revised July 2022)

GIAHS Promotion Association for the Kyoutou Area



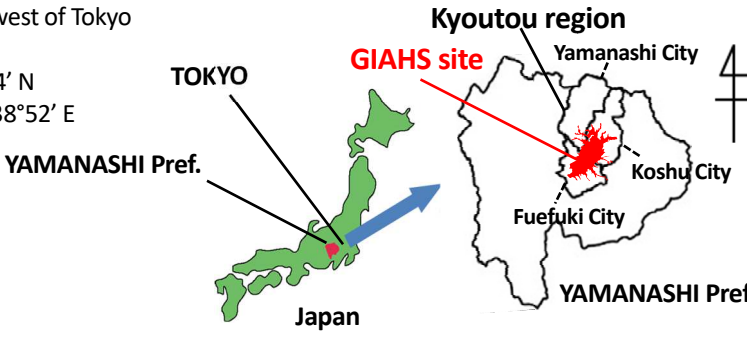
Front cover:

**“The eight rare fruits of Kai”** from *Kai Soki*, 1848.

Eight fruits grown in the Kyoutou area in the mid-19th century:  
Grapes, peaches, persimmons, apples, nashi pears, chestnuts,  
pomegranates and gingko nuts. Also known as the eight rare fruits of  
Koshu. (Kai and Koshu are old names for Yamanashi.)

# Proposal for Designation as Globally Important Agricultural Heritage System

## 1. SUMMARY INFORMATION

<p><b>Name/Title of the Agricultural Heritage System</b>  <b>Fruit Cultivation System in Kyoutou Region, Yamanashi</b></p>
<p><b>Requesting Agency/Organization</b>          GIAHS Promotion Association for the Kyoutou Area          • Members: Yamanashi City, Fuefuki City, Koshu City, Yamanashi Prefecture, and 24 other organizations</p>
<p><b>Responsible Ministry</b>          Ministry of Agriculture, Forestry and Fisheries of Japan</p>
<p><b>Location of the Site</b></p> <ul style="list-style-type: none"> <li>• Name: Kyoutou region in Yamanashi Prefecture, Japan              (Kyoutou region encompasses Yamanashi City, Fuefuki City, Koshu City)              (Proposed GIAHS site is part of the region)</li> <li>• Location: About 100 km west of Tokyo</li> <li>• Geographic coordinates:              Latitude: 35°30' – 35°54' N              Longitude: 138°35' – 138°52' E</li> </ul> 
<p><b>Accessibility from major cities</b>          Approximately 100 km west of Tokyo, accessible by both rail and road          Rail: 120 minutes from Tokyo Station (180 minutes from Tokyo International Airport)          Road: 90 minutes from Shinjuku, Tokyo (via Chuo Expressway)</p>
<p><b>Area of Coverage</b></p> <ul style="list-style-type: none"> <li>• Fruit orchards and vineyards (proposed GIAHS site): 5,064 ha              (Total area of managed arable land in Kyoutou region: 5,355 ha)              (Total area of Kyoutou region: 75,583 ha (755.83 km<sup>2</sup>))</li> </ul>
<p><b>Agro-Ecological Zones in site</b>          Orchard and dry field farming in temperate zone</p>
<p><b>Topographic Features</b>          Located on eastern edge of Kofu Basin. 75% forest cover. Most of the agricultural land is located on the alluvial fan at an altitude of between 250m and 800m, including substantial slopes and undulations.</p>
<p><b>Climate:</b> Temperate humid (Köppen)</p> <ul style="list-style-type: none"> <li>• Annual average temperature: 13.8°C</li> <li>• Annual precipitation: 1,080 mm</li> <li>• Sunshine hours: 2,163 hrs/year (Katsunuma)</li> </ul>
<p><b>Population:</b> 136,000 Beneficiaries: 14,000 farmers</p>
<p><b>Ethnic/Indigenous Population:</b>          N/A</p>
<p><b>Main Sources of Livelihood:</b> Agriculture and forestry, tourism, food manufacturing</p>

## **GIAHS Proposal: Fruit Cultivation System in Kyoutou Region, Yamanashi**

### **Executive Summary**

The Kyoutou region is thought to be the birthplace of Japanese grape cultivation. Grapes have been grown here for at least 800 years. Many other fruits in this region also have a long history—peaches, persimmons, ume (Japanese apricot), nashi pears, apples and chestnuts are all known to have been cultivated for at least 100 years.

Yamanashi Prefecture produces more grapes, peaches, and plums than any other prefecture in Japan. Fruit cultivation began in the Kyoutou region before 762, and the region has evolved a unique system of manual cultivation over its long fruit-growing history. Most of the region's agricultural land is located on an alluvial fan with substantial slopes and undulations. Individual plots tend to be small and irregularly shaped, with soil and other conditions varying according to location. Farmers in this region have long grown grape, peach, and other deciduous fruit trees adapted to the alluvial fan topography and to Japan's rainy, humid climate.

Many techniques have been developed to ensure stable fruit production on small plots. Of particular note is the local grape cultivation method, in which thick, sparsely planted vines are trained over Koshu-style trellises (trellises suspended high above the ground) to counter the wet, humid conditions. Whatever fruit they produced, farmers developed manual techniques to grow superb fruit for the table—fruit that appealed to discerning palates and to the consumers who prefer large fruit that looks stunning. (The manual techniques used include training/pruning, cluster thinning/shaping, berry thinning, covering, bagging, and harvesting for grapes, and training/pruning, bud/flower thinning, hand pollination, fruit thinning, bagging, and harvesting for peaches.)

Currently, over ten types of fruit are cultivated commercially, including grape, peach, plum and persimmon. With over 300 varieties or strains, these crops also constitute a rich genetic resource. The diversity of fruit species and varieties adapted to the complex and highly variegated topographic and climatic conditions of the alluvial fan mitigates weather risks and enables more efficient use of labor, thereby playing an important role in stabilizing the livelihoods of small-scale farmers and enhancing the resilience of fruit farming.

Local agricultural practices contribute to biodiversity, and many species inhabit the orchards and their surroundings. The native vegetation ground cover employed in the orchards not only prevents soil erosion and supplies organic matter to the soil, but also supports biodiversity by providing a home for a variety of plants and insects.

This fruit cultivation system has shaped a unique mosaic landscape. Together with the surrounding woods and mountains (satoyama), this creates countryside that is beautiful in every season, attracting a great many tourists to the region. The orchards and vineyards also perform a direct role in tourism, with groups of tourists picking fruit or gathering under grape trellises at a fruit farm to share food and drinks while enjoying the vineyard scenery.

Another aspect of the fruit cultivation system is fruit processing. "Korogaki" dried persimmons produced for over 400 years, and wine, produced for over a century, are just two of the many products born from the wisdom, ingenuity, and efforts of farmers to support themselves and develop the local economy.

To ensure that younger generations learn to appreciate the agricultural system and keep it functioning, training courses are provided to young people interested in fruit farming. Local elementary and junior high school children attend programs to learn about agriculture by actually taking part.

The Kyoutou region's fruit cultivation system is a form of land use that is well adapted to the alluvial fan topography. It enables small-scale family farms to make a decent living by using small plots of land profitably through largely manual and painstaking management techniques. As such, it constitutes a unique and outstanding agricultural system of global importance.

# Fruit Cultivation System in Kyoutou Region

Distinctive features of the alluvial fan fruit cultivation landscape

Diverse fruit tree characteristics and locally-developed techniques suit the topographic and climatic conditions of the alluvial fan.

A rich diversity of grape, peach, plum, persimmon, and other fruit tree types and varieties are preserved through cultivation.

Satoyama  
(Surrounding woods and mountains)

Traditional persimmon fruit processing

Koshu-style grape trellises

Winemaking

Native vegetation ground cover

Tourist fruit farm

**Heritage to be protected and passed on to future generations:  
Distinctive fruit cultivation System in the Kyoutou Region**



Diversity of fruit types and varieties



Ingenious use of complex topography in alluvial fan land 1: Peaches (Fuefuki City)



Ingenious use of complex topography in alluvial fan land 2: Grapes (Koshu City)



Native vegetation ground cover (Yamanashi City)



Koshu-style grape trellises (Koshu City)



“Korogaki” dried persimmons produced by hand (Koshu City)



Superb fruit produced by manual techniques



Fruit management using manual techniques



'Koshu' grapes growing on a Koshu-style trellis with widely-spaced large vines



# DESCRIPTION OF THE AGRICULTURAL HERITAGE SYSTEM

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## 2. DESCRIPTION OF THE AGRICULTURAL HERITAGE SYSTEM

### 2.1 Significance of the Proposed GIAHS Site

#### 1) Outline of agricultural system

The Kyoutou region is thought to be the birthplace of Japanese grape cultivation. Grapes have been grown here for at least 800 years, possibly as long as 1,300 years. The long history of fruit cultivation extends to other fruit besides grapes—peaches, persimmons, and many other fruit have been cultivated here for at least 100 years.

The whole of Yamanashi Prefecture is involved in fruit farming, producing more grapes, peaches, and plums than any other prefecture in Japan. Within Yamanashi Prefecture, the Kyoutou region has the longest history of fruit cultivation. The region has prospered through the distinctive and innovative cultivation system that it has nurtured over the centuries. It is located in the eastern part of the Kofu Basin, with most of its agricultural land situated on alluvial fans of varying sizes on the eastern edge of the basin (Figure 1). Much of the topology consists of sloping land and undulations, with the result that soil type and water availability vary from place to place, and there is a large variety in temperatures and other climate conditions. Individual tracts of agricultural land are small and irregularly shaped.

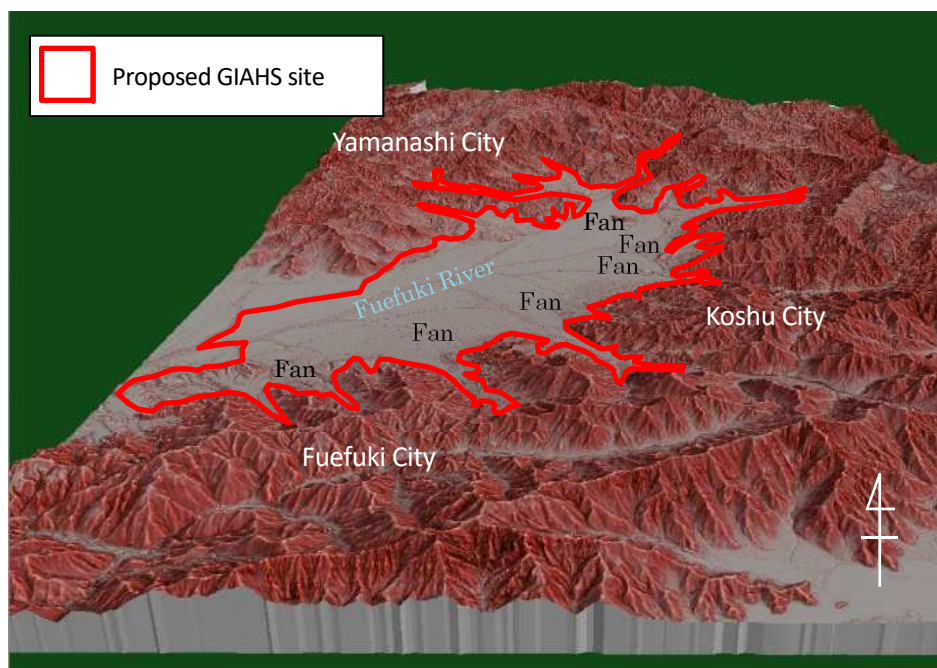


Figure 1. Relief map of the Kyoutou Region

Source: Yamanashi Prefectural Land Improvement Project Federation, Red Relief Image Map (Pat. Asia Air Survey Co.,Ltd.)

Water resources are difficult to manage in an alluvial fan area, which makes such areas unsuitable for rice paddies. In contrast, grapes, peaches, persimmons, and other deciduous tree fruits adapt well to the land, and they have long been cultivated in this area. Taking advantage of the soil conditions, a mix of fruits and varieties has been grown here for centuries. In addition to grapes, peaches, and persimmons, ume (Japanese apricot), nashi pears, apples, and chestnuts are all known to have been cultivated for at least 100 years.

Small family-run farms are the mainstay of agriculture in the Kyoutou region, with over 80% of farms cultivating less than 1ha in total. Also, their farm is scattered several places. It means individual plots are very small, quit often which is less than 0.1ha. Farmers employ traditional fruit cultivation methods, managing their vines and

fruit trees, and the fruit that they produce, solely by hand. Machinery is only used for weed mowing and chemical spraying. All other processes are performed using traditional, manual techniques.

In the case of grapes, the training/pruning, cluster thinning/shaping, berry thinning, covering, bagging, and harvesting are all done by hands traditionally. Inter pruning is a means of controlling the vine's vigor to keep it in adequate condition. The extent of pruning depends on the number and length of the arms, in accordance with cultivars, age, and vigor. From spring onwards, in the main growing season, the focus shifts to enhancing taste and appearance. The number of grape clusters needs to be reduced step by step to between two-thirds and one half of the original number, or less. This process is called cluster thinning, and is followed by cluster shaping and berry thinning to control the shape of each bunch. Each of these processes is conducted carefully by hand. Later, the fruit are covered or bagged to protect them against disease and insect damage, bird damage, and damage from rain or hailstorms until they are ready to be harvested.

In the case of peach, the training/pruning, bud/flower thinning, artificial pollination, fruit thinning, bagging, and harvesting are all done by hands traditionally. Winter pruning is a means of controlling the branch's vigor to keep it in adequate condition. The extent of pruning depends on the number and length of the arms, in accordance with the branch's variety, age, and vigor. From spring onwards, in the main growing season, the focus shifts to producing large fruits. Farmers tend the tree manually at each stage, thinning first buds, then flowers, then small fruits. At this time, for varieties that do not bear fruit stably, pollen is manually attached to promote fruiting in order to ensure that the restricted fruits bear fruit. Each of these processes is conducted carefully by hand. Later, the fruit are bagged to protect them against disease and insect damage, bird damage, and damage from rain or hailstorms, and the fruits are sacked to promote coloring, until they are ready to be harvested.

The Kyoutou region's fruit cultivation system incorporates a richly diverse range of fruit types and varieties that functions as a significant genetic resource. By using native vegetation ground cover in orchards, the system also boosts plant and other biodiversity in the orchard ecosystem. Fruit cultivation and biodiversity are closely linked, and the region produces a large diversity of agricultural products.

In the alluvial fan areas of the Kyoutou region, knowledge and expertise derived from the cumulative experience of local farmers facilitate the clever use of small plots of land, enabling cultivation of a diversity of fruits and fruit varieties. This approach has shaped a unique mosaic landscape, and enhances the resilience of the fruit cultivation system. This landscape presents beautiful rural scenery that changes with the seasons, providing vistas that calm and relax. This attracts a great many tourists to the Kyoutou region, bringing vitality to the local economy. The orchards and vineyards also perform a direct role in tourism, with groups of tourists picking fruit or gathering under grape trellises to share food and drinks while enjoying the vineyard scenery. This unique cultural experience shares some of the attractions of *hanami*, Japan's cherry-blossom viewing tradition.



Photo 1. Koshu-style trellises with widely-spaced, large, extended vines (Kyoutou region, Yamanashi)



Photo 2. European vineyard with densely planted small vines (Bordeaux, France)



Photo 3. Pergola trellises with tall vines densely planted in rows (Soave, Italy)

Source: Soave Traditional Vineyards (2018): Proposal for designation as Globally Important Agricultural Heritage System P32  
 Website: <http://www.fao.org/3/CA3436EN/ca3436en.pdf>



Photo 4. Funnel-framed trellises with vines planted in the center of the frame (Xuanhua, China)

Source: Xuanhua Traditional Vineyards System (2013): Proposal for designation as Globally Important Agricultural Heritage System Front cover  
 Website: <http://www.fao.org/3/a-bp786e.pdf>

Development of the Kyoutou region fruit cultivation system was accompanied by the development of local techniques that enable reliable production of fruit on small farms. Grapevines can grow in all kinds of climate, but most grape production regions around the world are in areas with relatively low rainfall during the growing season. In contrast, the Kyoutou region has higher rainfall. The trellis cultivation method developed for grapes in the Kyoutou region (Koshu-style trellises in combination with widely-spaced large vines) is an original adaptive technology suited to grape production in Japan's humid climate, allowing farmers to manage vine vigor and minimize problems with diseases. Koshu-style trellises can be readily installed regardless of the gradient or shape of the vineyard. That makes this an effective cultivation method for land that is sloping or irregularly-shaped.

Another feature of the Kyoutou region is that most grape production is for the table, unlike European and other international production areas, where grapes are mainly produced for winemaking. Farmers of the region cultivated superb fruit that appealed to discerning palates and to the market's fondness for large fruit that also looks stunning. In order to produce fruit that looks like a work of art, in addition to nurturing the fruit and the tree, farmers have developed meticulous manual cultivation techniques, including yield adjustment and bagging of individual fruits.

The region has a rich diversity of fruit trees. Fruit tree types and varieties currently cultivated include over 10 types of fruit, predominantly grapes, peaches, plums, and persimmons, and over 300 varieties and strains (Photo 5). The diversity of fruit species and varieties adapted to the complex and highly variegated topographic and micro-climatic conditions of the alluvial fan mitigates typhoon and other weather risks and enables more efficient use of labor, thereby enhancing the resilience of the fruit cultivation system and making small family-run farming sustainable.



Photo 5. The main fruits cultivated in the Kyoutou region

Another aspect of the Kyoutou region's fruit cultivation system is fruit processing. Korogaki dried persimmons produced from 400 years ago, and wine, produced for over a century, are just two of the many products born from the wisdom, ingenuity, and efforts of farmers to support themselves and develop the local economy through increased value added.

Native vegetation ground cover is used for floor management in orchards and vineyards. It prevents soil erosion on sloping ground and supplies organic matter to the soil. It is also intimately connected with biodiversity, providing habitats for plants and insects in the orchards, and raising biodiversity in the surroundings as well.

The alluvial fan fruit cultivation system of the Kyoutou region, Yamanashi has been built up by local farmers through long years of innovation, ingenuity, and effort. Today, this heritage ensures effective use of small plots of land, sustains small family-run farms, and maintains biodiversity. It has developed through close links with local culture, and remains a resilient and innovative system capable of bringing vitality to the region. Its features and characteristics make it an agricultural system of global importance.

## 2) Outline of region

Kyoutou is the name given to the region to the east of the Fuefuki River in the Kofu Basin. It consists of Yamanashi City, Fuefuki City, and Koshu City. The whole region is part of Yamanashi Prefecture, which corresponds to the historical Province of Kai, also known as Koshu.

The region has long been a center for agriculture in Yamanashi prefecture. The cities of Yamanashi, Fuefuki, and Koshu formed through administrative mergers of the many small agricultural villages that once existed throughout the region. Construction of a railway and other infrastructure had led to urbanization of the villages in convenient locations, particularly those with direct access to the main stations. As a result of this pattern of development, there are still orchards and other working farms within the urban areas, making it difficult to draw clear boundaries between urban/village districts and fruit cultivation districts. Therefore, GIAHS Site shown in Fig. 2, the application site is limited to orchards and agricultural heritage constituent facilities, excluding urban areas and village areas.

In addition to the Kyoutou region, fruit cultivation areas in Yamanashi Prefecture include the western and northern parts of the Kofu Basin, where grapes, peaches, and other fruit are produced. However, Yamanashi's best-known traditional fruit farming region is the Kyoutou region, and fruit farms in the Kyoutou region account for close to 40% by value of Yamanashi Prefecture's total agricultural production (Figure 3).

Table 1. Kyoutou region profile

	Kyoutou region	Percentage of prefecture total
Population	136,371 individuals	16.3 %
Households	50,618 households	15.3 %
Farm households	8,957 households	27.5 %
Entities managing arable land	7,774 entities	43.5 %
Entities managing orchards/vineyards	7,636 entities	61.8 %
Area of coverage	75,583 ha	16.9 %
Managed arable land area	5,355 ha	36.6 %
Orchards/vineyards (GIAHS area)	5,064 ha	68.4 %

Source (population, households):2015 Population Census (Ministry of Internal Affairs and Communications)

The Kyoutou region has a total area of 75,583 ha. Farming land accounts for 5,355 ha, of which 5,064 ha (95%) is given over to orchards and vineyards producing fruit such as grapes, peaches, and plums. Of the total of 8,957 farm households in the region, 7,636 households (85%) are involved in fruit production (Table 1). The Kyoutou region currently produces approximately 18% of Japan's grapes and 25% of peaches, making it the largest production area nationwide. The Kyoutou region has a monthly average temperature of 25.7°C in the warmest month (August), precipitation of 31mm in the driest month (December). Under the Köppen classification, the region has a humid subtropical climate (Table 2).

Table 2. Weather for Kyoutou region (AMeDAS Katsunuma)

	Annual av. temp.	Daily max. temp.	Daily min. temp.	Av. temp. warmest month (Aug)	Av. temp. coldest month (Jan)	Annual precip.	Precip. in wettest month (Sep)	Precip. in driest month (Dec)	Annual sunshine hours
Annual averages (1981-2010)	13.8 °C	20.1 °C	9.0 °C	25.7 °C	2.0 °C	1,080.9 mm	181.7 mm	31.0 mm	2,163.6 hrs

Source: JMA (figures for av. year)

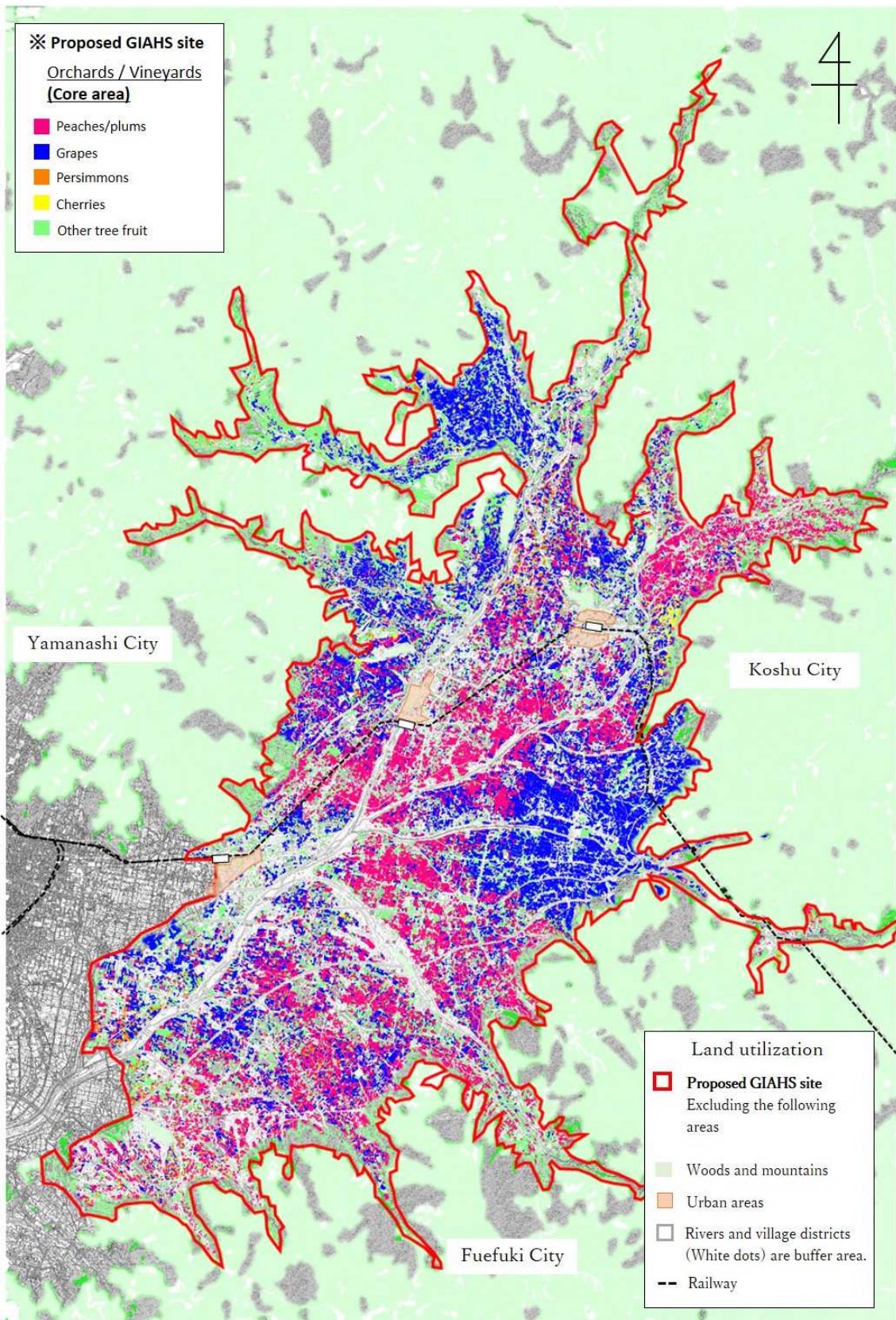


Figure 2. Land-use map indicating fruit orchards and vineyards (proposed GIAHS site)

Source: Yamanashi Prefectural Land Improvement Projects Federation



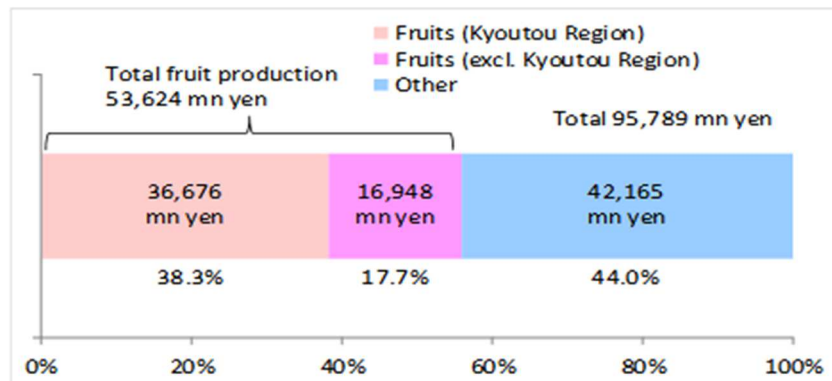


Figure 3. Kyoutou region fruit production as percentage of total agricultural production for Yamanashi prefecture  
 Source: 2016 Annual Agricultural Production by Value (Yamanashi Prefecture)

### 3) Characteristics of site and natural conditions

The Kofu Basin is surrounded by mountains, and has alluvial fans of various sizes. The Kyoutou region has a number of fans with a variety of sizes and soils, including the Fuefuki River Fan, Kane River Fan, and Mitarai River Fan (Photos 6, 7).

Alluvial fans like these spread out in a fan shape from the foot of the mountains. They form due to an accumulation of sediment when detritus, earth and sand are carried down from the mountains by rivers or rain. The resulting topology is undulating, with many mounds and depressions. Most of the orchards and vineyards are on an alluvial fan at an altitude of between 250m and 800m. They have complex microclimates and site conditions such as gradient, topology, soil, temperature, wind directions, sunshine, and water availability.

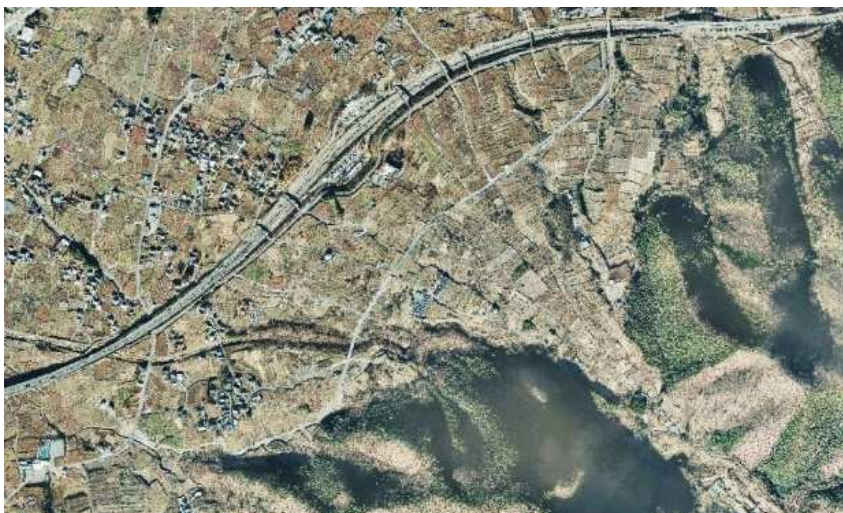


Photo 6. Alluvial fans in the south part of Kyoutou region, near Sembeiji (Ichinomiya-cho, Fuefuki City) and Fujii (Katsunuma-cho, Kosu City)

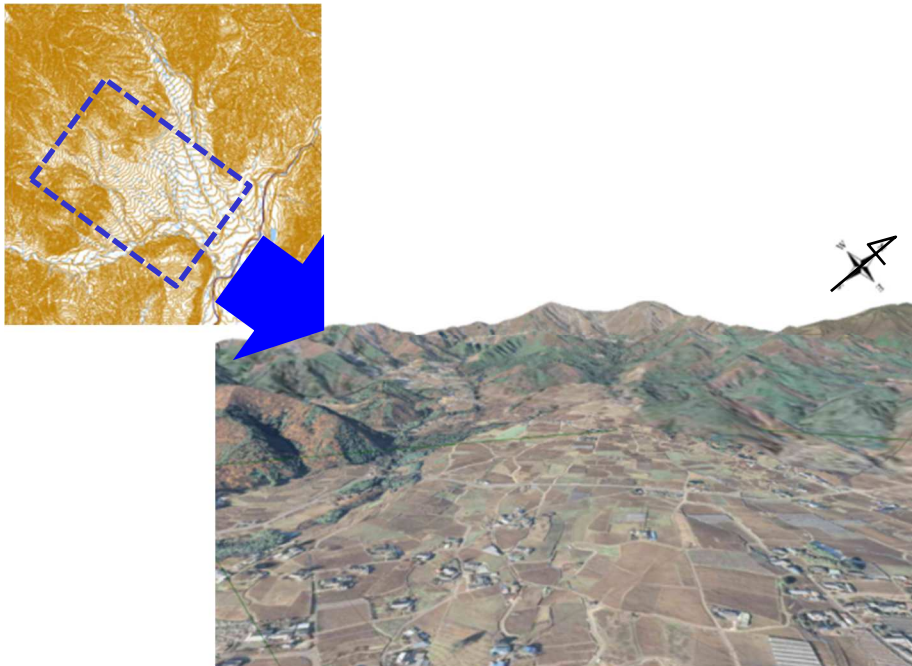


Photo 7. Alluvial fan in the north part of Kyoutou region (near Kurashina, Makioka-cho, Yamanashi City)

Kyoutou region has a basin climate, an inland climate typical of basins, having relatively long sunshine hours and relatively low rainfall during growing season for Japan. Summer temperatures are high, and there are large diurnal and annual temperature ranges. In Japan, this is considered a good climate for fruit cultivation.

At the global level, most grape and peach producing regions are arid or semi-arid, with low rainfall during growing season. In contrast, the Kyoutou region is much more humid and wetter than other production regions around the world (Figures 4, 5).

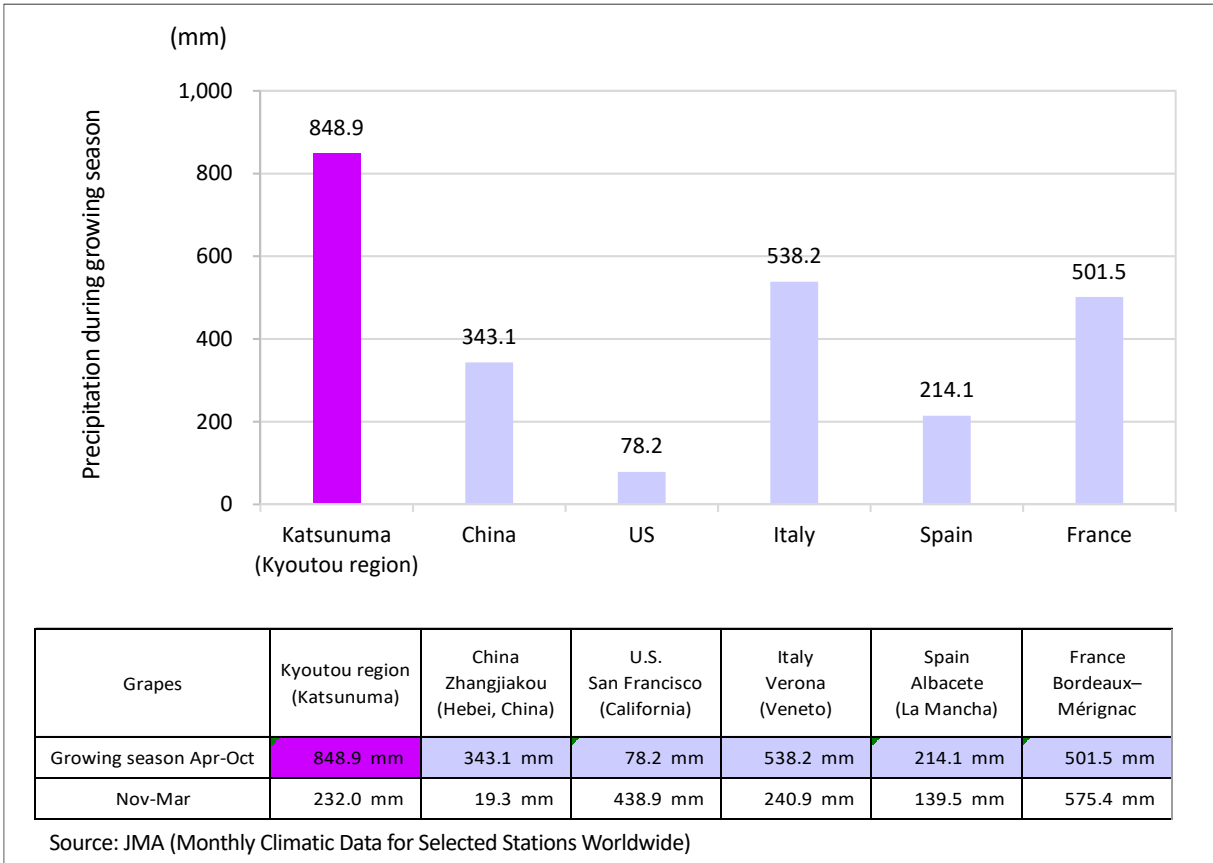


Figure 4. Precipitation for major grape producing regions worldwide

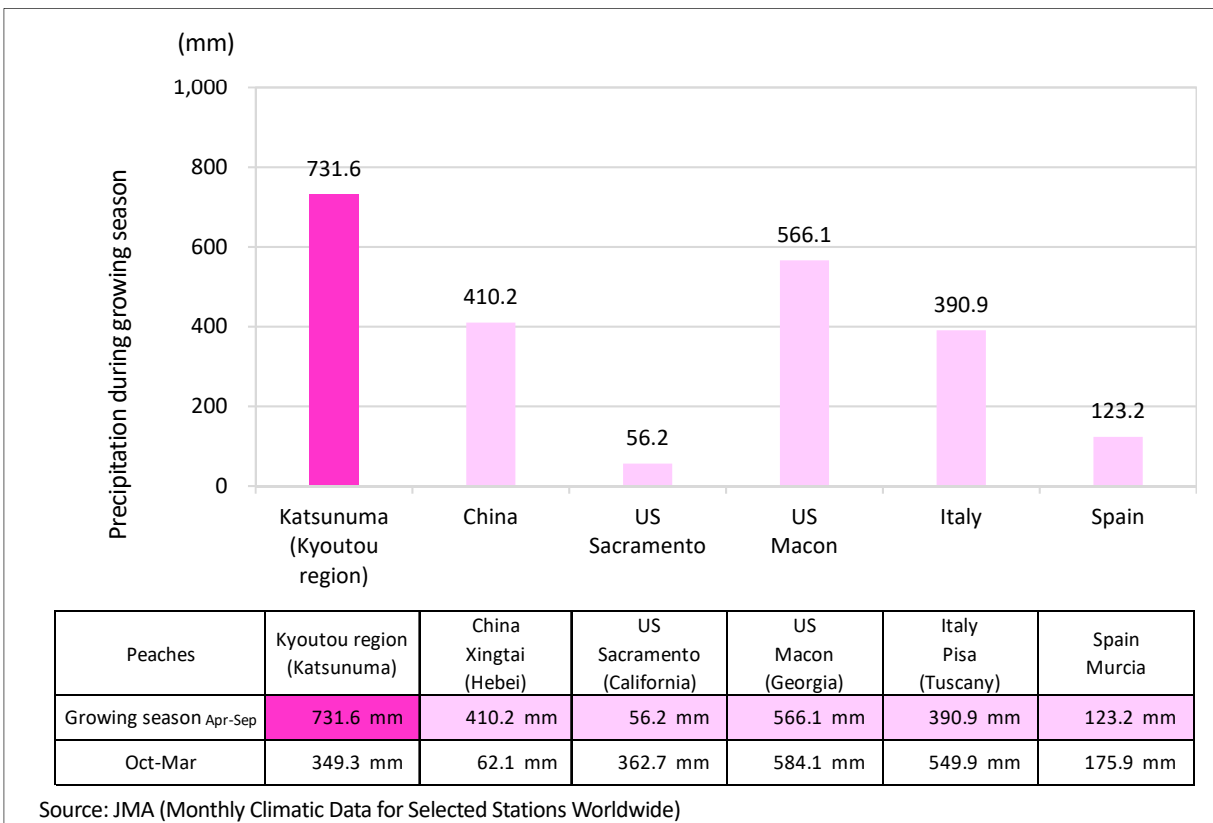


Figure 5. Precipitation for major peach producing regions worldwide

The nature of alluvial fans means that the Kyoutou region has few rivers, as water either flows underground or flows rapidly, eroding deep channels. Consequently, even when located close to a river, water sources are likely to be inconvenient. Many farms on the high or medium-high sections of an alluvial fan have poor access to water, but soil with good drainage. During the growing season (spring and summer) there is little rain, and the air is hot and dry. Such land is unsuitable for rice paddies or for growing cereals and vegetables.

The agricultural land on the high sections of the alluvial fan is contiguous with woods and mountains that are used by the community (satoyama). Further back is “Onshirin commons,” a commons bestowed by Emperor Meiji in 1911. Local community people participate in the conservation and management of the Onshirin commons, which plays an important role in protecting local livelihoods and agriculture against water-related disasters (Figure 6).

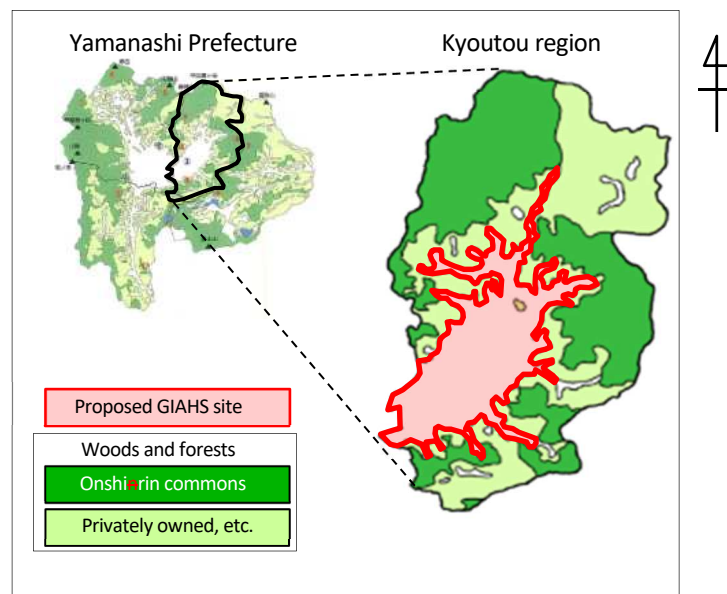


Figure 6. Woods and forests around the Kyoutou Region

#### 4) Expansion of traditional fruit cultivation system

The Kyoutou region is where fruit cultivation began in Yamanashi Prefecture, and economic growth has followed the unique cultivation system that evolved over the region’s long fruit-growing history. *Kai Soki*, compiled in 1848, includes a depiction of “The eight rare fruits of Kai,” also known as “the eight rare fruits of Koshu” (Figure 7). This includes grapes, peaches, and persimmons, and bears witness to Yamanashi Prefecture’s history of cultivating a large variety of fruit. (‘Kai’ and ‘Koshu’ are old names for Yamanashi.)

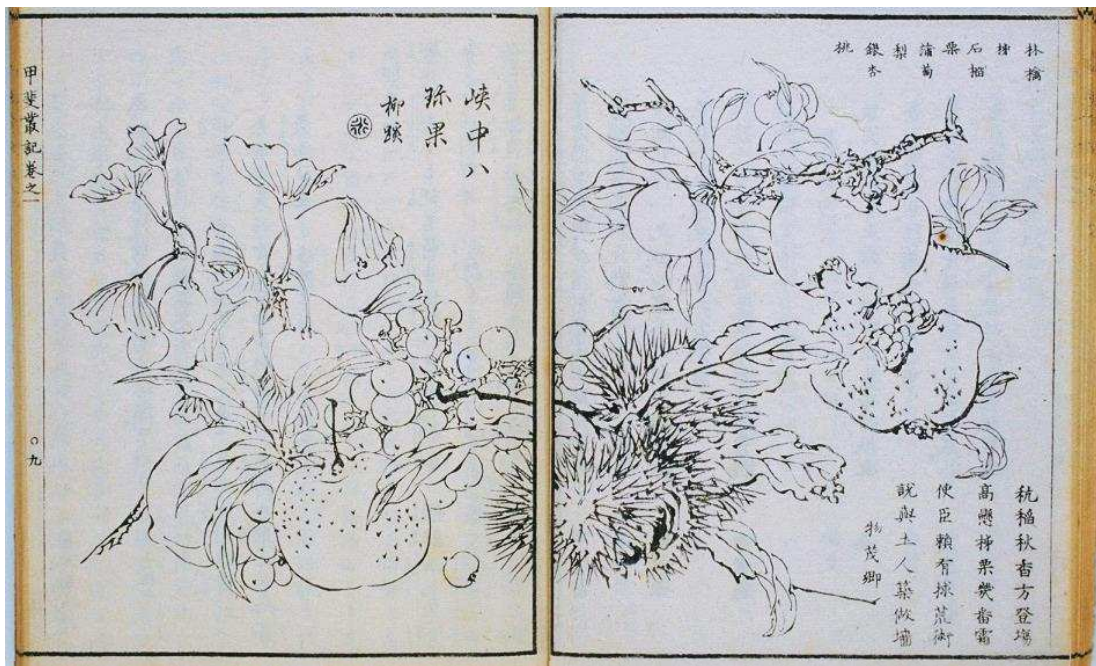


Figure 7. “The eight rare fruits of Kai” from the *Kai Soki*, 1848

Eight fruits grown in the Kyoutou area in the mid-19th century: Grapes, peaches, persimmons, apples, nashi pears, chestnuts, pomegranates and ginkgo nuts. Also known as the eight rare fruits of Koshu. (Kai and Koshu are old names for Yamanashi.)

##### a) Expansion of fruit cultivation that supports the region

The Kyoutou region has long been a center for fruit cultivation, with Katsunuma-cho in Koshu City reputed to be the birthplace of Japanese grape cultivation. Grapes are said to have been grown here for at least 800 years, possibly as long as 1,300 years. Fruit such as peaches and persimmons have been cultivated here for over a century (Figures 8, 9).

Grape production figures dating back to over 100 years ago are recorded in documents for present-day Katsunuma-cho, Koshu City (publ. 1711-1716); Enzan, Koshu City (publ. 1916); Yatsushiro-cho, Fuefuki City (publ. 1975, etc.), Ichinomiya-cho, Fuefuki City (publ. 1967, etc.). Similarly, production of peaches as a local specialty over 100 years ago can be seen from documents for present-day Ichinomiya-cho, Fuefuki City (publ. 1848, etc.); Kasugai-cho, Fuefuki City (publ. 1988, etc.); Itchotanaka, Yamanashi City (publ. 1848); Kanoiwa district of Yamanashi City (publ. 1916); and Katsunuma-cho, Koshu City (publ. 1916). There are also records showing the cultivation of fruits such as ume, nashi pears, apples, chestnuts, and pomegranates over 100 years ago. These records show that the Kyoutou region has historically cultivated a mix of fruit types. Furthermore, fruit such as ume, nashi pears, and apples are still cultivated today.

In the Edo period (1603-1868), locally produced fruit was transported to Edo (present-day Tokyo) along the Koshu Kaido, which was one of Japan’s five main highways, and corresponds to today’s National Route 20.

Transportation in the Edo period relied on human porters and pack horses, requiring several days to reach Edo from Yamanashi. Fruit that was soft and difficult to carry could only be transported in very small quantities.

In the subsequent Meiji period (1868-1910), government policy promoted sericulture (silk farming). The mulberry trees that provided the leaves required by silkworms could grow on sloping ground in poor soil conditions, and in areas with poor water supplies, so the number of mulberry plantations in the Kyoutou region grew. From the first decade of the 1900s, sericulture experienced a series of recessions. Economic change and other transformations affecting the industry led to a reduction in silk production nationwide.

In the Kyoutou region, the existence of a local fruit cultivation system developed over many long years made it easy for mulberry plantations to switch to fruit farming, producing peaches and other fruit. Moreover, the opening of a railway in 1903 (now the JR Chuo Line linking Kofu to Shinjuku in Tokyo) and other improvements to logistics networks made it possible to transport large amounts of fruit quickly to Tokyo and other market areas. As a result, fruit cultivation became more popular. As fruit cultivation spread, an increasing number of farmers adopted a mix of fruits and varieties to distribute labor more effectively and to mitigate weather risks, thereby enhancing the resilience of fruit cultivation in the region.

Monoculture on a family-run farm leads to a concentration of labor requirements at specific times, which restricts the size of the farm. And if the whole region cultivates the same crop, farmers are at greater risk from weather disasters and price collapse. In addition to affecting the livelihood of individual farmers, such circumstances would hit the local economy hard. The cultivation of a mix of fruits and varieties distributes labor requirements more evenly, enabling farms to grow, and can also mitigate the risk of weather disasters and price collapse, protecting farmers against sudden loss of income.

In the Kyoutou region, including areas where fruit cultivation has been newly introduced, applying the fruit cultivation system that had been developed by the region as a whole has brought stability to the livelihoods of small family-run farms, contributing to the present form of fruit farming in Kyoutou region.

Currently, approximately 95% of farmland is given over to orchards and vineyards. All of them employ this traditional fruit cultivation system, creating the distinctive landscape that is one of the region's assets.

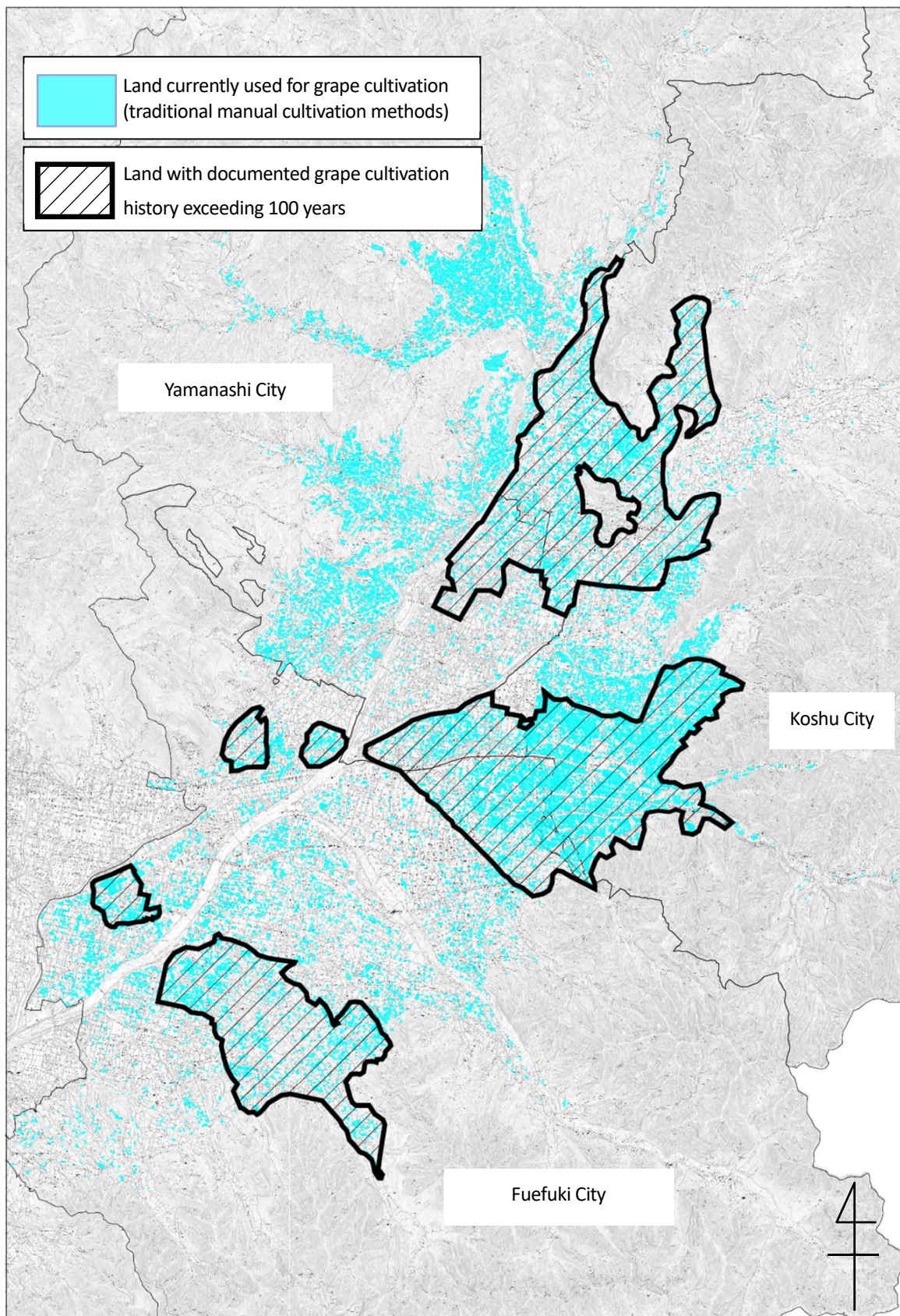


Figure 8. Expansion of traditional fruit cultivation system (grapes)

Source: Shotoku Kenchicho, Higashiyamanashi-gunshi, Yatsushiro-choshi, Ichinomiya-choshi, etc.

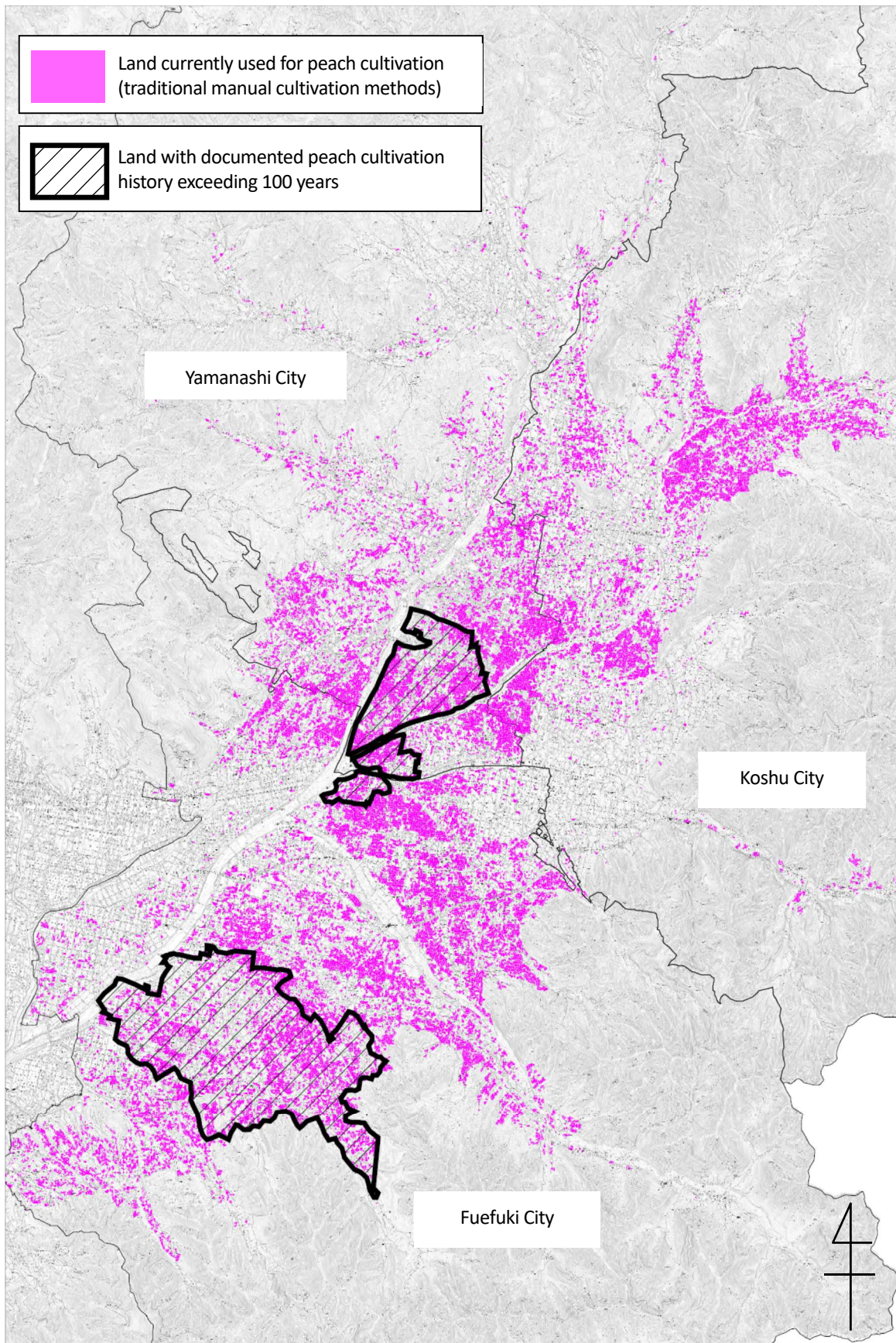


Figure 9. Expansion of traditional fruit cultivation system (peaches)

Source: Kai Soki, Kasugai-choshi, Higashiyamanashi-gunshi, etc.



## b) Histories of main types of fruit produced

### i) Grapes

There are two competing traditions for when grape cultivation in Japan began. The first explanation is that grape cultivation dates back to the year 718, when the Buddhist priest Gyoki dreamed of Yakushi Nyorai, the Buddha of healing, holding a bunch of grapes. Gyoki carved a statue and built the Daizenji Temple on Mt. Kashio in present-day Katsunuma, Koshu City (Photo 8). The alternative explanation is that in 1186, Amemiya Kageyu found a variety of wild grape in Kamiwasaki, Katsunuma, Koshu City, and planted it in his own field.

Records show that the variety ('Koshu') discovered by Amemiya first bore fruit in 1190. However, it took a long time to propagate, and in 1601, a little over 400 years later, there were still only 164 vines. For this reason, the grapes were considered a trade secret during the early years, and were only cultivated in a strictly limited number of regions.

In the middle of the Edo period (1603-1868), the grapes began to be cultivated as a marketable cash crop, and the area of land used for grape cultivation expanded. Then, in the Meiji period (1868-1912), new varieties were introduced and grape cultivation expanded to other regions.

### ii) Peaches

The oldest record of peaches in Japan is from 1380, recording the presence of peaches and plums near to Erinji Temple in present-day Koshu City.

The *Kai Soki* of 1848 also has a description, saying "Itcho Tanaka, the village of Tanaka, has two districts; north and south. The southern district has many peach trees. The peaches that they produce are sweet and considered a specialty product" (Figure 10). The southern part of Tanaka corresponds to the Tanaka district and its surroundings in present-day Ichinomiya-cho, Fuefuki City. This record shows that during that period, peaches were already being cultivated systematically, and that the peaches produced were sweet. There are also records of peaches being produced and sold over 100 years ago in at least the districts around Ohno in Yamanashi



Photo 8. Yakushi Nyorai, the Buddha of healing at Daizenji Temple in Katsunuma, holding a bunch of grapes.

Statue dates from early Heian period (800s) and is designated by Japan as important cultural property. The grapes make this a very rare example.



Figure 10. Depiction of peaches in Tanaka, present day Fuefuki City, from the *Kai Soki*, 1848, demonstrating that peaches were already considered a local specialty in the mid-nineteenth century

Source: Yamanashi Prefectural Library

City. Later, peaches were the crop of choice to replace mulberry cultivation. Peach cultivation expanded and grew to rank alongside grapes as the main fruit crops of the region.

### iii) Persimmons, Korogaki dried persimmons

Many old documents and literary works show that persimmons have long been considered a Yamanashi Prefecture specialty. In addition to persimmons for the table, persimmons were produced for use as paint.

A large number of varieties of persimmons have been produced. A record from 1680 mentions 'Hyakume,' 'Hachiya,' and Yamato persimmons, and an 1814 record (*Kai Kokushi*) lists 'Koshu Maru' and 'Hyakume.'

Production of Korogaki dried persimmons is said to have begun in about 1570 at the encouragement of Yamanashi warlord Takeda Shingen. Later, in the Edo period (1603-1868), Korogaki was one of the local specialties included in tributes presented to the Edo Shogunate. These dried persimmons also gained a reputation in the Edo market as a delicacy. Korogaki require many processes to produce, and the techniques have been further developed over the years as the production process has been handed down.

### iv) Winemaking

The history of wine production in the Kyoutou region begins in 1877 when four people in present-day Katsunuma-cho, Koshu City established the Dainihon Yamanashi Wine Company.

The same year, the company sent two young men to France to learn about winemaking. They also studied cultivation techniques such as pruning, and then returned to Japan in 1879 (Photo 9).

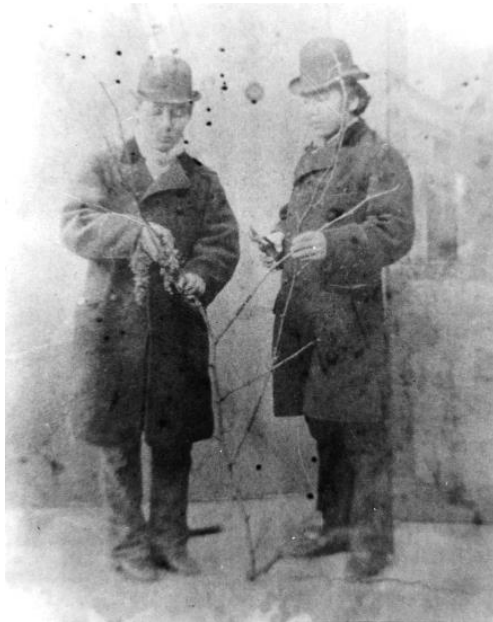


Photo 9. Katsunuma winemakers Masanari Takano and Sukejiro Tsuchiya studying pruning in France (1877–1878)



Photo 10. Old photographs of the winemaking process (1920s)

Since then over a thousand individuals and groups have produced wine, which was called *budoshu* (grape sake), both for personal consumption and for sale.

Groups of winemakers joined together to establish cooperative wineries (block wineries). Consequently, the Kyoutou region now has over 60 wineries of various sizes, and has played an important role in the history of wine production in Japan (Photo 10).

### 5) Distinctive land use adapted to alluvial fan (landscape)

Land on the alluvial fans of the Kyoutou region has soil, water, and weather conditions that vary from place to place. In order to cope with these differences in land and weather conditions, a distinctive approach to land utilization is employed for the cultivation of grapes, peaches, and other fruit, selecting varieties of vines and fruit trees that are suitable for each individual plot of land.

In addition, increasing the number of types of fruit cultivated is a useful approach for mitigating the risks of weather disasters such as typhoons, torrential rain, and severe drought, allocating labor more efficiently, and ensuring income stability. Currently grapes and peaches are the main fruits, but the total number of fruit types cultivated is in double figures.

Furthermore, some 75% of the land in the Kyoutou region is forested, and agricultural land accounts for only 9.8%. The amount of arable land per farm household is low, only about 0.7ha, and individual plots of land are small and irregularly shaped, so farmers have constructed stone walls to enable more efficient use of sloping land in the small, irregularly shaped plots (Photo 11).



Photo 11. Farmers build stone walls in peach orchards to prevent soil erosion and make their work easier

In this way, the experience and knowledge accumulated by Kyoutou region farmers over long years have enabled the selection of suitable fruit trees for the complex characteristics and conditions, sustaining agriculture on the alluvial fan land. This original approach to land utilization has created distinctive mosaic patterns in the landscape (Figures 11, 12, 13, 14).

The original approach to land utilization taken by farmers increases the resilience of the fruit cultivation system. In conjunction with the surrounding satoyama (woods and mountains), it also provides beautiful scenery that changes with the seasons, which is an important tourist resource.

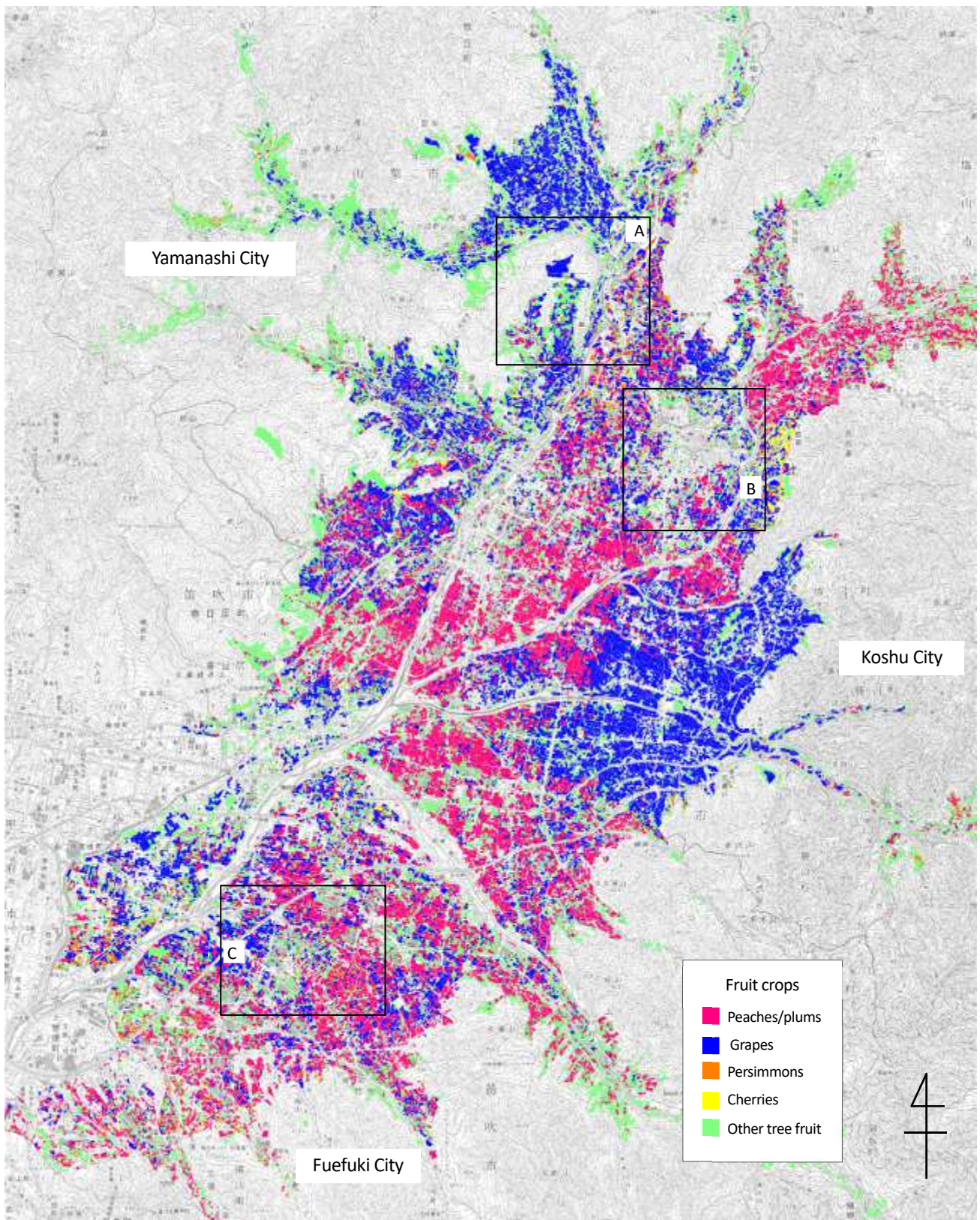


Figure 11. Mosaic landscape produced by cultivating a variety of types of fruit on alluvial fans (Land utilization map)

Source: University of Yamanashi (Yoichi Shimazaki, Yuki Shinahama, Moena Nakajima, Ayumi Nakaya, Taisei Yamamoto), Yamanashi Prefectural Land Improvement Projects Federation

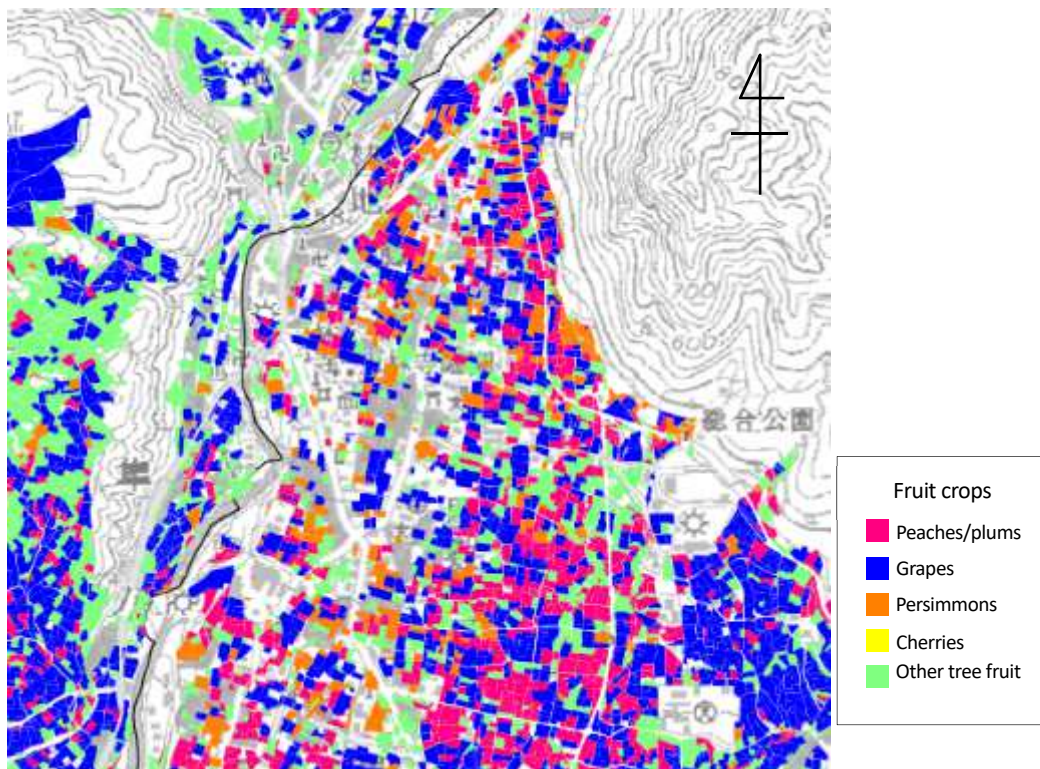


Figure 12. Mosaic landscape (detail)  
 Area near Enzan Oyashiki, Koshu City (Area A in Figure 11)

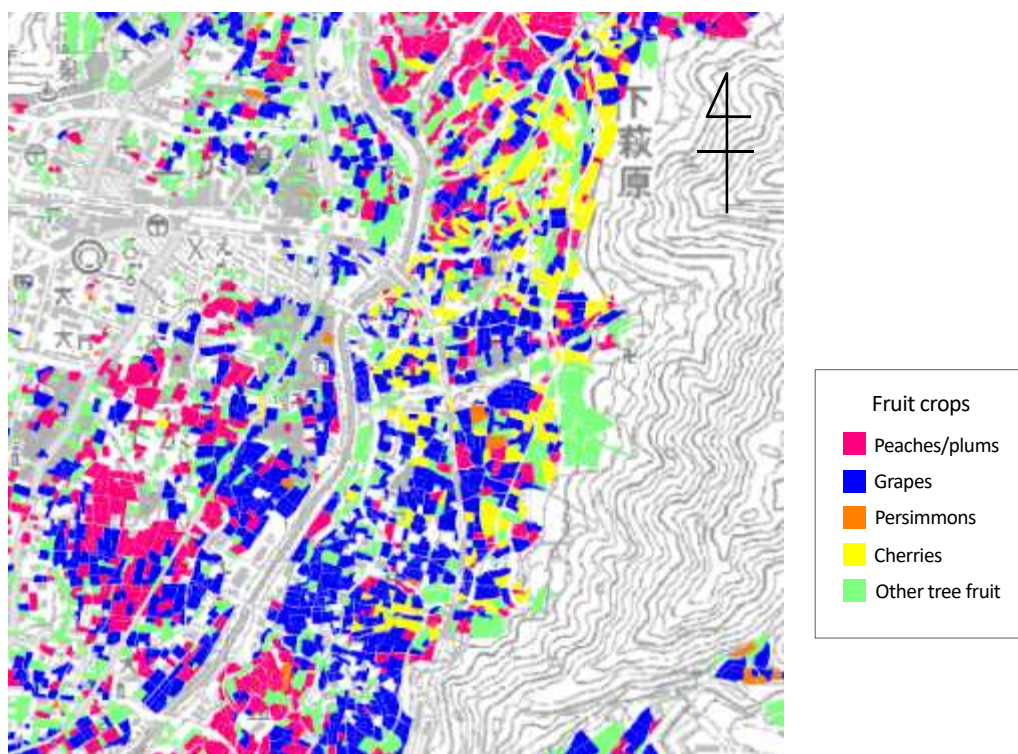


Figure 13. Mosaic landscape (detail)  
 Area near Enzan Shimohagihara, Koshu City (Area B in Figure 11)

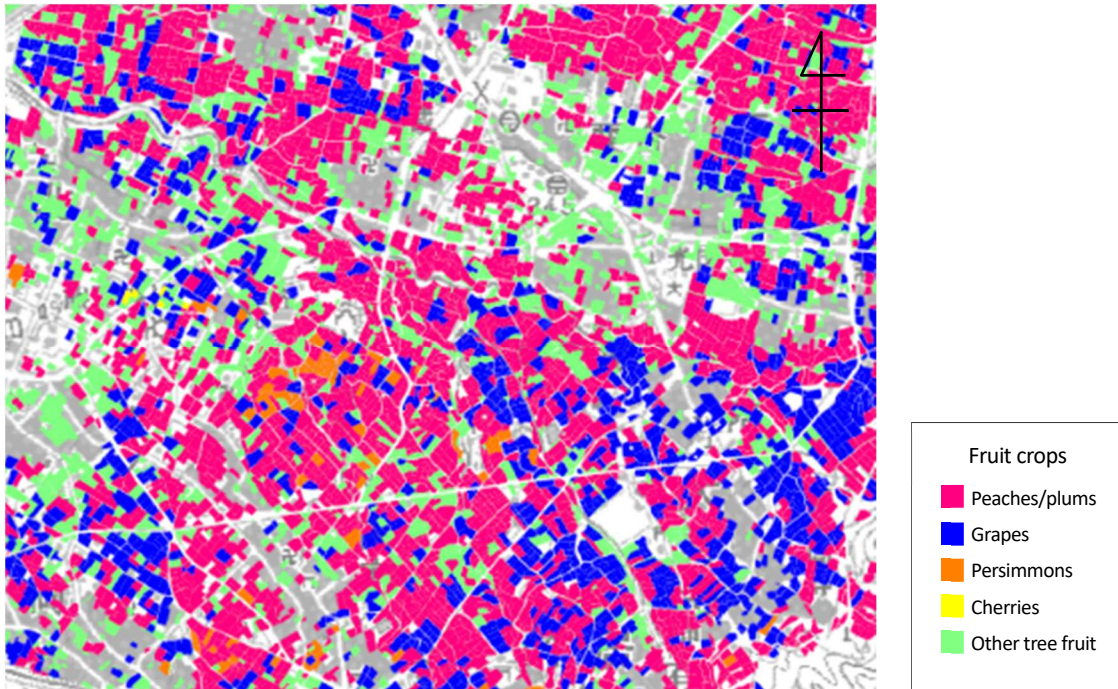


Figure 14. Mosaic landscape (detail)  
Area near Yatsushiro-cho Minami, Fuefuki City (Area C in Figure 11)

## 6) Traditional fruit cultivation adapted to alluvial fan

### a) Locally-developed cultivation techniques: Trellis vineyards, widely-spaced large vines, etc.

Around the world, many different cultivation techniques are used for grapes. Nevertheless, vines are typically planted in rows in most of the main grape-producing areas worldwide.

This approach, however, is disadvantageous in the Kyoutou region and other parts of Japan that have high rainfall and humid weather conditions during growing season. In order to ensure reliable grape production under such weather conditions and on the sloping ground of alluvial fans, farmers in the Kyoutou region developed an original trellis system, using what are now known as Koshu-style trellises for grape production. The Koshu-style trellises keep the vines away from the ground at a height of 2.1m or so, which enhances ventilation and suppresses disease. Furthermore, because form a continuous trellis, they impose no constraints on the directions in which vines can spread out, thereby enabling cultivation with no adverse effect on grapevine physiology. The trellises can be installed to match the slopes and shapes of vineyards. As such, they are an original adaptive technology suited to the Kyoutou region with its many small, irregularly shaped plots of land (Photo 12, Figure 15).



Photo 12. Koshu-style trellises installed on sloping land

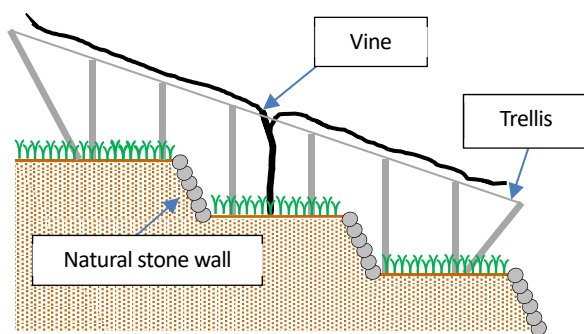


Figure 15. Form of Koshu-style trellises on irregular sloping land

At the global level, most grape producing regions are arid or semi-arid, with low rainfall. Such conditions suppress the growth of vines. As individual grapevines do not grow very large, they are densely planted. Under the wet and humid conditions of the Kyoutou region, grapevines grow vigorously, with thick growth of both shoots and leaves. Consequently, dense planting would make it difficult to produce quality fruit. For this reason, in the Kyoutou region, low planting densities are used in combination with Koshu-style trellises, ensuring that vines are widely spaced, and that each individual grapevine is allowed to grow large and spread out. The number and lengths of shoots can be adjusted to control vigor. This approach enables the production of high quality grapes (Figures 16, 17).

The photograph in Figure 17 shows 'Koshu' grapes growing on a Koshu-style trellis with widely-spaced large vines. In the Kyoutou region, rainy conditions produce thick growth of shoots and leaves. Vines are widely spaced, and each individual grapevine is allowed to grow large and spread out. Allowing a large number of shoots distributes the vigor, suppressing the growth of new shoots. New shoots are trained horizontally across the trellis, suppressing vigor to feed water & nutrients to the grapes. This enables large numbers of grape clusters to be produced and harvested from a single vine. The vineyard in the photograph has 22 vines in a 0.23 ha plot, producing a yield of about 4 t. This yield is larger than the Yamanashi Prefecture average of 11.4 t/ha because the vines are mature (about 15 years old) and because the 'Koshu' grape variety has a relatively high yield.

Conditions in the Kyoutou region are largely different from those in Europe in terms of climate, soils, varieties grown, growing methods, and consumption trends. For instance, planting density in Europe can be as high as 6,500 vines/ha (Haut-Médoc AOC standards), but planting density in the Kyoutou region is only 50–100 vines/ha, so Europe (Haut-Médoc) has substantially more vines. The Haut-Médoc standards keep yields to a maximum of 9.5 t/ha, whereas Yamanashi Prefecture had an average yield of 11.4 t/ha in the 10 years 2009–2018.

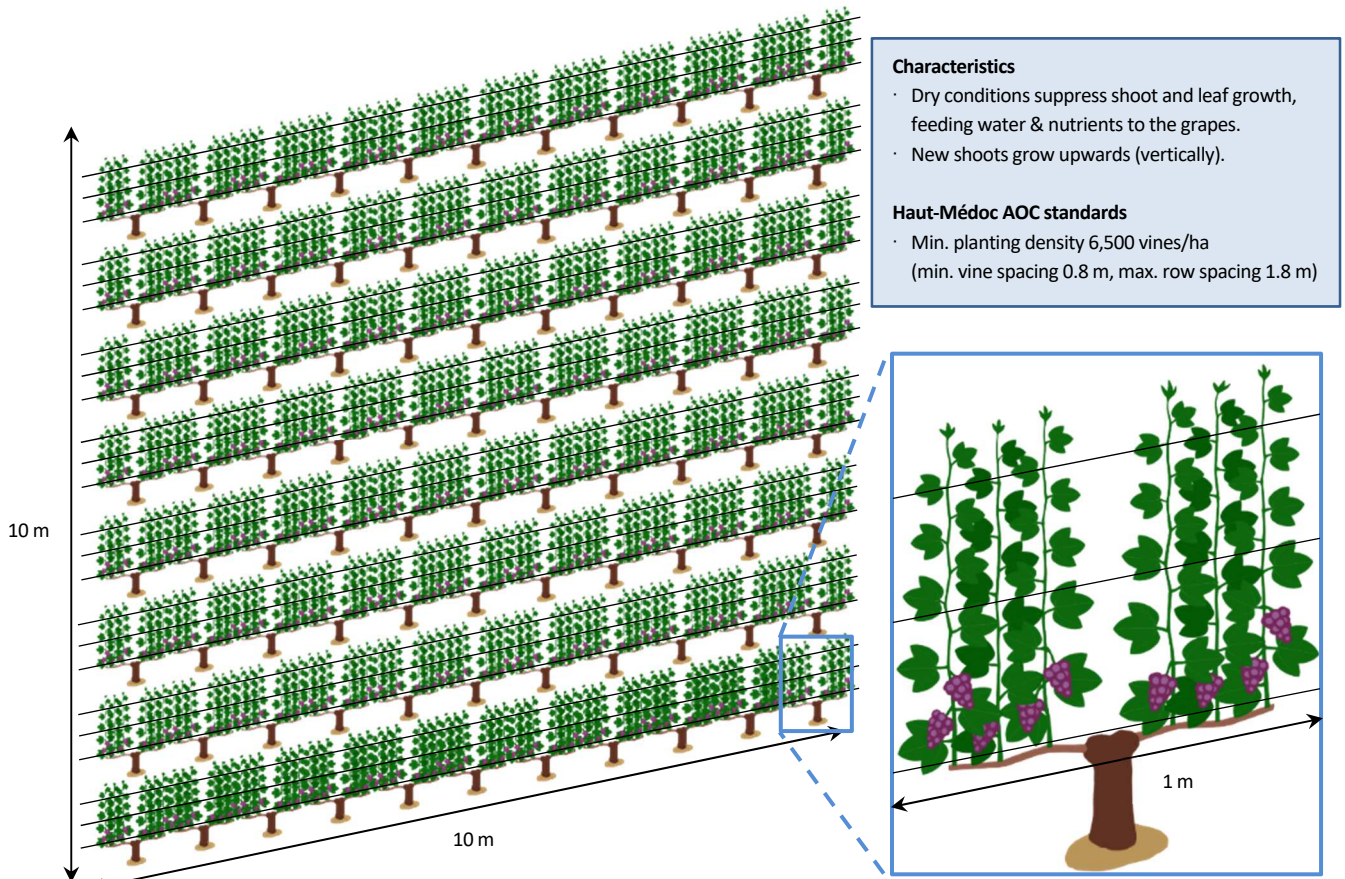


Figure 16. Vines planted in rows on vertical shoot position trellis as frequently used in Europe, etc.

(Created by authors based on information provided by Bordeaux, France; based on *Cahier des charges de l'appellation d'origine contrôlée « HAUT-MÉDOC »* (2018), BO du MAA, France )

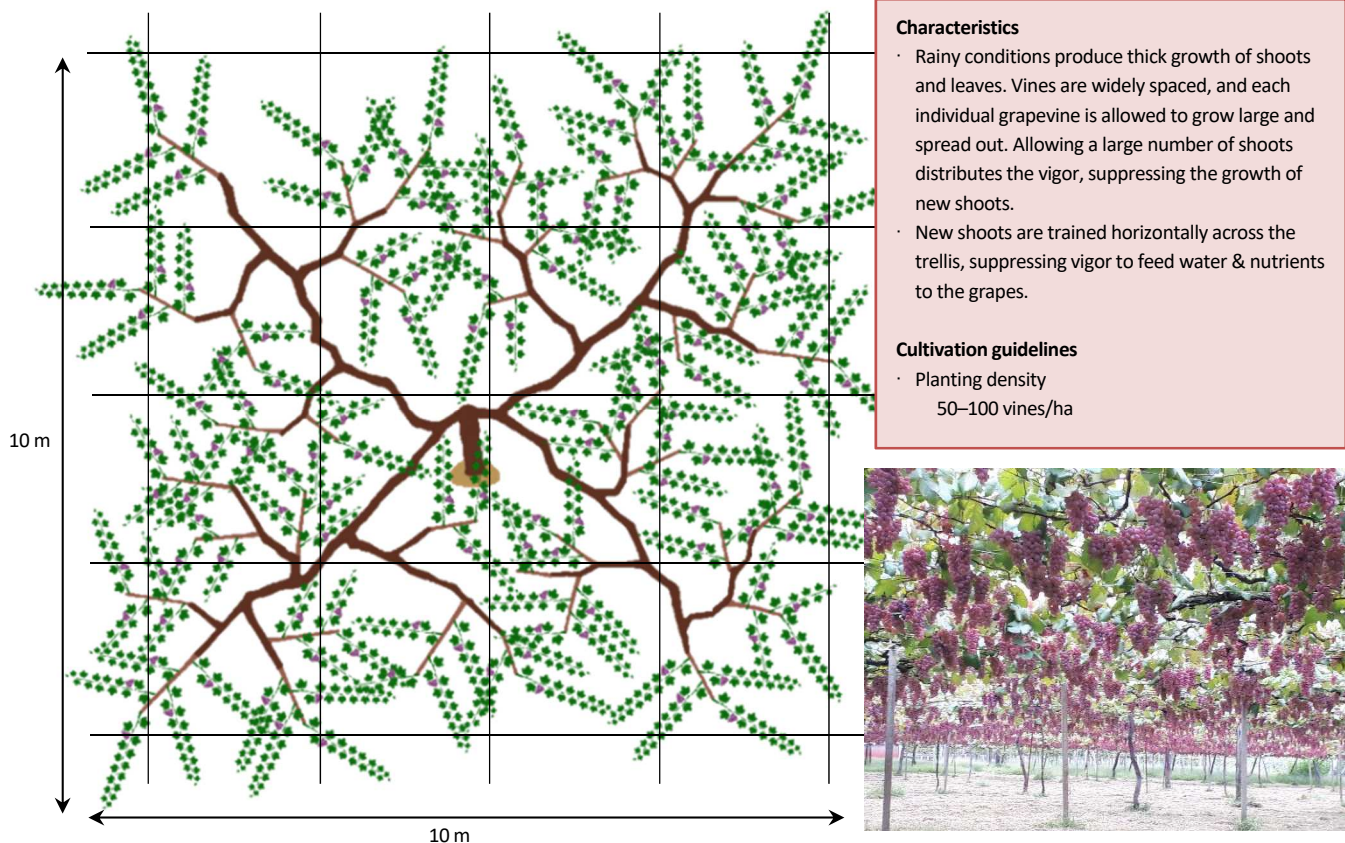


Figure 17. Koshu-style trellis with widely-spaced large vines (Kyoutou region)



This approach contrasts to the funnel-framed approach used in the vineyards of Xuanhua in China, which already have GIAHS designation. That is a cultivation system where multiple vines are trained over a funnel frame that can be removed before winter to bury the grapevines in trenches as protection against the cold (Photo 13). The Veronese pergola used in the Soave vineyards of Italy also uses densely planted vines, training them over galleries (rows) of trellises (Figure 18). The Xuanhua vineyards and the Soave vineyards each use a form of trellis, but neither uses a cultivation method with widely-spaced large vines like that of the Kyoutou region, which allows individual vines to grow large, and neither uses the trellis system to cover the whole surface of the vineyard as the Koshu-style trellis does.



Photo 13. Funnel-frame trellis, bird's eye view  
(Xuanhua, China)

Source: Xuanhua Traditional Vineyards System (2013): Proposal for designation as Globally Important Agricultural Heritage System P70  
Website: <http://www.fao.org/3/a-bp786e.pdf>

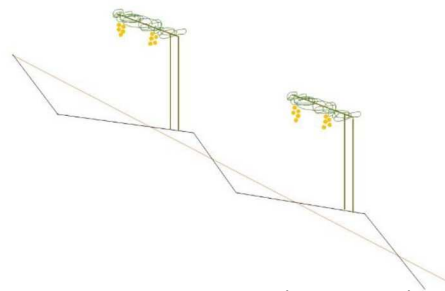


Figure 18. Pergola trellises (Soave, Italy)

Source: Soave Traditional Vineyards (2018): Proposal for designation as Globally Important Agricultural Heritage System P28  
Website: <http://www.fao.org/3/CA3436EN/ca3436en.pdf>

Pergola systems had been used in Italian vineyards since ancient times, but in the 1990s, many vineyards switched from traditional pergolas to a Guyot training system. Since then, global warming has resulted in a rapid rise in temperatures, which are now much higher than those ten years ago. This has shortened the grape maturation period, and resulted in changes in grape quality. As a result, there are reports of vineyards considering reverting to pergola systems because the grapes grow in the shade of the trellis where temperatures do not rise as high.

The trellis cultivation method developed and improved under the weather conditions of the Kyoutou region (Koshu-style trellises in combination with widely-spaced large vines) has spread throughout Japan. It is an original system based on an innovative and globally important knowledge system, and is considered to be adaptive technology that can cope with global warming and other aspects of climate change. Furthermore, the trellis system can fit varied topology, which requires special construction skills. For each of these reasons, this traditional cultivation system is an important heritage that should be handed down to future generations. So far, the techniques for installing trellises on different slopes and plot shapes using only simple tools have been passed down from farmer to farmer. But because there is no need for frequent maintenance, fewer and fewer farmers are familiar with the techniques, and there is a great risk of the skills and techniques being lost.

b) Careful management of fruit to increase value added

Consumers in Japan choose grapes by appearance (size, color and shape) as well as by sweetness and other flavor considerations. Fruit that both tastes good and has an attractive appearance is considered to be of high quality. Such fruit is used for luxury gifts.

For this reason, farmers in the Kyoutou region adjust the number of fruit produced in accordance with fruit type and variety, and using meticulous techniques such as bagging of individual fruit to maximize the quality (value added) of fruit produced on a confined plot. Producing higher quality fruit raises the price that can be obtained, increasing the productivity of the land. The fundamental techniques of this sort of high quality fruit production cannot be mechanized, so are performed by hand (Photo 14). Such high quality fruit has gained recognition worldwide for both its flavor and appearance, being described as like a work of art (Photo 15).



Photo 14. Skillful care is required to produce high quality value-added fruit  
(Left: Grape cluster shaping. Right: Hand-pollinating peaches)



Photo 15. High quality Kyoutou region fruit in presentation boxes

**c) Encouraging diversity in fruit tree types, varieties and strains (genetic resources), agricultural biodiversity**

In the Kyoutou region, many different varieties of each fruit type (grapes, peaches, etc.) are conserved through cultivation. Over 300 fruit varieties are currently cultivated by farmers, ensuring their conservation, including 148 grape varieties, and 86 peach varieties. This diversity stands alongside the biodiversity within orchards and vineyards, and is further augmented by rich agricultural biodiversity.

The reasoning behind this diversity is similar to that behind the diversity of fruit types. Increasing the number of varieties cultivated is a useful approach for mitigating the risks of weather disasters brought on by adverse weather conditions, allocating labor more efficiently, and ensuring income stability. It is also the result of meeting demand for fruit for a variety of purposes and producing fruit to suit consumer needs and tastes.

These varieties include the 'Koshu' grape variety that made a vital contribution to the history of grape cultivation in Japan (Photo 16). It is preserved through ongoing cultivation by farmers, both as a grape for the table, and as a grape for winemaking.



Photo 16. 'Koshu' grapes

Of the varieties and strains being cultivated today, 38 varieties of grapes, and 32 varieties of peaches were developed and selected by Kyoutou region farmers or by the Research and Education Center Supporting Fruit Cultivation. New varieties and strains with a variety of characteristics continue to be produced today. The Kyoutou region is a rich store of fruit tree genetic resources for fruit trees (Photo 17, Table 3).

In addition to fruit, a small number of other agricultural products are produced of the foot of the alluvial fan and other points with plentiful water supplies. They include paddy-field rice and vegetables such as sweetcorn and eggplant.



Photo 17. Main fruit types developed in the Kyoutou region

Table 3. Number of varieties and strains cultivated for the main fruits in the Kyoutou region

Fruit	Number of varieties/strains	Number developed and selected in the Kyoutou
Grapes	148	38
Peaches	86	32
Plums	45	5
Cherries	53	4
Persimmons	13	1
Total	345	80

\* Other fruits grown in addition to the main five include ume, apples, kiwifruit, nuts, chestnuts, and blueberries.

**d) Sustainable fruit cultivation with small scale family-run farms**

As many as 99% of the farms operating in the Kyoutou region are family businesses. With only 1.8 laborers per farm household on average, most are small family operations. The amount of arable land per farm household is low, only about 0.7ha, which is only about one third of the national average excluding Hokkaido (2.08ha). The extremely small size of the farms is a characteristic of the region.

Compared with the average area of farmland per agriculture, forestry and fisheries worker in other areas of the world, the Kyoutou region farms are extremely small. Europe’s top fruit producers Spain and Italy have 35.9ha per worker, and 16.6ha respectively. Even compared to the 2.3ha per worker in China, which has a large grape and peach production, the approximately 0.4ha per worker of the Kyoutou region farms is small, and Kyoutou has a much larger proportion of very small farms than the GIAHS-designated Soave Traditional Vineyards (Figure 19, Tables 4, 5). Much of the alluvial fan land is sloping, and there are large undulations. This topology makes it difficult to introduce mechanization and scale up the farms.

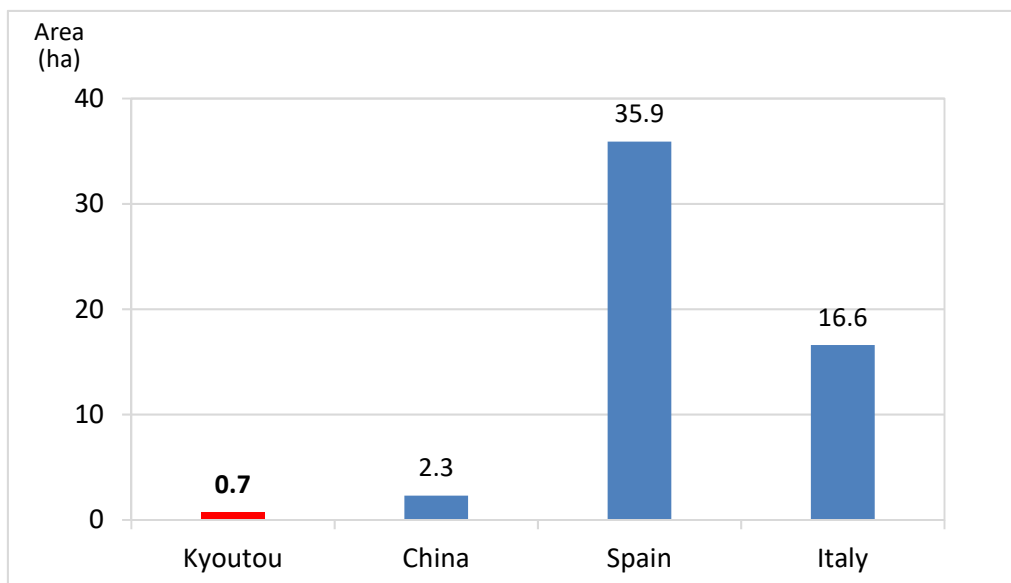


Figure 19. Average area of farmland per agriculture, forestry, and fisheries worker  
 Source: China, Spain, Italy: Kokusei Zue (2017).  
 Kyoutou: Census of Agriculture and Forestry (2015)

Table 4. Area of managed arable land per entity in the Kyoutou region

	Managed arable land area	Number of entities	Area of managed arable land per entity
Overall	5,355 ha	7,774 entities	0.7 ha
Orchards/vineyards	5,064 ha	7,636 entities	0.7 ha

Source: Census of Agriculture and Forestry (2015)

Table 5. Farm sizes

Size	Kyoutou (2015)	Soave (Italy, 2017)
< 1ha	64%	21%
1-2ha	32%	24%
2-5ha	4%	35%
5-10ha	—	15%
> 10ha	—	5%

Source: Soave: GIAHS Proposal (2018). Kyoutou: Census of Agriculture and Forestry (2015).

In Japan, grapes and peaches are regarded as special. High class fruit is used for gifts as a mark of respect or to make a special impression. Consequently, high quality fruit fetches high prices.

Farmers have long grown grape, peach, and other deciduous fruit trees as crops able to provide a reliable livelihood for a small, family-run farm. Raising the quality of the product increases the productivity of the farmland, enabling the farm to be run as a profitable business. Working with a small area of arable land enables detailed observation while the fruit is growing, and also facilitates experimentation with new techniques. These circumstances are believed to have helped the development of crop management techniques that raise product quality.

In the Kyoutou region, each farmer cultivates various crops, varieties and lines with different harvest seasons, which increases labor distribution and resilience to meteorological disasters, leading to stable management.

The Kyoutou region fruit cultivation system is able to sustain small family-run farming businesses, and is in accord with the United Nations Decade of Family Farming declared in 2017. From a global perspective, it is important that knowledge of this system is handed down to future generations.

#### e) Hybrid operations combining production, processing, and tourism

Outside Japan, grapes are predominantly cultivated for wine or as the raw material for dried fruit. In the Japanese cuisine, however, since ancient times, the role of fruits such as grapes and peaches has largely been as fresh fruit for the table. Consequently, cultivation for the table has been the primary objective of cultivating such fruit.



Photo 18. Persimmons hand-processed to produce Korogaki, which are carefully packaged for sale as gifts.



Photo 19. Tourist fruit farm popular with young people and families

In addition to producing fresh fruit for the table, fruit is processed locally in the Kyoutou region. Production of Korogaki dried persimmons is said to have begun over 400 years ago, and winemaking has a 140-year history. Agritourism is said to have begun some 120 years ago with the advent of tourist fruit farms in combination with

direct sales of produce. Complex fruit farming businesses have developed, and the combination of production, processing and tourism (sales) has become a feature of the fruit cultivation system in the Kyoutou region (Photos 18, 19).

### 7) Relationship between fruit cultivation system and biodiversity in orchards and vineyards

Biodiversity surveys of plants, insects, and birds conducted by the GIAHS Promotion Association for the Kyoutou Area in 2015 and 2017 revealed that fruit farms and nearby roadsides in the Kyoutou region have high biodiversity of plants and insects in particular. The plant surveys identified 35 orders, 64 families, and 269 species (+ 1 subspecies, 4 varieties, 5 forms), and the insect surveys identified 16 orders, 205 families, and 550 species (taxa).

Native vegetation ground cover is used in the orchards and vineyards to prevent soil erosion on sloping ground and supply organic matter to the soil. It also provides a home for a variety of plants and insects. The vegetation is managed by manual cutting of the grass, creating a range of environments that suit different plants and insects. This practice is intimately connected with biodiversity in the orchards, vineyards, and their surroundings (Photo 20).

Many birds that feed on fruit and birds further up the food chain that feed on smaller birds are observed. The presence of fruit and of the open spaces in the orchards attracts fruit-feeding birds, which is thought to be related to the diversity of birds in the areas around the fruit farms.



Photo 20. Native vegetation ground cover (Peach orchard in April)

### 8) Society and community organizations working to hand down and conserve the fruit cultivation system

On the alluvial fan, where sandy or gravel soils are common, sustaining water is difficult. Local people throughout the district collaborated to dig water channels called *segi* that provide stable water supplies. Long ago, community organizations formed to maintain and manage the *segi* water channels, and they remain active today. The activities of these organizations and the links between people in the local communities have survived times of disaster, continuing to support the fruit cultivation system (Photo 21).



Photo 21. Community group maintaining a *segi* (water channel)

\* *Segi* is a local dialect word for water channel.

The Kyoutou region has been hit by disastrous landslides and flood damage many times over history. Flood damage was particularly prevalent in the Meiji period (1868-1912). In 1911, the Meiji Emperor gifted a large area of forests and grasslands to Yamanashi prefecture for preservation as a commons. These estates, known

as *Onshirin*, are managed by organizations for their protection under rules and regulations established by local communities. The Kyoutou region is involved in the protection of these forests, which today still play a part in ensuring a stable livelihood for the local communities on the alluvial fans.

Early in the 140-year history of winemaking, many community winemaking associations were established in the Kyoutou region. These associations (called *block jazo* organizations) were unique to the region, and are the reason that there are so many wineries in the Kyoutou region today. No other region in Japan has such a concentration of wineries. In some parts of the region, wine is still produced by the community winemaking association, preserving a winemaking heritage that only exists in the Kyoutou region (Photo 22).



Photo 22. Community winemaking by farmers with long-used equipment  
(Hishiyama Chuo Winery, Kosu City)

### 9) Culture and traditions associated with fruit growing

In addition to the tradition of the origin of 'Koshu,' Japan's oldest grape variety, the Kyoutou region has many records and traditions relating to fruit trees, bearing witness to the role played by fruit farming in securing a livelihood for local people. Many of these cultural practices and traditions involving fruit trees are handed down as local heritage.

In the Kyoutou region, fruit farming is closely linked with the lives of the local people, including local culture, society, and customs. Traditional festivals and events held throughout the region involve prayers for good harvests from the fruit trees and other agricultural products. Fruit is also used regularly as gifts to shrines and temples and also as presents to people who are special to the gift-giver, and in many other ways as a result of fruit trees becoming a part of everyday life and culture.

The people of the Kyoutou region have continued adapting to economic changes and changes in the natural environment on the alluvial fan. With each change, they have selected the optimum products and continued farming. As a result, they have accumulated precious traditional knowledge and culture, and developed the innovative local techniques that make up the Kyoutou region's original fruit cultivation system.

## 10) Contribution to resolving global issues and current issues

The Kyoutou region's fruit cultivation system enables profitable and sustainable agriculture by family-run entities making maximum use of local resources. It is in accord with the United Nations Decade of Family Farming, and contributes to the current global effort to achieve The 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs).



### a) Sustainable fruit cultivation by small family-run farms (SDG 1, SDG 2, SDG 8)

The fruit cultivation system built by small family-run farms on alluvial fan land enables small family farms to be profitable by producing high quality, high value added fruit. Application of the system achieves highly sustainable agriculture that can support the livelihoods of small farmers.

Moreover, the fruit cultivation system produced by small farmers is a highly sustainable cultivation system that is resilient to weather disasters and to abnormal weather conditions resulting from climate change.



### b) Fruit type and variety diversity providing resilience to environmental change (SDG 1, SDG 2, SDG 13)

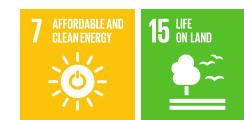
Over ten types of fruit are cultivated in the Kyoutou region, including grapes, peaches, plums, and persimmons. In all, over 300 varieties and strains are currently cultivated, representing a formidable genetic resource. This agricultural product diversity has been developed over long years to enable farmers to select suitable fruit trees for the complex characteristics and conditions of the alluvial fan land and to mitigate against typhoons and other weather risks.

This sort of diversity of fruit types and varieties increases resilience against weather disasters and against global warming and other climate change. Thereby contributing to reliable livelihoods for the farmers.



### c) Native vegetation ground cover contribution to biodiversity and reducing environmental impact (SDG 7, SDG 15)

Ground cover with locally-occurring grasses and other native vegetation is used for floor management in orchards and vineyards. The grass is managed sustainably, including cutting by hand, providing a home for a variety of plants and insects in the orchards, and contributing to maintaining biodiversity.



The native vegetation ground cover is also effective for preventing nutrients from being washed away by rain. Consequently, less fertilizer needs to be applied, which reduces the impact on the environment.

Native vegetation ground cover makes use of the natural local ecosystem and, at the same time, maintains and preserves biodiversity. It is a sustainable agricultural method that results in a lower impact on the environment.



#### d) Initiatives in environmentally friendly farming practices (sustainable agriculture) (SDG 12)

The Kyoutou region is involved in several initiatives at different levels concerning environmentally friendly farming practices, including organic farming, practices involving specially cultivated agricultural products,\* unofficial standards for cutting agrochemicals and chemical fertilizers, and group participation in the Eco-Farmer\*\* program.

These initiatives in environmentally friendly farming practices contribute to the cultivation system by enhancing sustainability, and at a time when consumers are increasingly concerned about food safety and security, meet these needs in addition to quality in terms of flavor and appearance.

In addition, GAP (good agricultural practice) accreditation is recommended in order to achieve food safety. By reducing the amount of agrochemicals and nitrogen released to the environment, this initiative reduces impact on human health and on the environment, and is considered to contribute to achieving sustainable production.



Figure 20. Yamanashi GAP logo

- \* Guidelines for labeling as specially cultivated agricultural products were set out in the Notice of the Ministry of Agriculture, Forestry and Fisheries, Food Marketing No. 3889 on 1 October 1992. Based on this notice from the directors general of the MAFF General Food Policy Bureau, Agricultural Production Bureau, and Food Safety and Consumer Affairs Bureau, the guidelines were to keep applications of agrichemicals and chemical fertilizer to no more than 50% of the local customary level, and to keep the nitrogen component of chemical fertilizers to no more than 50% of local customary levels, where customary levels are considered to be the customary levels in the locality of agrichemicals and chemical fertilizers subject to reduction in usage.
- \*\* Based on the Act on Promotion of Introduction of Sustainable Agricultural Production Practices, enacted in July 7, 1999, an Eco-Farmer is a farmer who has submitted a plan for the introduction of sustainable agricultural production practices to the Prefectural governor, and had the plan recognized as being appropriate.

#### e) Orchard and vineyard carbon storage function (SDG 13)

It is said that a rise in atmospheric CO<sub>2</sub> density is a cause of global warming, and that the effects of global warming include weather-related disasters. Studies on the carbon cycle of grape and peach production were conducted to discover how the Kyoutou region orchards and vineyards were associated with carbon emissions.



The studies showed that because the fruit trees are perennial plants, carbon is stored in the tree during cultivation. Moreover, the native vegetation, including green manure from cutting the grass, supplies carbon to the soil and the ecosystem, where it is stored. In regular fields and rice paddies, weeds are quickly removed, so very little carbon supply to the soil can be expected. In contrast, the active use of native vegetation, including the return of clippings, in orchards and vineyards facilitates carbon supply to the soil.

The carbon balance for agricultural products is negative (i.e. carbon is emitted) when the products are cultivated in regular fields, and said to be balanced when using paddy fields. However, orchards and vineyards using native vegetation ground cover to grow grapes, peaches, etc. have a positive carbon balance. In the Kyoutou region, where fruit cultivation uses native vegetation ground cover (sod culture), the carbon storage function is considered to be high, making this an important cultivation system (Figure 21).

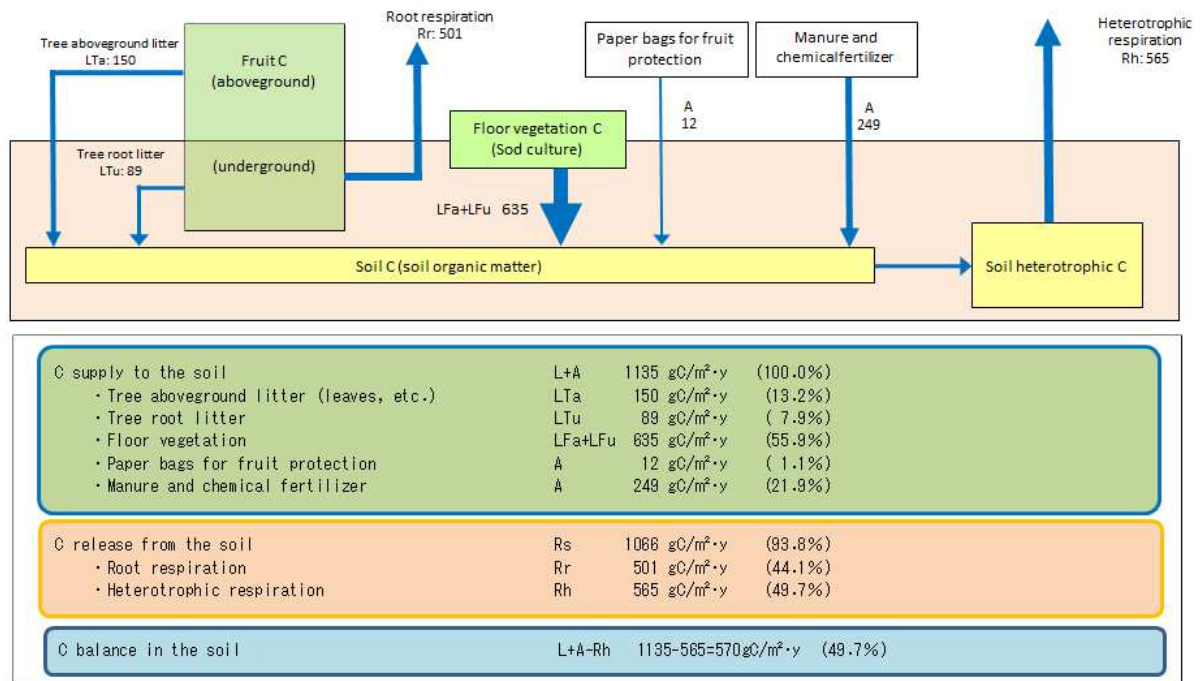


Figure 21. Soil carbon balance for peach orchard adjacent to the Yamanashi Fruit Tree Experiment Station  
 Source: Seiko Sekikawa et al. (2002) "Soil Carbon Budget in Peach Orchard Ecosystem in Japan," *Environmental Science* Vol.16 No.2, p.97-104 (Data from Sekikawa's report visualized for this proposal)

**f) Participation of women in agriculture (SDG 5, SDG 10)**

In the Kyoutou region, approximately 46% of agricultural workers are women. Women are extremely important to the success of the Kyoutou region fruit cultivation system.



As most of the farms in the Kyoutou region are small family-run farms, women either share the work with men or divide up the work between men and women to operate the farms. The role of women is significant.

Relatively little heavy work is involved in tending the fruit trees. On the contrary, much of the work required to produce quality fruit is meticulous manual work. The detailed observation and careful handling needed are an area where many women excel. Such abilities are used to the full, and underlie the production of high quality, high added value fruit.

Many women have also developed their analytical and management skills, putting them into practice in business administration and accounting work. In addition to participating in business decisions, women have actively



Photo 23. Group of women working on processed fruit products

formed groups throughout the region to acquire traditional processing techniques and knowledge, preserving the heritage and using the knowledge to actively develop new specialty products (Photo 23).

Processed fruit products made principally by women are sold through the local Michi-no-Eki roadside stations and other direct sales outlets, and some are sold outside Yamanashi prefecture. Women are increasingly starting their own businesses in this area.

As can be seen from the above, the fruit cultivation system applied in the Kyoutou region makes full use of women's abilities and provides an environment where women and men can work on an even footing.

### **11) Threats and challenges to the fruit cultivation system**

The Kyoutou region's fruit cultivation system faces serious challenges in the shape of decreasing numbers of farming households and farmers, advancing age among farmers, and growing incidence of abandoned farmland. In 2015, the Kyoutou region had a total of 8,957 farm households. This is an 11% decline on the number in 2010. Moreover, the proportion of people engaged in farming who are aged 65 and over has already reached 63%, and the age of farmers continues to advance. These demographic changes represent the single greatest threat to maintenance of the fruit cultivation system.

When the number of farm households declines, farmland is abandoned, making it more difficult to maintain the traditional fruit cultivation system. The region's traditional fruit cultivation knowledge and culture were acquired, maintained, and cultivated over the course of many generations, but are now in danger of being lost due to insufficient opportunities to maintain them, conserve them, and pass them on. Furthermore, there is a growing risk of losing agro-diversity and being unable to preserve the region's unique landscape.

Recognition of the Kyoutou region fruit cultivation system as a GIAHS site would inspire great confidence and pride among local farmers, other local residents, and people who aspire to carry on the traditional fruit farming techniques of the Kyoutou region. It would also give a strong boost to the stability of Kyoutou region fruit farms, alleviate succession issues, and improve the sustainability of the local fruit cultivation system.

Identifying and analyzing the threats and challenges that might otherwise prevent the maintenance and survival of fruit farming systems in the Kyoutou region, and steadily implementing specific policies, actions, and initiatives can help to ensure that the unique and precious fruit cultivation system developed by small family-run farms on the alluvial fans is passed on to future generations, thereby assuring farmers a livelihood based on fruit farming. Fruit farming is also the essential core of efforts to promote sustainable wine and tourism industries, invigorating the local economy.

## 2.2 Characteristics of the Proposed GIAHS Site

### 1) Food and Livelihood Security

#### a) Fruit cultivation supports livelihoods and the local economy

Currently, the Kyoutou region has a total of 8,957 farm households, of which 7,636 households (85%) are involved in fruit production. The area of farming land in the region is 5,355 ha, of which 5,064 ha (95%) is given over to orchards and vineyards producing fruit such as grapes, peaches, and plums. Annual production of fruit was 70,570 tons in 2014, with a value of 36.7 billion yen. The Kyoutou region currently produces approximately 18% of Japan's grapes and 25% of peaches. This production supports farmers' livelihoods and makes a significant contribution to distinctive local industries such as winemaking and tourism.

#### b) Cultivation system is economically viable for small family-run farms

The farms in the Kyoutou region are almost all small family-run businesses. The area of arable land per farming household in the region is about 0.7 ha, which is one of the smallest figures in the world.

The main processes involved in cultivating grapes and peaches require a great deal of labor, most of which cannot be mechanized, so has to be performed manually. The fact that many of the plots of land are small and scattered around sloping land is another factor that prevents substantial labor-saving through mechanization.

The farmers of the Kyoutou region have overcome these disadvantages by selecting suitable fruit trees for the conditions in order to make small plots of agricultural land profitable. The cultivation of a diversity of fruit types and varieties also enables efficient allocation of labor. Constant effort and the process of managing the fruit meticulously through manual work have led to the development of this sort of superb technique, and employing such techniques enables the reliable production of high value added, high quality fruit. The result is high productivity agriculture.

Applying the cultivation system in this way has earned the fruit of the Kyoutou region a strong reputation throughout Japan that now extends internationally. The average agricultural income per 0.1 ha of land was 145,700 yen in 2014, making it one of the highest productivity farming regions in Japan, with agricultural income 2.4 times the national average of 61,900 yen per 0.1 ha. In Japan, grapes and peaches are regarded as special. High class fruit is used for gifts as a mark of respect or to make a special impression. Consequently, high quality fruit fetches high prices. The producer price of fruit produced in Japan is higher than in world markets.

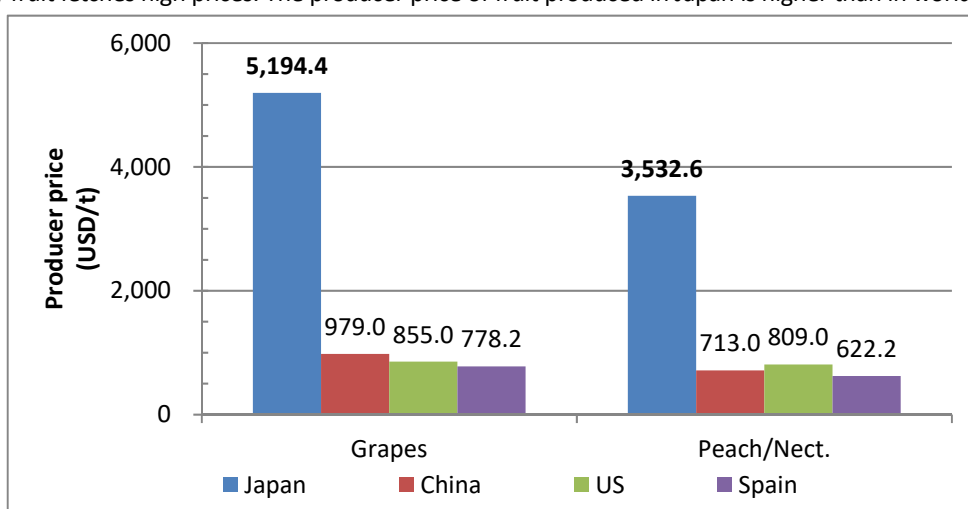


Figure 22. Producer prices in major grape producing countries. Source: FAOSTAT 2015

For instance, the producer price of grapes in China is 979 USD/tonne, in the US is 855 USD/tonne, and in Spain is 778.2 USD/tonne (FAOSTAT 2015). In Japan, the equivalent price is 5194.4 USD/tonne nationwide, including the Kyoutou region (Figure 22).

Farmers have been able to earn a reliable living from a small family-owned business by selecting fruit trees suitable for particular plots of land and raising the quality of the fruit. This approach increased the productivity of the land, making the farm into a profitable business. Working with a small area of arable land enables detailed observation of the growing fruit, and also enables experimentation with new techniques, which helps with the establishment and development of crop management techniques that raise product quality.

Today, fruit from the Kyoutou region has gained a reputation as a quality product in markets outside Japan. Farmers are passing down the fruit cultivation methods and meticulous management techniques, using manual labor, so that farms can continue to operate in the Kyoutou region, mainly as family businesses. The Kyoutou region fruit cultivation system is based on small family farms, makes full use of local resources, and has a promising future. Moreover, it accords with the thinking behind the United Nations Decade of Family Farming.

### **c) Cultivation is combined with fruit processing, agritourism, and direct sales**

The fruit produced in the Kyoutou region is mainly destined for the table, but fruit is also processed to become products like the Korogaki dried persimmons or wine. Relative proximity to Tokyo (Edo) also made it possible to combine production with direct sales of fruit and tourist fruit farms.

#### **i) Korogaki (dried persimmons)**

The dried persimmon delicacy branded Korogaki is based on 'Koshu Hyakume,' a large variety of astringent persimmon native to Japan. Taking advantage of local weather conditions, peeled persimmons are dried from late autumn into the winter when skies are clear and a cold dry monsoon blows (Photo 24).

The time for processing the persimmons begins in early November, providing an important supplementary source of income for farmers at a time where there is no other income from fruit. This process functions as a way of allocating labor resources efficiently, and of mitigating weather disaster risks. The traditional way of processing persimmons is a heritage that has been passed down to the present day.



Photo24. 'Koshu Hyakume' persimmons are processed to become Korogaki

## ii) Winemaking

Winemaking is one of the features of the Kyoutou region fruit cultivation system. The wineries and the farmers who grow the grapes for wine have maintained close relationships ever since winemaking began about 140 years ago.

The Kyoutou region is unique in Japan for the number of wineries. Over 60 wineries of varying sizes each produce their own distinctive wines here. Annual production of grapes for winemaking is about 7,000 tons, making this an important source of income for farmers (Photo 25).



Photo 25. Many varieties of Koshu wine are produced

Annual shipments of wine from the region amount to about 12.8 billion yen (2014), representing 17% of the Japan total. Wineries in the region employ over 800 people, making a substantial contribution to the local economy.

## iii) Tourist fruit farms with direct sales of fruit

In the Kyoutou region, the use of fruit as a tourism resource (tourist fruit farms) centers on grapes, but there are also tourist fruit farms cultivating cherries, peaches, and other fruit. A total of 334 farm households operate fruit farms for tourists, and in 2015 they attracted some 1.25 million tourists, who spent over 2.6 billion yen, making this an industry unique to the Kyoutou region (Photo 26).



Photo 26. Tourists relax under a canopy of vines at one of the many tourist fruit farms in the Kyoutou region.



Photo 27. Farmers sell a large range of fresh fruit and processed fruit products at farm stands

Tourist fruit farms offer activities such as fruit picking and the opportunity to join in the fruit harvest. They also form part of the Kyoutou region scenery with its belt of fruit farms and the surrounding satoyama (woods and mountains). This scenery is a valuable tourist resource. Additionally, the farms provide a place where city-dwellers can mix with farmers, and are evolving into places where tourists can make deeper contact with agriculture and with the nature and culture of the region.

Direct sales of fruit are conducted at 22 farm stands run by agricultural cooperatives (JA), enabling locals and tourists to buy fresh fruit and processed fruit products. These have become popular places for travelers to call at (Photo 27). Annual sales at direct outlets like these amount to about 1.2 billion yen, and attract over 900,000 people each year, enhancing farmers' incomes and making a major contribution to the vitality of the community.

#### **iv) Fruit processing**

In addition to processed fruit products with a long history such as Korogaki and wine, farmers today are manufacturing and selling a variety of new products that they have developed themselves using grapes, peaches, and other fruit, including jams, juices, dry fruit products, and confectionery such as custard pudding deserts (Photo 28).



Photo 28. Wide variety of processed fruit products on sale at a farm stand

Agricultural organizations such as JA and the administrations of the three cities in the Kyoutou region have established an association as an entity to play a central role in matching businesses to facilitate development, manufacture, and sales of new processed products, and to handle PR for processed products.

Other new developments include links between a Kyoutou region winery and an individual in the livestock industry to use the pomace (skins, seeds, and stems) left over from winemaking as animal feed to produce new specialty products such as “Koshu wine beef,” and “Kai salmon red.” (Koshu and Kai are old names for Yamanashi.) These are example of some of the many active initiatives in farm management that are boosting farmers' incomes by combining fruit production, processing, sales, and tourism.

## **2) Agro-biodiversity**

### **a) Diversity of fruit types and varieties**

In the Kyoutou region, farmers retain a large number of fruit variants and strains by cultivating them. For grapes, 148 varieties are protected in this way, including the endemic ‘Koshu’. For peaches, there are as many as 86 confirmed varieties in the region, including the ‘Asama Hakuto’ that was developed locally. Among these totals are 38 grape and 32 peach varieties that were developed in Kyoutou. Including other fruits, at least 80 varieties currently cultivated varieties were developed and selected locally (Tables 3, 6). In this sense, the Kyoutou region is a true store of genetic resources for fruit trees.

Working with a large number of fruits or varieties tends to involve different techniques and different management issues for each fruit and variety, making the work more complicated. Modern agriculture considers circumstances like that to be inefficient—both in terms of production efficiency and economic efficiency—and is shifting strongly towards monoculture. In the Kyoutou region, however, the focus remains on adapting to a diversity of cultivation conditions, different uses for fruits, and changes in consumer needs. As such, the approach of cultivating a diversity of fruits and varieties at the farm level is continuing to expand. As a result, the diversity of fruits and varieties of the region as a whole is further increased, and the region

becoming a distinctive production area with a diversity of fruit trees not seen elsewhere. This fruit tree diversity makes for a highly resilient fruit cultivation system, which is one of the features of the Kyoutou region.

Table 6. Fruit tree varieties developed in Kyoutou region

Fruit	Variety	Developer	Fruit	Variety	Developer
Grapes (table)	Appare	Fuefuki City farmer	Peaches	Asama Hakuto	Fuefuki City farmer
	Arisa	Fuefuki City farmer		Ichimiya Suimitsu	Fuefuki City farmer
	Wink	Fuefuki City farmer		Ichimiya Hakuto	Fuefuki City farmer
	Enzan	Koshu City farmer		Ichiyo	Koshu City farmer
	Kaiotome	Fuefuki City farmer		Kanoiwa Hakuto	Yamanashi Cty farmer
	Kainokuromaru	Experiment Station		Kimiko	Fuefuki City farmer
	Kaimirei	Experiment Station		Queen Endo	Yamanashi Cty farmer
	Queen Seven	Fuefuki City farmer		Kouki	Fuefuki City farmer
	Koibito	Fuefuki City farmer		Sachi-Akane	Fuefuki City farmer
	Gold Finger	Fuefuki City farmer		Shoho	Yamanashi Cty farmer
	Kotopy	Fuefuki City farmer		Sweet Nect. Shogyoku	Experiment Station
	Koyubinoomoi	Fuefuki City farmer		Sweet Nectarine Shoko	Experiment Station
	Sunny Dolce	Experiment Station		Sweet Nectarine Reio	Experiment Station
	Summer Black	Experiment Station		Sweet Nectarine Reimei	Experiment Station
	Jewel Muscat	Experiment Station		Sotta Nectarine	Koshu City farmer
	Sekirei	Yamanashi Cty farmer		Takei Hakuho	Yamanashi Cty farmer
	Sonja Sweet	Fuefuki City farmer		Natsuyubi	Fuefuki City farmer
	Tenzan	Fuefuki City farmer		Hanayome	Fuefuki City farmer
	Violet King	Fuefuki City farmer		Hikawa Hakuho	Yamanashi Cty farmer
	Patio	Fuefuki City farmer		Himekko	Experiment Station
	Honey Juice	Yamanashi Cty farmer		Matsumori Wase	Fuefuki City farmer
	My heart	Fuefuki City farmer		Misakakko	Fuefuki City farmer
	Muscat Biolay	Fuefuki City farmer		Misaka Hakuho	Fuefuki City farmer
	Madonnanohoseki	Fuefuki City farmer		Meibi	Fuefuki City farmer
	Fujinokagayaki	Fuefuki City farmer		Yahata Hakuho	Yamanashi Cty farmer
	Yuhou	Fuefuki City farmer		Yamaichi Hakuto	Fuefuki City farmer
	Rubel Muscat	Fuefuki City farmer		Yamaka Hakuto	Yamanashi Cty farmer
	Wagamichi	Fuefuki City farmer		Yamanashi Hakuho	Yamanashi Cty farmer
	Kai Berry 3	Experiment Station		Yume Shizuku	Experiment Station
	Grapes (wine)	Harmo noir		Experiment Station	Plums
Kai Noir		Experiment Station	Yonegura Kintou	Fuefuki City farmer	
Kai Blanc		Experiment Station	Kaitoka 17	Experiment Station	
Sun Semillon		Experiment Station	Kagayaki	Koshu City farmer	
Neo Alicante		Experiment Station	Koumei	Experiment Station	
Bijou Noir		Experiment Station	Summer Angel	Experiment Station	
Fuefuki		Experiment Station	Summer Beaut	Experiment Station	
Monde Briller		Experiment Station	Taiyo	Koshu City farmer	
Colline Verte	Experiment Station	Persimmon	Midai	Koshu City (unknown)	
Cherries	Saori		Koshu City farmer		
	Kaiouka6	Experiment Station			
	Porenta	Experiment Station			
	Fuji Akane	Experiment Station			



### **i) Fruit tree diversity results from selecting the optimum variety for each location**

The Kyoutou region encompasses a substantial difference in altitude, which results in much of the land being sloping. This is exacerbated by the alluvial fan, with its complex mix of gradients, topologies, soil types and soil characteristics. The region has a basin climate, an inland climate typical of basins, which around the year has relatively long sunshine hours and, for Japan, relatively low rainfall during the growing season. Summer temperatures are high, and there are large diurnal and annual temperature ranges.

The complex topology and differences in altitude result in a variety of microclimates. Today, there are advanced instruments for observing and monitoring climate change, but before they existed, farmers had to rely on their own observations and experience to read the complex weather conditions before using accumulated knowledge and wisdom to select a tree suited for each particular location.

At one stage, many farmers in the Kyoutou region planted mulberry trees to use for sericulture, because the mulberry grew well in these conditions. However, with the objective of ensuring a more reliable income, they later selected trees such grapes and peaches as suitable for the region, and then carefully selected appropriate trees for each location to overcome the complex site and weather conditions on the alluvial fan.

Currently, at least ten types of fruit, including grapes, peaches, and plums, are cultivated in the Kyoutou region.

### **ii) Diversification of varieties to suit uses such as production, processing, and tourism/direct sales**

In the Kyoutou region, in addition to fruit that is destined for the table, fruit is produced for processing, for tourist fruit farms, for direct sale, and for other specific uses. In order to meet the specific needs and preferences of consumers for each type of use, a large number of different fruits and varieties are cultivated.

Farms that function as tourist fruit farms or sell directly to consumers have tended to create distinctive features for their own farm by cultivating rare varieties or varieties that are difficult to cultivate or ensure productivity. This trend helps to maintain diversity of varieties at the individual farmer level.

### **iii) Mitigating risk of weather and other disasters, and raising labor efficiency**

The weather characteristics of the Kyoutou region alluvial fans have meant that throughout history, the region has frequently been subject to flooding due to typhoons and torrential rain, damage from strong winds, and other weather disasters such as hailstorms and droughts. Grapes and peaches are only harvested once a year, and the harvest period is short. Weather conditions and weather events from the growing season to the harvest can have a substantial impact on the crop. Farmers needed a way to avoid or mitigate the risk of weather disasters and variable weather conditions.

The management practices in the cultivation of fruit trees are difficult to mechanize and need to be performed by hand. Moreover, the management work is concentrated into the period from April to June, and the harvest into the period from July to September. For the family businesses that constitute most of the farms in the Kyoutou region, it is necessary to plan carefully to allocate the limited labor appropriately.

Even in the case of combined management of grapes and peaches, the cultivation schedule is set in consideration of the difference in growth due to the difference in altitude, the difference in harvest and work time depending on the types of fruit and varieties, etc., so it is not necessary to give priority to only a specific type.

The approach of planting multiple types of fruit and multiple varieties in combination developed in order to mitigate the risks of weather disasters and similar circumstances, and to allocate labor efficiently to ensure a stable business (Figures 23, 24).

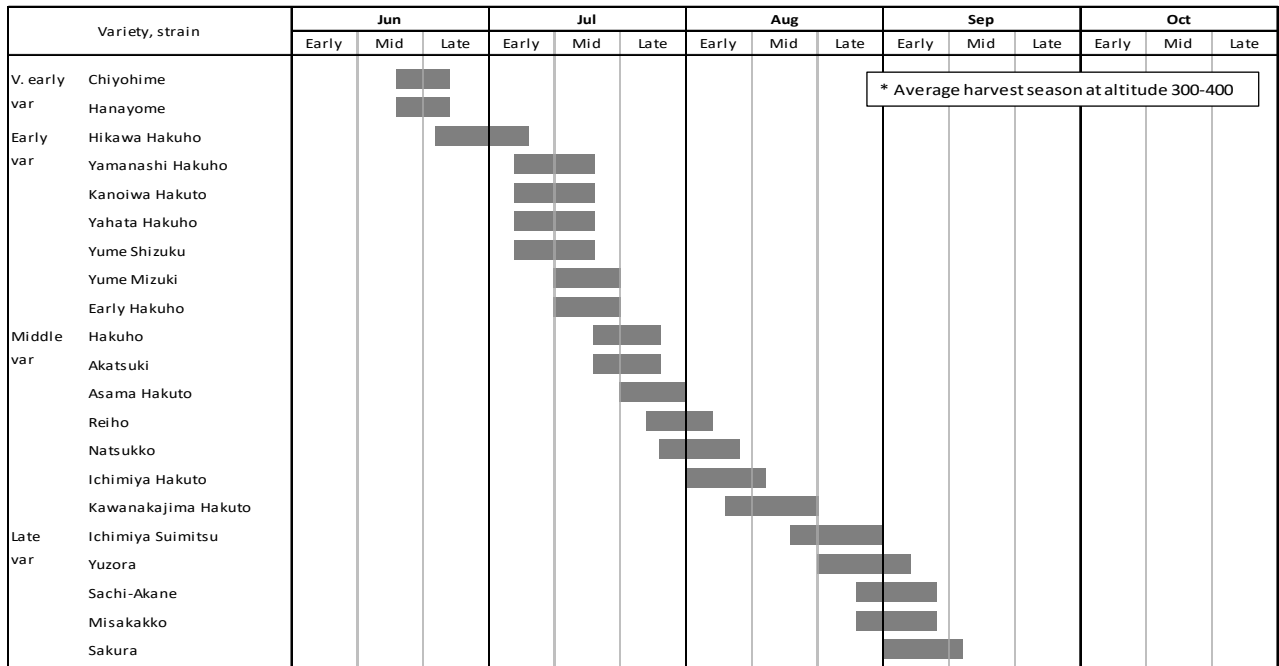


Figure 23. Peach harvest season by variety

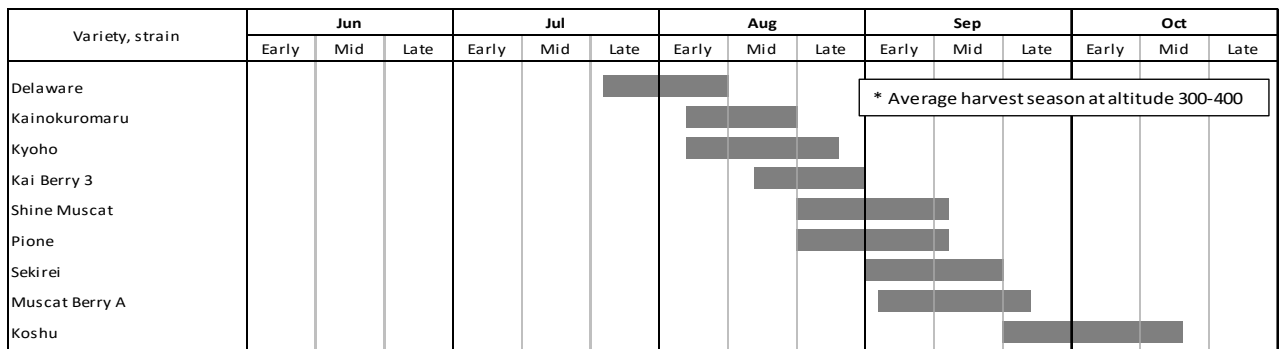


Figure 24. Grape harvest season by variety

**iv) The endemic variety ‘Koshu’ and other traditional varieties that brought diversity to the Kyoutou region**

**i. Grapes**

The ‘Koshu’ grape variety is said to date back 800 years or 1300 years. Even today, it has a high economic value as a variety that can be used either for the table, or for wine production.

‘Koshu’ is one of the few endemic grapes cultivated in Japan. To Yamanashi Prefecture, it is a hugely important variety in terms of the history of grape cultivation, culture, and the development of technology.

Recent research has revealed that ‘Koshu’ is a cross between a European grape (*Vitis vinifera*) and a wild East Asian grape variety that grows in the south of China (*Vitis davidii*). It seems likely that the European grape was brought to China, where it was crossed with the wild variety before coming to Japan (Figure 25).

The *vinifera* characteristics of 'Koshu' make it poorly resistant to rain and disease, which would have made it hard to cultivate in Japan's humid environment. However, the Kyoutou region with its inland climate having relatively small rainfall for Japan, and the well-drained soil of the alluvial fan provided a suitable place for the vine to grow. The Koshu-style trellises and the widely spaced large vine technique developed in Kyoutou were innovative techniques developed for the 'Koshu' grape, and the grape being cultivated for so long surely contributed to the innovation. Today, Kyoutou farmers cultivate and preserve the 'Koshu' variety.

The 'Koshu' variety is precious because it was the grape that first established grape cultivation in humid and rainy Japan.

Another old variety in the Kyoutou region is 'Koshu Sanjyaku,' whose origin is unknown. Recent DNA analysis shows that 'Koshu Sanjyaku' is a close relative of 'Koshu', and it provides a highly valuable genetic resource. As many as 28 other varieties have their roots in 'Koshu Sanjyaku,' including the currently popular 'Shine Muscat,' demonstrating that its genetic characteristics are carried on by today's grapes.

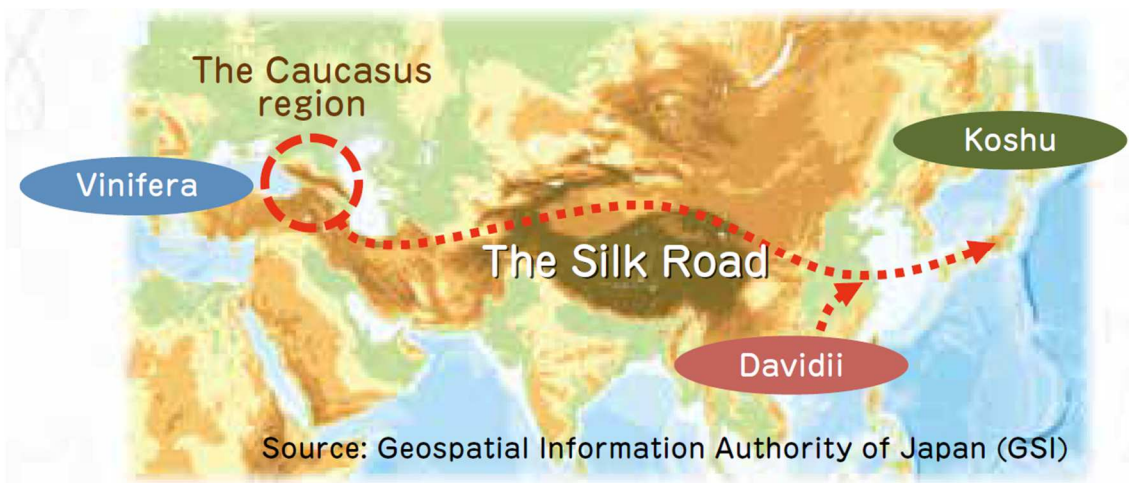


Figure 25. 'Koshu' grape's journey to Japan  
Source: National Research Institute of Brewing

## ii. Peaches, plums

The productive life of a peach tree is short, typically 15-20 years. New varieties appear readily, either through crossing or through bud mutation (sudden change in genetic composition of a bud). As a result of these two factors, transitions to a new variation occur more quickly than most fruit trees.

Based on the number of confirmed varieties, at least 86 varieties of peaches are cultivated in the Kyoutou region. Among these, 32 varieties were developed and selected in Kyoutou.

The longest-cultivated variety is 'Hakuho,' which has been cultivated for over 80 years since being developed in Japan. 'Hakuho' remains one of the major varieties today, and is cultivated in large numbers. It is an economically productive variety, and is at the root of many other varieties, so it is considered highly valuable as a genetic resource.

'Asama Hakuto,' a variety developed in the Kyoutou region, does not have as long a history as 'Hakuho.' However, its roots can be traced back to the 'Shanghai Suimitsuto' variety brought to Japan in the Meiji period over 100 years ago. 'Shanghai Suimitsuto' was improved to become 'Hakuto,' which gave birth to

‘Taiyo Hakuto,’ the variety from which ‘Asama Hakuto’ was discovered. ‘Asama Hakuto’ carries the genetic characteristics of these older peach varieties.

The plum (Japanese plum) variety ‘Koshu Daihatankyo’ has been cultivated in Yamanashi since the end of the Edo period. It is also known as ‘Botankyo.’ This variety was taken to the US in 1870, then brought back to Japan in the mid-1920s under the name of ‘Kelsey,’ after which it was propagated in Japan again (Photo 29). The ‘Beauty’ plum and the ‘Santa Rosa’ plum, a cross between the Japanese plum and American plum, were also imported during that period, and are still cultivated today.

‘Soldum’ is a variety of plum that was introduced from America in 1907 and gained a firm place in Japan. It has high economic value, and is one of the main plum varieties cultivated in the Kyoutou region today (Photo 30). Many new varieties have their roots in ‘Soldum’. It is a valuable genetic resource.



Photo 29. Plums (‘Koshu Daihatankyo’)



Photo 30. Plums (‘Soldum’)

### iii. Persimmons

The Edo period poet Takarai Kikaku (1661-1701) wrote a haiku poem about persimmons and grapes carried to Edo (Tokyo) by Yamanashi horses. Today, his poem tells us that persimmons have been a Yamanashi specialty for centuries. In addition to persimmons for the table, persimmons were produced for use as paint.

The ‘Koshu Hyakume’ persimmon is a variety native to the Kyoutou region. In the 16th century, Yamanashi warlord Takeda Shingen encouraged the production of persimmons for processing into dried persimmons. There are many different types of persimmon. In the Edo period there were said to have been over 100 types, but today, it is difficult to identify all the different types. ‘Koshu Maru’ and ‘Hyakume’ are varieties listed in the *Kai Kokushi* of 1814. A record from the year 1680 includes mentions of ‘Hyakume,’ ‘Hachiya,’ ‘Yamato,’ ‘Toyama,’ and ‘Gosho’ persimmons.

Today, the ‘Koshu Hyakume’ variety is still cultivated for processing into Korogaki dried persimmons. Its economic value is high, and it is an important variety from a historical perspective.

## b) Biodiversity in orchards, vineyards, and their surroundings

Biodiversity surveys of plants, insects, and birds were conducted by the GIAHS Promotion Association for the Kyoutou Area in 2015 and 2017, surveying 22 locations at fruit farms and nearby roadsides in the Kyoutou region. The plant surveys identified 35 orders, 64 families, and 269 species (+ 1 subspecies, 4 varieties, 5 forms). In terms of the type of orchard, the surveys identified 212 species in vineyards, 213 species in peach orchards,

and 110 species in persimmon orchards. Kyoutou region orchards are sited adjacent to villages or residential land. The surveys found that of the species identified, approximately 36% were non-native species or species associated with cultivation. Nevertheless, although the surveys were limited to just the orchards and roadsides in their vicinity, 178 native species were found.

The equivalent insect surveys identified 16 orders, 205 families, and 550 species (taxa). The differences between numbers of plant and insect species associated with different types of orchard were not large enough to be statistically significant, but large differences were observed between the species of plants and insects seen at each of the survey sites (orchards). Factors behind this observation include the difference between the individual orchards in the Kyoutou region in terms of soil properties, whether the soil is dry or moist, location, temperature and other conditions. Moreover, the timing and frequency of grass-cutting by farmers differs from orchard to orchard, so plants and insects are provided with a diversity of environments in which to grow and live.

Inside the orchards, species identified that were on the Ministry of the Environment or Yamanashi Prefecture Red Lists included The Flower Swift (*Zinaida pellucida*), and Great purple emperor (*Sasakia charonda*). Among the insects, there were many species specified as Indicators for Functional Agro-biodiversity,\* including Parasitica and Coccinellidae (Table 7).

The bird surveys identified 12 orders, 28 families, and 59 species (taxa). Of these, 42 species were found within the orchard, and 46 species were found outside the orchard. Birds identified that were on the Ministry of the Environment or Yamanashi Prefecture Red Lists were the Oriental honey-buzzard (*Pernis ptilorhyncus*), Sparrowhawk (*Accipiter nisus*), Northern Goshawk (*Accipiter gentilis*), Japanese Paradise Flycatcher (*Terpsiphone atrocaudata*), White's Thrush (*Zoothera dauma*), and Yellow-throated bunting (*Emberiza elegans*).

The number of birds observed per hour in the orchards was 201.4–440.6 in the wintering period, 67.7–156.0 in the breeding period. In the mountain forests, the numbers were 62.3 birds in the wintering period and 56.2 birds in the breeding period. The number in the orchard was much larger than the number in the forest. The frequent appearance of birds of prey such as the Northern Goshawk in the winter was a feature of the survey. This is thought to be because there were large numbers of the small birds that constitute its prey, and that there were broad, open spaces that provided a good environment for hunting (Figure 26).

Table 7. Insects identified at the orchard classified as “Indicator Animals of Functional Agro-biodiversity” and insects considered to be natural enemies of fruit tree pests

Family/species for insects found in orchard that are treated as natural enemies of orchard pests		Classification of insect as indicators for functional agrobiodiversity*	Notes
Anthocoridae	<i>Orius sauteri</i>	<i>Orius spp.</i>	Feeds on thrips etc.
Chrysopidae	<i>Chrysoperla nipponensis</i>	—	Feeds on aphids etc.
Coccinellidae	<i>Scymnus japonicus</i> <i>Chilocorus kuwanae</i> <i>Coccinella septempunctata</i> <i>Propylaea japonica</i>	<i>Coccinellidae spp.</i>	Feeds on aphids etc. Feeds on scales, etc. Feeds on aphids etc. Feeds on aphids etc.
Syrphidae	<i>Episyrphus balteatus</i> etc.	<i>Syrphidae spp.</i>	Feeds on aphids
Braconidae	<i>Braconidae sp.</i>	Parasitoid wasps	Feeds on larvae of Lepidoptera etc.
Scelionidae	<i>Scelionidae sp.</i>		Parasitizes eggs of Lepidoptera etc.
Encyrtidae	<i>Encyrtidae sp.</i>		Feeds on larvae of Lepidoptera etc.
Eulophidae	<i>Eulophidae sp.</i>		Feeds on larvae of Lepidoptera etc.
Geocoridae	<i>Geocoris proteus</i> <i>Geocoris varius</i>	<i>Geocoris spp</i>	Feeds on small insects As above

Family/species for insects found in orchard that are natural enemies of orchard pests		Notes
Carabidae	<i>Dolichus halensis</i> etc.	<i>Carabidae spp.</i> Feeds on insects
Staphylinidae		<i>Staphylinidae spp.</i> Feeds on insects

\* From “Indicator Animals of Functional Agro-biodiversity: A Survey and Evaluation Manual, I Survey methods/Evaluation methods, II References”

(MAFF Agriculture, Forestry and Fisheries Research Council Secretariat, National Institute for Agro-Environmental Sciences, National Institute of Agrobiological Sciences)

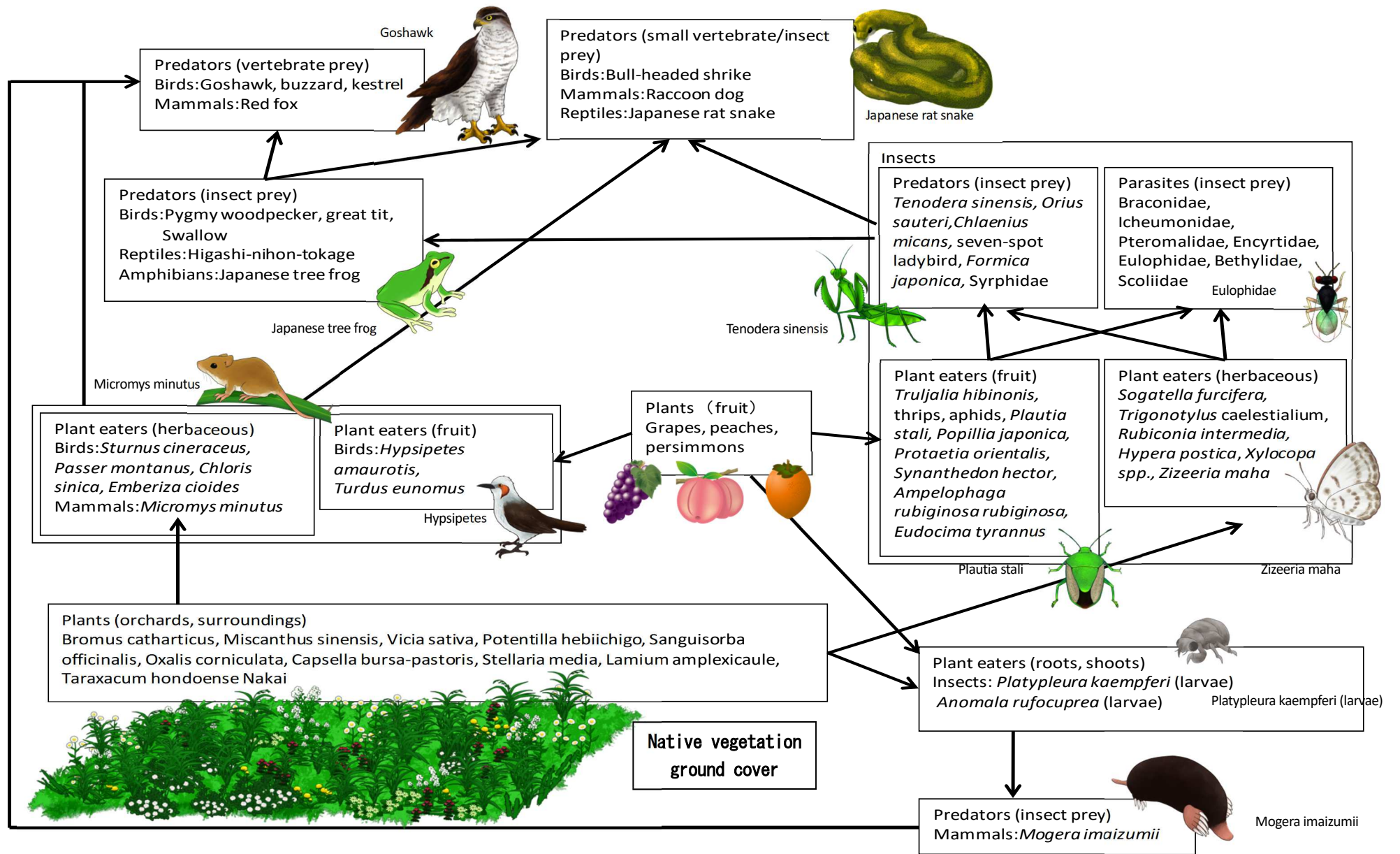


Figure 26. Food chain for main species found in Kyoutou region orchards

### c) Links between fruit cultivation and biodiversity

Native vegetation ground cover is employed in the orchards and vineyards to prevent soil erosion due to the sloping ground that is common on the alluvial fan and to supply organic matter to the soil from grass cutting. With native vegetation ground cover as employed in the Kyoutou region, the locally-occurring grasses arrive in the orchards naturally, reproducing the functions of the natural ecosystem. The grasses are managed by cutting manually, creating an environment as if semi-natural managed grassland had been brought into the orchard. This gives a substantial boost to the biodiversity of plants and insects in the orchards and in their immediate neighborhood (Figure 27, Photo 31).

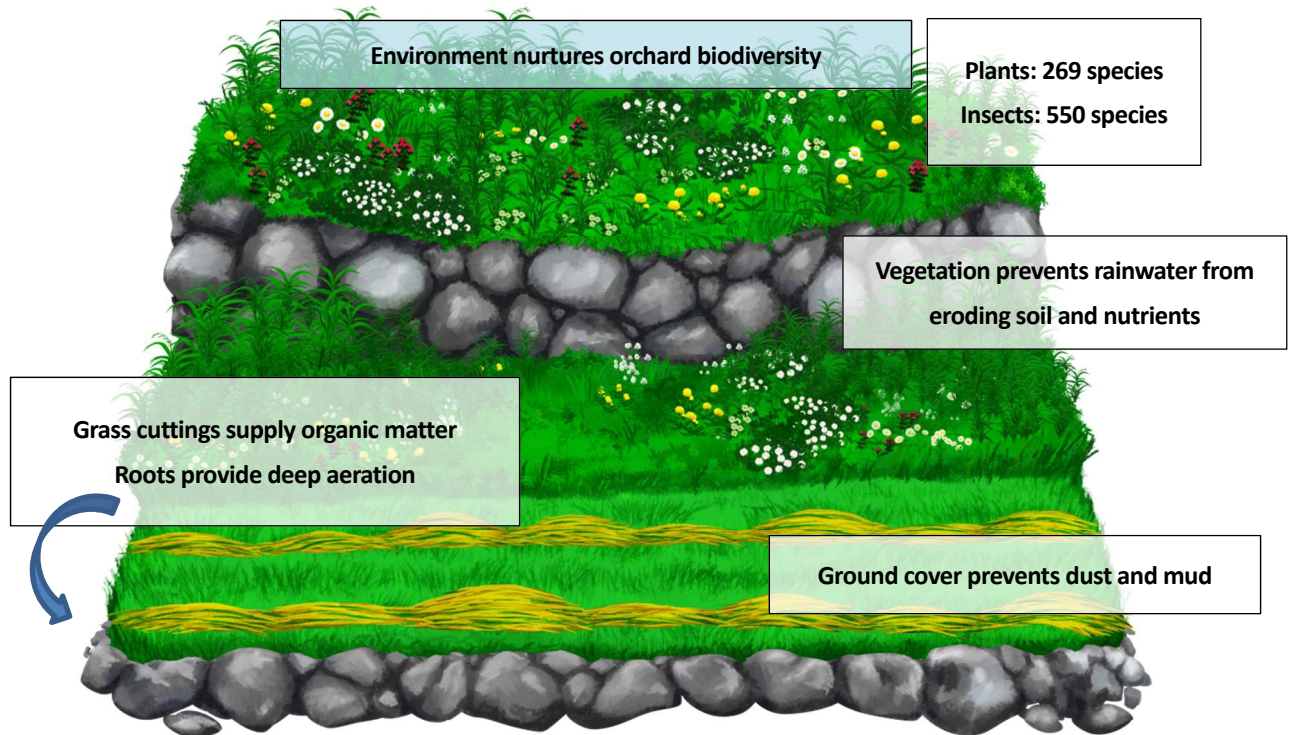


Figure 27. Functions of native vegetation ground cover



Photo 31. Native vegetation ground cover in vineyard



Not all the grasses have been identified, but they include fast-growing, prolific species such as *Hordeum jubatum* (Poaceae), *Sicyos angulatus* (Cucurbitaceae), *Malva neglecta* (Malvaceae), and *Physalis angulata* (Solanaceae), raising concerns that these grasses will run rampant at the expense of other plants.

However, the process of cutting the grass several times a year that is part of native vegetation ground cover management appears to have the effect of suppressing its explosive propagation, contributing to sustaining a relatively diverse group of plants.

In general, grass-cutting or inter-tillage is thought to deprive the insects living there of their habitat and food, but as many as 550 species of insects were found in the Kyoutou orchards. Factors behind the high numbers are considered to include the timing, frequency, and method of grass-cutting, differences between individual farmers and plots of land, and between the fruits and varieties grown. And although each individual plot is small, insects are able to move easily to another plot nearby.

In addition to using native vegetation to provide ground cover, a growing number of farmers are taking a no-till approach, not tilling or inter-tilling the land year-round. This is thought to contribute to the orchard environment that provides a home to large numbers of types and species.

The combination of native vegetation ground cover with a no-till approach, eliminating the use of herbicides, is thought to be a good approach to soil management.

#### **d) Initiatives to promote environmentally friendly farming**

Disease and insect damage are threats to the reliability of fruit production under the fruit cultivation system in the Kyoutou region. Specific pests and diseases affect each fruit. Threats to grape cultivation include downy mildew (*Plasmopara viticola*), which damages leaves and fruit; and clearwing moths (*Glossospecia romanovi* Leech), which feed on the vine, eventually leading to vine death. Threats to peach cultivation include bacterial shot hole/leaf spot/canker (*Xanthomonas campestris* pv. *pruni*), which damages leaves and fruit, and peach fruit moths (*Carposina sasakii* Matsumura), which feed on the fruit.

Kyoutou region fruit farmers use compost and native vegetation ground cover to encourage the healthy growth of trees. To mitigate disease and insect damage threats, they physically protect the fruit with bagging, cut off infected parts of trees to prevent the spread of infestations, and eliminate insects that attack the fruit (Table 9). They continually monitor for disease and insect damage, and may use chemical spraying if it deems necessary. In such cases, the appropriate timing for application is carefully selected in order to keep the amounts sprayed to a minimum.

As part of its efforts to ensure the continuation of the Kyoutou region's fruit cultivation system, the region is involved in several initiatives at different levels concerning environmentally friendly farming practices, including the production of organic produce and specially cultivated agricultural products, local standards for reducing usage of agrochemicals and chemical fertilizers, and group participation in the Eco-Farmer program.

These initiatives in environmentally friendly farming practices contribute to the cultivation system by enhancing sustainability, and are important at a time when consumers are increasingly concerned about food safety and security.

One of the group initiatives in the Kyoutou region is that 5,690 farming households, 78% of the commercial farm households, have acquired Eco-Farmer authorization based on the Act on Promotion of Introduction of Sustainable Agricultural Production Practices. An Eco-Farmer is a farmer who has submitted a plan for the introduction of sustainable agricultural production practices to the Prefectural governor, and had the plan recognized as being appropriate, and is working through environmentally friendly working practices such as cutting agrochemicals and reducing soil nitrogen levels from chemical fertilizer.

In addition to the efforts of individual farmers to achieve authorization, there is also a community initiative centered on the agricultural cooperative's production department. This represents close to 90% of the total authorizations for the whole prefecture (Table 8).

The various efforts made to reduce the use of chemical pesticides and chemical fertilizers in the production of grapes and peaches are summarized in Table 9. As a result of these initiatives, the number of applications of chemicals to grapes or peaches has fallen by about 40% from the number twenty years earlier. Bagging and covering of fruits are laborious manual processes that need to be applied to all fruits individually, but in addition to greatly alleviating disease and insect damage, they also provide the fruit with effective protection against bird damage (Photo 32). In addition, nets and lopes are used to physically control the access of birds to individual orchards or vineyards.

Among the fruit farmers of the Kyoutou region, there are farmers involved in the initiatives at various levels, including farmers practicing organic farming, producing specially cultivated agricultural products, and setting their own standards to reduce or eliminate the use of agrochemicals.

To promote the appropriate use of pesticides, JA and Yamanashi Prefecture work year-round, organizing talks to encourage compliance with usage standards and to give guidance on preventing the overuse of pesticides by applying them with optimum timing. JA also conducts analysis of pesticide residues on fruits each year.

Table 8. Eco-Farmer authorization

	Agricultural management entities	Commercial farm households	Authorizations (number)		Proportion of Eco-Farmers among commercial	
				Fruit		Fruit
Yamanashi Prefecture	17,970	17,020	6,646	6,390	39.0%	37.5%
Kyoutou region	7,823	7,318	5,690	5,647	77.8%	77.2%

Source: Number of management entities, number of farmers making direct sales: 2015 Agriculture and Forestry Census

Source: Eco-Farmer authorizations: Agricultural Technology Division, Yamanashi Prefectural Government (as of end-March 2017)

Table 9. Practical initiatives for environmentally friendly farming of grapes and peaches

<p>Pesticide reduction initiatives</p> <ul style="list-style-type: none"><li>◇ Bagging or covering fruits</li><li>◇ Native vegetation ground cover (herbicide reduction)</li><li>◇ Pest trapping, removing tendrils and uncut fruit that can harbor pathogens over winter, debarking to cut number of pests overwintering, incinerating or burying fallen leaves and prunings, other means of cultural pest control</li><li>◇ Use of pest-resistant rootstocks</li><li>◇ Farm hygiene (removing diseased fruit, foliage)</li><li>◇ Pest control based on JA and prefecture outbreak forecasts and occurrence at site</li></ul>
<p>Chemical fertilizer reduction initiatives</p> <ul style="list-style-type: none"><li>◇ Use of compost, other organic material, organic fertilizers</li><li>◇ Use of green manure crops (cut grass from native vegetation ground cover)</li><li>◇ Use of fertilizer based on soil component analysis results</li><li>◇ Topical fertilization</li></ul>



Photo 32. Bagging used for grapes (top) and peaches (bottom)

These organizations are also working to prevent accidental ingestion of pesticides by keeping them locked away in a safe place, and to encourage farmers to take care that the surroundings are not affected when spraying chemicals. Currently, there is also an effort to promote GAP (Good Agricultural Practice) accreditation in order to achieve sustainability through food safety, protecting the environment, and ensuring labor safety. In the Kyoutou region, 22 groups, companies, and individuals are currently accredited (Table 10).

Each of these initiatives aims to reduce the impact on human health and impact on the environment by cutting the amount of chemical pesticides and nitrogen discharged to the atmosphere. Working on the initiatives as a group is a way of contributing to the attainment of sustainable production.

Table 10. GAP accreditation

	Certified entities (groups, companies, individuals)				
	Global GAP	Asia GAP	JGAP	Yamanashi GAP	Total
Yamanashi Pref.	4	2	4	31	41
Kyoutou region	1	1	3	17	22

Source: Global GAP: Agricultural Technology Division, Yamanashi Prefectural Government (as of May 2018)

Source: Asia GAP, JGAP: Japan: GAP Foundation website search system (accessed May 29, 2018)

Source: Yamanashi GAP: Yamanashi Prefectural Government Agricultural Technology Division website.

\* Yamanashi GAP is a system whereby Yamanashi Prefecture provides accreditation of individuals, companies, and producer groups who are appropriately implementing GAP (good agricultural practice) according to Yamanashi GAP Introduction Standards, which have been established in compliance with the Japanese government's "Guideline on the Common Standard of Good Agricultural Practices (GAP)," and currently cover fruit, vegetables, rice, and tea, etc. (as of June 20, 2018)

### 3) Local and Traditional Knowledge Systems

Kyoutou region farmers have adapted to the complex topography of the alluvial fan and to the wet and humid conditions to ensure that farming provides a stable livelihood. Making good use of the knowledge and techniques developed over history and through experience, they have built and maintained the fruit cultivation system that is part of the heritage of the Kyoutou region.

Knowledge and techniques originating in the Kyoutou region have spread to the whole of Japan, not just other parts of Yamanashi Prefecture. The cultivation method using Koshu-style trellises in combination with widely-spaced large vines is an innovative adaptive technology that has not emerged in other regions around the world.

#### a) Vineyard trellises (Koshu-style trellises)

This trellis system for training vines is now in widespread use around Japan. It is an innovative technique conceived for grape production under Japanese weather conditions, which are more humid and have greater rainfall during the growing season than other grape-producing regions around the world.

Japan's oldest grape variety 'Koshu' has characteristics from the European grape, *Vitis vinifera*, that leave it vulnerable to disease under wet and humid conditions. Despite those conditions, the use of trellises has enabled cultivation of 'Koshu' to continue to the present day.

The origin of trellises in Japan is said to have been about 400 years ago in about 1615-1624 when physician Tokuhon Nagata (also known as Tokuhon Kai) had the idea of training vines over a trellis instead of letting them run free over the ground, which had not been very productive.

The earliest known written description of grapevine trellises is from 1681 in the middle of Japan's Edo period. The square trellises were close to 2.0m tall, and repeated at similar intervals to the spacing of grapevines. Wood (mainly chestnut) was used for the verticals, with bamboo tied into a grid for the racks. The bamboo had to be retied each year, requiring labor and incurring costs (Photo 33).

The earliest trellises to use wires are said to have emerged in about 1906. These underwent many improvements and enhancements before reaching the form they have today.

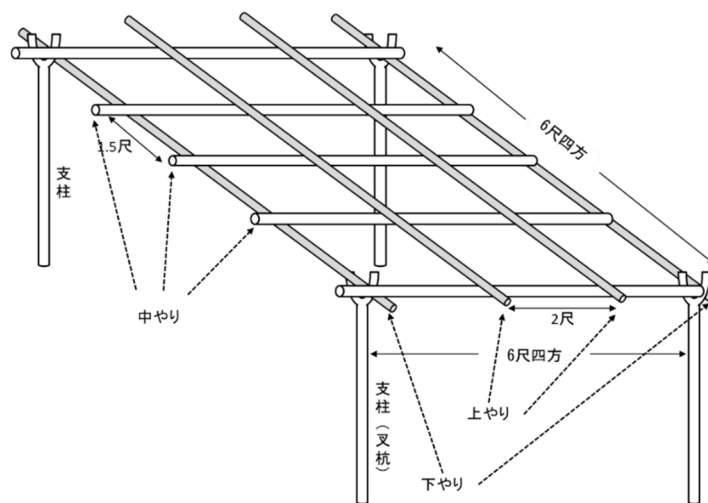


Photo 33. Bamboo trellis in 1890s (top), trellis structure (bottom)

Today, these trellises are known as Koshu-style trellises. Because they can be installed to suit the gradient and shape of each plot of land they caught on nationwide, and the technique is still used today for many of the grapes produced throughout Japan (Photo 34). In the Kyoutou region, they are also used for cultivating plums.

In most vineyards around the world today, vertical planting is the mainstream. From a global perspective, the trellis approach, combined with widely spaced large vines, is an innovative technology.

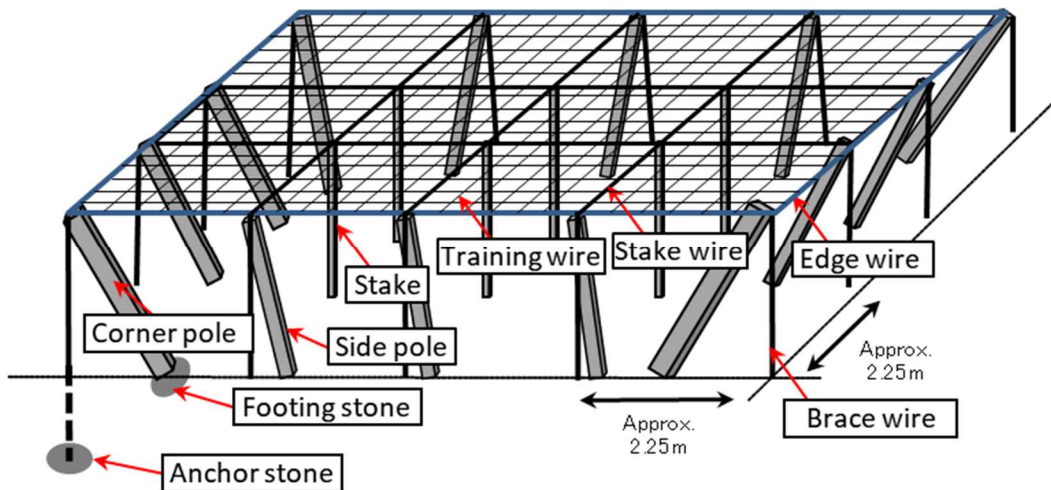


Photo 34. Koshu-style trellises today (top), trellis structure (bottom)

#### b) Native vegetation ground cover in orchards and vineyards

The use of grass in Kyoutou region agriculture is a legacy from a time before chemical and other fertilizers were available for sale. Farmers cut undergrowth in the nearby forests and grass from riverbanks to use as fertilizer. Grass (green manure) has long been considered an essential resource for agriculture.

However, grass growing on farmland competed with the farmers' crops for water and nutrients, and came to be seen as having a detrimental effect. Tillage and weeding were used to prevent grass from growing so that farmers could use bare soil (clean cultivation).

In contrast to clean cultivation, native vegetation ground cover keeps the soil surface covered, and that prevents the soil and nutrients from being eroded by rainfall. Cuttings add organic matter to the soil, and the grass roots provide deep aeration that helps in soil preparation, absorb excess moisture, and protect against dust, mud, and sludge. Because of these and other beneficial effects, many orchards in the Kyoutou region use native vegetation ground cover (Photo 35).



Photo 35. Native vegetation ground cover and clean cultivation

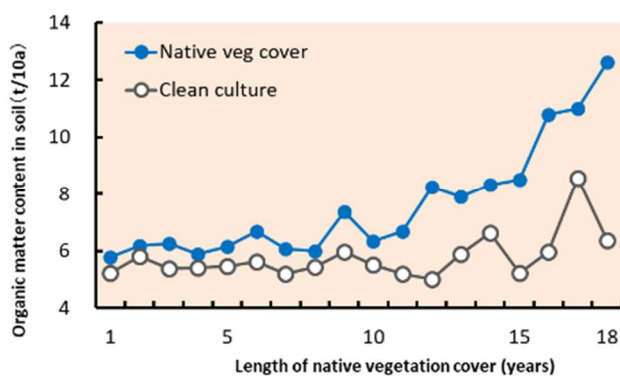


Figure 28. Organic matter in peach orchard soil (up to 18 yrs)

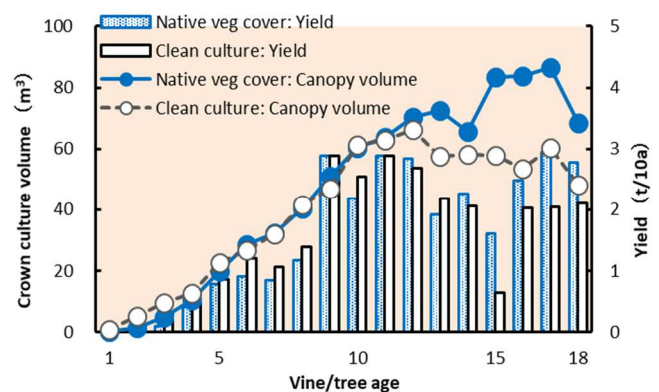


Figure 29. Peach tree growth and crop (18 yrs)

Source: Yamanashi Fruit Tree Experiment Station (2015): Long-term use of native vegetation ground cover in peach orchard leads to accumulation of organic material in soil and extension to productive life of fruit trees

Studies by the Yamanashi Fruit Tree Experiment Station revealed that after long-term use of native vegetation ground cover (sod culture) in a peach orchard, the soil acquired a greater proportion of organic material than a peach orchard using clean cultivation (Figure 28). In addition, it was reported that the trees have greater canopy volume and bear more fruit (Figure 29). The grass clippings from cutting the native vegetation cover crop were used as fertilizer to provide organic material, equivalent to between 7 and 12 t/ha of cow dung compost per year. Native vegetation ground cover prevents the erosion of nitrogen and other components from the soil due to rainfall, and herbicide is not required. Furthermore, the grass species in the cover crop and the creatures that live there contribute to biodiversity and lower the impact on the environment. This technique is promising as a means of making agriculture sustainable.

A feature of the native vegetation ground cover usage practice in the Kyoutou region for fruit cultivation is that it uses local naturally-occurring grass species that entered the orchard to create the ground cover.

The grass species included in the native vegetation vary greatly according to whether the plot is dry or damp, and according to the plot conditions and management methods. However, the species living around each plot

are suited to the environment, including sunshine hours, water supply, and surrounding plants. Here, the species that naturally live in the surrounding environment extended their range into the orchard, and are being used to provide cover.

As vegetation covers the whole floor, including directly beneath the trees, it is necessary to consider competition with the fruit trees for water and nutrients. It is particularly important to avoid competition for water and nutrients at the start of spring and after the end of the rainy season when the climate tends to be dry. For this reason, these seasons are chosen as times for cutting the grass, which needs to be done a few times each year. To suit the fruit trees and varieties grown on each particular plot of land, farmers make frequent fine adjustments to the timing and frequency of grass cutting depending on how it grows.

### c) Meticulous management with traditional manual techniques

Japanese consumers value high quality fruit, and are prepared to pay high prices to obtain it. Producers have learned to take care of each individual fruit carefully to produce fruit as beautiful as a work of art.

The grapes, peaches, and other fruit produced in the Kyoutou region are considered top quality in Japan, and are highly evaluated as export markets, too (Photo 36).



Photo 36. Grapes and peaches from the Kyoutou region on sale at a department store in Thailand



**i) Vine and grape management techniques (widely-spaced large vines)**

‘Koshu’ and many other grape varieties tend to grow too vigorously to bear fruit, and take a long time to start producing fruit under the wet conditions of Japan. There is often a long wait before the trees settle down. For this reason, vines are planted with wide spacing, giving them room to grow and become quite large. The training and pruning methods that control the vine’s vigor were established in combination with trellis cultivation. These techniques have spread out to become fundamental cultivation techniques for grapevines throughout Japan. The number of vines planted per 1 ha is 50–100, which is about one tenth the density of the vertical shoot systems in use around the world.

The training and pruning techniques include “X-shaped pruning,” which was conceived in about 1950 by Nagao Tsuchiya, a keen grower and researcher in the Kyoutou region who was attempting to extend the vine at an early stage and ensure a reliable crop of high quality grapes (Figure 30). Pruning is used to control the vigor of the vine by adjusting the number and length of canes. When pruned and trained in an X-shape, each arm can be managed separately to ensure stable production. These characteristics were highly rated, and X-shaped pruning became a fundamental technique used throughout Japan.

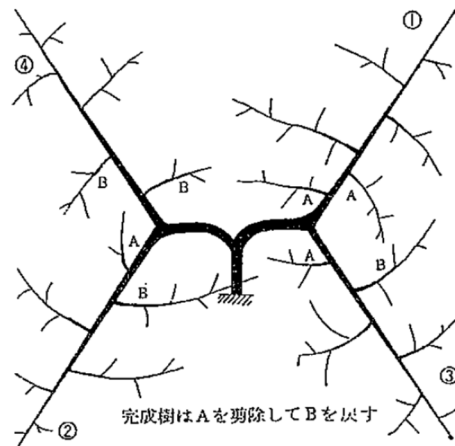


Figure 30. X-shaped cane pruning

Producing high quality fruit using these traditional techniques requires careful and detailed attention to their cultivation around the year.

Winter pruning is a means of controlling the vine’s vigor to keep it in top condition. The extent of pruning depends on the number and length of the arms, in accordance with the vine’s variety, age, and vigor.

From spring onwards, in the main growing season, the focus shifts to enhancing flavor and color. The number of grape clusters needs to be reduced step by step to between two-thirds and one half of the original number, or less. This process is called cluster thinning, and is followed by cluster shaping and berry thinning to control the shape of each bunch. Each of these processes is conducted carefully by hand. Later, the fruit are covered or bagged to protect them against disease and insect damage, bird damage, and damage from rain or hailstorms until they are ready to be harvested (Photo 37, Figure 31).



Photo 37. Key management practices for grapes

Yields of vineyards in Yamanashi Prefecture have grown due to bagging and other techniques to prevent disease or insect damage, rising from an average of 9.5 t/ha in the 10 years 1908–1917 to 11.4 t/ha in the 10 years 2009–2018.

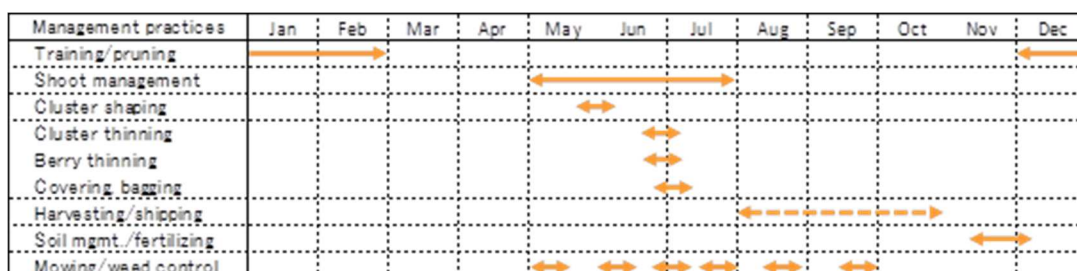


Figure 31. Schedule: Key management practices for grapes

**ii) Peach management techniques**

A fully-grown peach tree produces between 10,000 and 20,000 flowers each year. Farmers tend the tree manually at each stage, thinning first buds, then flowers, then small fruits, until eventually each tree has only between 500 and 800 fruits remaining. Restricting the number of fruits is essential for producing large fruits, but removing fruits breaks the balance between fruit growth and foliage growth, and can result in physiological fruit drop or fruit deformation. To avoid such problems, the number of thinning processes is kept to a minimum. The timing and extent of such intervention is determined by carefully monitoring how the fruit is growing. It requires experience and careful observation (Photo 38, Figure 32).

For some varieties of peaches are self-incompatible, so they need to be pollinated with pollen from another variety. Under natural conditions, pollinators such as bees pollinate the trees, but different varieties have different flowering times, and in many cases, relying on natural pollination does not result in sufficient fruit. To ensure stable production, the trees are hand-pollinated using a feather duster or similar.

The individual peaches are later bagged to protect them against disease and insect damage, bird damage, and damage from rain or hailstorms, and to ensure a beautiful appearance and red coloring. As with grapes, the use of bagging enables a significant reduction in the use of pesticides, making this an environmentally friendly technique.

The harvest time is not strict for firm fresh peaches, which are often produced overseas, but for ones with a soft-melting flesh and a mouth-watering aroma, which are often cultivated in the Kyouto region, the harvest timing is very critical and the softness and coloring of the fruits are manually checked one by one to determine the harvest time. This makes it possible to harvest delicious peaches that are rich in fruit juice and have an excellent appearance.

Peach yields in Yamanashi Prefecture have increased due to development of new varieties and introduction of techniques to prevent disease or insect damage, rising from an average of 3.7 t/ha in the 10 years 1908–1917 to 13.4 t/ha in the 10 years 2009–2018.

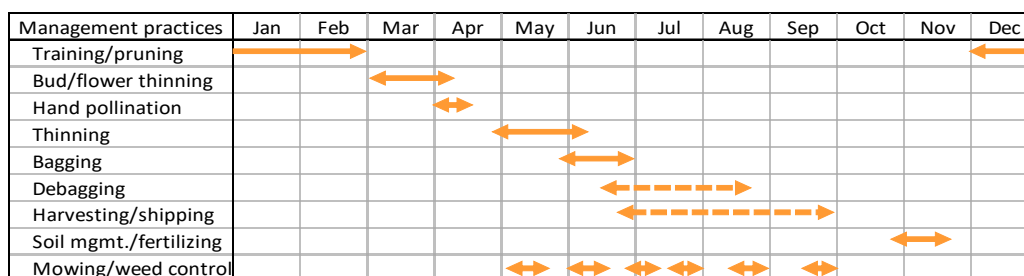


Figure 32. Schedule: Key management practices for peaches



Photo 38. Key management practices for peaches

With peaches and plums, another consideration is the short period from flowering to harvesting, which means that most of the manual work is concentrated into a short period. This work needs to be performed on the alluvial fan with its overall gradient and substantial undulations, so one objective is to train trees into shapes that enhance the efficiency of manual work. Even in a small field, the height of the tree is trained and pruned low to improve work efficiency, and in order to produce high-quality fruits, the branches are arranged so that sunshine reaches the whole tree. Branching and pruning are performed to make peach and plum trees into a Y or V shape when viewed from the side.

The training and pruning processes performed in the winter include a number of techniques developed to suit the conditions of the individual orchards on the alluvial fan with their variations in fertility and gradient. For instance, the “Ofuji style” of training and pruning peaches is an original technique developed in Kyoutou from an idea by a local farmer for keeping trees low while ensuring quality and stable crops.

Plum trees have a tendency to grow taller than peach trees, so techniques have been developed in Kyoutou for growing plums trained onto Koshu-style trellises (trellis cultivation of plums, Photo 39). Using trellises greatly improves the work efficiency of practices such as thinning and covering the fruit. Trellis cultivation also reduces the risk of fallen fruit due to strong winds and similar conditions, thereby increasing crop sizes and enhancing quality.



Photo 39. Plum cultivation using Koshu -style trellises

Most plum varieties are self-incompatible, so they need to be pollinated with pollen from another variety. Under natural conditions, pollinators such as bees pollinate the trees, but different varieties have different

flowering times, and in many cases, relying on natural pollination does not result in sufficient fruit. To ensure stable production, the trees are hand-pollinated using a feather duster or similar.

The techniques described here would probably be unsuitable for large operators focused on efficiency. However, small family-run farms in the Kyoutou region are able to observe the growing process in detail, enabling them to work towards higher quality fruit production. Over the years, local farmers have tried out their own ideas and conducted their own experiments for managing the fruit, and this has resulted in the development of a series of finely-honed techniques. Large farm operators seeking efficiency would probably not have been able to develop such techniques.

Overall, this system of management techniques is more detailed than any other worldwide. The fruit produced by these techniques is superb in terms of both flavor and appearance, looking like a work of art. The high prices that such quality fruit commands can enhance productivity, providing sufficient income for small family farms.

#### **d) Development and selection of promising varieties, mixed-variety cultivation**

Beginning with the 'Koshu' grape variety, the Kyoutou region has long been an area where fruit trees are developed, including peaches, persimmons and other fruit as well as grapes.

From the 1870s onward, many different varieties of fruit trees were introduced to Japan from overseas, but the majority were unsuited to the hot and humid climate of Japan, succumbing to pests or being unable to fruit or produce a reliable crop. The development of new fruit tree varieties and strains was not easy because of the length of time required for an experimental cross to reach fruiting age.

In the Kyoutou region, farmers, research institutions, and JA technicians have all worked to develop and select varieties that meet consumer preferences for flavor and quality, and varieties that can provide good fruiting and reliable production. Some 38 varieties of grapes (table and wine), and 32 varieties of peaches have now been developed locally, with over 60% of them being developed by local farmers themselves.

#### **e) Locally-developed fruit processing techniques and agritourism**

Besides fruit for the table, this region has a long practiced a unique approach in which it combines fruit processing, such as Korogaki (dried persimmon) and wine, with direct sales of fruit and orchard tourism. Farmers continue to develop new processed items, and selling these products through channels such as direct sales is proving to be an important source of income for them, helping to enliven the region.

##### **i) Korogaki (dried persimmons)**

Korogaki are a type of dried persimmon made from the heirloom astringent persimmon variety 'Koshu-Hyakume' from the Kyoutou region. Many of the processes used in making them—harvesting, peeling, tying, hanging, and crystallizing—are traditional processes that have been handed down from generation to generation (Figure 33).

Most of this work is done by hand, and the agricultural cooperative made up of the current producers ships them under uniform processing criteria and standards that they have established.

In general, dried persimmons are mostly made from smaller persimmons that can be easily dried. But in the Kyoutou region they are produced from the bigger 'Koshu-Hyakume' fruit. Because the persimmons are big it takes some time to dry them, but the finished Korogaki are also large. They also gain a consistent shape as a result of the various processes before shipping, and are known throughout the country as

gourmet dried persimmons. They are well regarded for their quality internationally, and a proportion of production is exported to Asian and other markets. This processing technology, along with the outside fruit production technology, is a meticulous technology that cannot be found anywhere else in the world.



Figure 33. The Korogaki (dried persimmon) production process

## ii) Winemaking

Wine is a quintessential processed item of the region, and the history of winemaking is also the history of the 'Koshu' grape. Globally, 71% of grape production is for winemaking, while in Japan more than 90% of production is destined for the table.

Because in the Kyoutou region table grapes such as the 'Koshu' variety are used for wine production and farmers themselves began making wine, the region is still characterized by its many small wineries today.

By improving cultivation techniques and winemaking methods (using the sur lie method in which racking after fermentation is delayed to keep the wine in contact with the lees for longer, thus imparting the flavor of the lees to the wine) for the "raw materials" used for wine in order to raise the quality of the wine made from 'Koshu' grapes, winemakers have been able to make wine that takes advantage of the characteristics of these grapes. And as a result, the wines produced by the wineries in the Kyoutou region and elsewhere that use 'Koshu' grapes as "raw material" have become highly regarded around the world as wines that go well with Japanese cuisine (Figure 34).

Various types of wine are now produced from 'Koshu' grapes, such as citrusy white wines and sparkling wines and rose wines fermented on the skin. It is rare to find another example anywhere in the world of so many different types of wine made from a single variety.

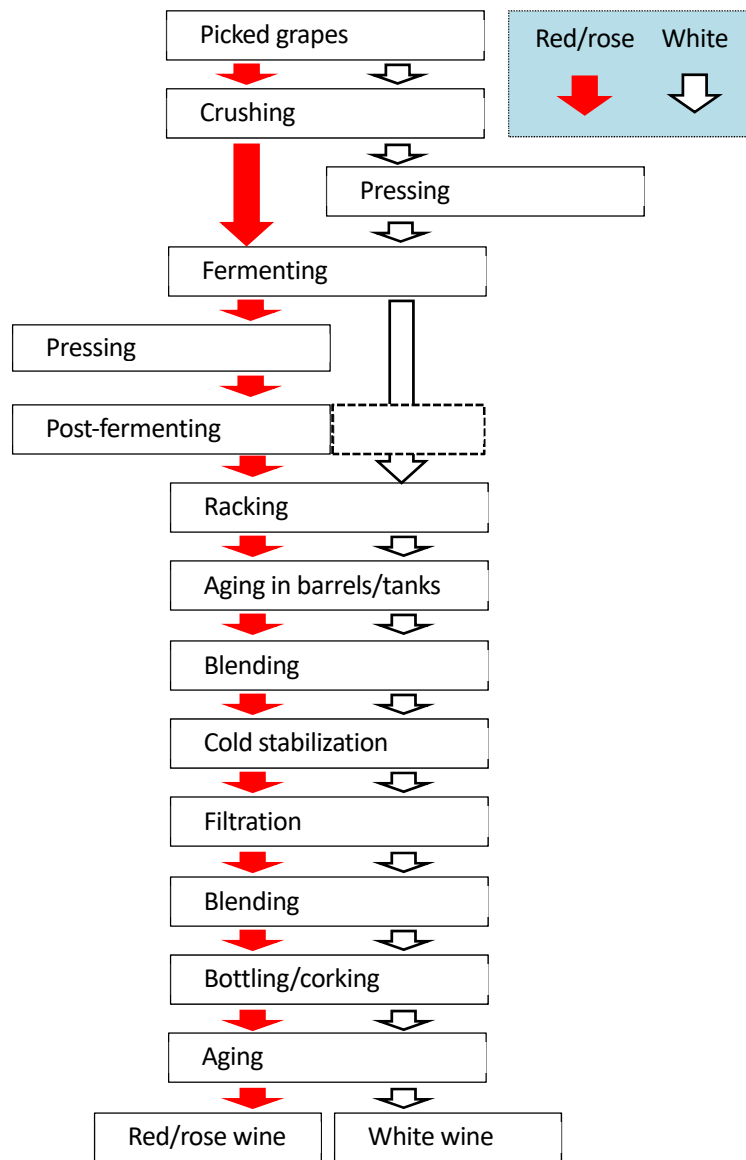


Figure 34. The winemaking process

### iii) Tourist fruit farms

The Katsunuma district of Koshu City flourished as a post town during the Edo era that lasted from 1603 to 1867, and agritourism in the Kyoutou region is said to have begun with people selling local specialty grapes and other products to passing travelers. One ukiyo-e picture of everyday life from that time depicts a woman chatting as she tries to sell grapes to travelers sitting under a grape trellis (Figure 35). It is said that today's tourist vineyards originated with the Miyakoen (Koshu City) of 1894 (Photo 40).

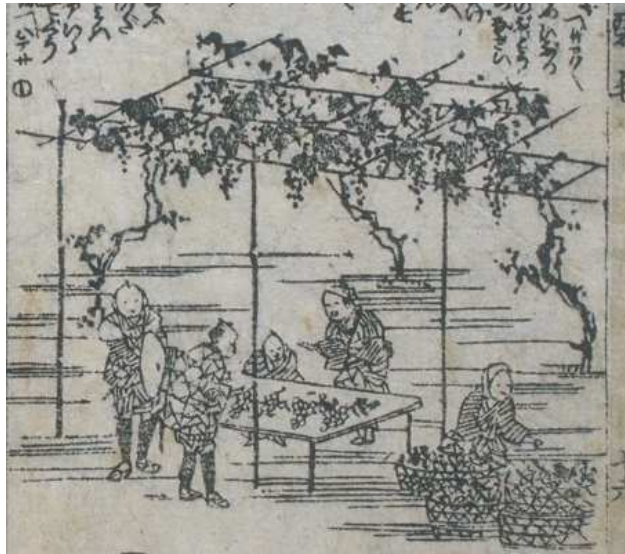


Figure 35. An 1857 illustration depicting a stand selling grapes to travelers in the mid-19th century. ("Koshudochu Hizakurige Katsunuma")

Koshu City's Katsunuma district was located on the Koshu Kaido, a major highway, connecting Tokyo to Kofu and onwards. One of the pleasures of traveling through has long been the opportunity to

taste the local grapes (Figure 36). The subsequent opening of the Hachioji-Kofu railway line (Chuo Main Line) in 1903 not only dramatically increased transportation capacity, it also led to the development of tourism businesses that used the railway to attract tourist groups. With the opening of the National Highway No. 20 Sasago Tunnel in 1958, many tourist fruit farms opened on major arterial roads. And today, thanks to the Chuo Expressway passing through the area, large numbers of tourists visit all sorts of tourist fruit farms that grow fruit such as grapes, peaches, and cherries. This has enlivened not only the orchards, but also other local industries such as tour operators and eating & dining establishments.

Japan has a unique culture of *hanami*, or cherry-blossom viewing. In springtime every year groups gather under cherry trees all over the country to share a meal and enjoy the scenery. In recent years this has also become popular among foreign tourists visiting Japan. Likewise, in the Kyoutou region tourists have long gathered under grape trellises to enjoy the vineyard scenery and dine, so the region is the birthplace of the style of sightseeing farm that offers delights like a meal under grape trellises.



Photo 40. Miyakoen tourist fruit farm in the Taisho period. (1912-1926)

Each spring when all the peach blossoms open, the scenery seems to be carpeted in pink. Every year a growing number of tourists come to the Kyoutou region to see the peach blossoms.

Approximately 5.6 million tourists visit the region each year to enjoy the tourist farms, the agricultural landscape around them, and the lush natural scenery.

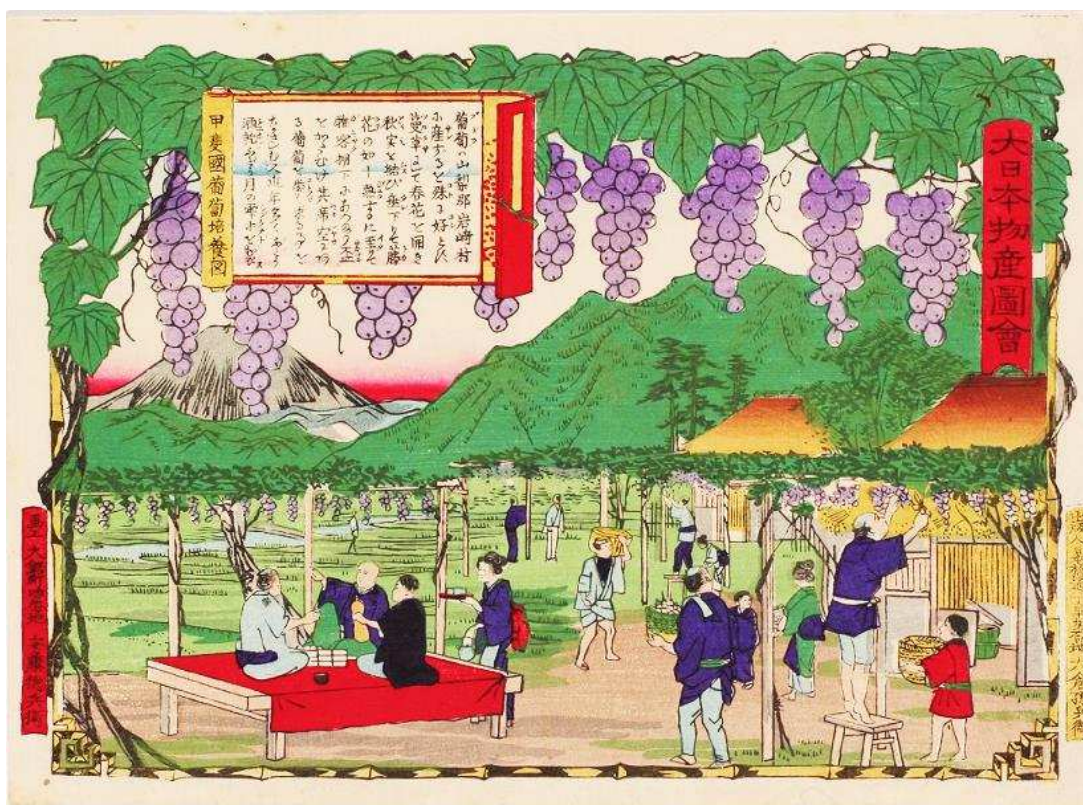


Figure 36. Visiting a vineyard has long been one of the Kyoutou region's attractions for travelers, as depicted in this 1877 print by Hiroshige III in the Yamanashi Prefectural Museum collection.

“Dai Nippon Bussan Zue: Kai no kuni budō baiyō zu”  
 (Products of Japan: Grape Cultivation in Kai Province)

Source: Yamanashi Prefectural Museum

#### f) Research and education centers supporting fruit cultivation

Research and education have played an important part in the maintenance and development of the fruit cultivation system in the Kyoutou region. Research and education facilities maintain and develop knowledge and techniques from the traditional fruit cultivation system, and teach new generations of farmers.

##### i) Yamanashi Fruit Tree Experiment Station

The Yamanashi Fruit Tree Experiment Station was established in response to a disastrous freeze that hit grape and persimmon growers in the Kyoutou region in 1931. The local municipalities lobbied Yamanashi Prefecture to protect fruit cultivation in the region, and the prefecture agreed to establish a research institution to focus on fruit trees. As a result, the Yamanashi Fruit Tree Experiment Station opened in 1938 as an outpost of the Yamanashi Prefectural Agricultural Research Center.

The Fruit Tree Experiment Station develops new varieties of grapes, peaches, and other fruit, and also works on cultivation management techniques, ecology and control of the main insect pests, low environmental impact pest control and fertilization techniques (Photo 41). In addition to this role as a research facility focused on local needs, it also has the key function of feeding the outcomes of research back to fruit farmers as cultivation techniques and new varieties. The Station's experts collaborate with JA and others to make the new cultivation techniques and other research outcomes available to growers.



The station has an additional role in providing teaching orchards for the Yamanashi Prefectural Agriculture Academy. In addition to nurturing fruit tree management specialists by teaching advanced cultivation techniques to Academy students and others, it also takes in trainees from other regions, including international trainees.

### ii) Yamanashi Wine Center

The Yamanashi Wine Center in Katsunuma, Koshu City, is a public research and testing institute conducting research and providing instruction. It specializes in wine, which is very unusual in Japan for institutes at the prefectural level (Photo 42).

The Wine Center supports wineries and conducts testing and research in accordance with winery requirements. This includes providing technical advice on winemaking, organizing lectures, and sending instructors to producers' facilities. In addition, for small winery businesses (which means most of the wineries in the area), it provides support for the management of wine from a scientific perspective to raise quality levels. This initiative includes making some of its research facilities and equipment available to small wineries, creating a setup that enables wineries to analyze samples at any time. Through these activities, it supports Japan's largest wine producing region in efforts to raise the quality of wine produced.

The Wine Center also collaborates with the University of Yamanashi's Institute of Enology and Viticulture, which is Japan's only education and research institution dedicated to wine, conducting joint research relating to raising the quality of Koshu wine.

### iii) Yamanashi Prefectural Fuefuki High School

The Yamanashi Prefectural Fuefuki High School in Fuefuki City includes a Fruit Farming Course that aims to nurture specialists in fruit farming in the Kyoutou Region (Photo 43).

Students of the Fruit Farming Course follow an educational program constructed around fruit trees, utilizing an expansive farm in the Kyoutou region associated with the school. To date, over 4,000 students have graduated from the course. Many have become successors to local farms or active as agricultural engineers. Graduates of the school include the renowned grape researcher Nagao Tsuchiya.



Photo 41. Yamanashi Fruit Tree Experiment Station



Photo 42. Yamanashi Wine Center



Photo 43. Yamanashi Prefectural Fuefuki High School

Fruit Farming Course vineyards and orchards

The school has a Food Science Course that is one of a very small number licensed for fruit fermentation, enabling it to conduct test brewing. Winemaking is one of the specialized subjects included in the course, and students learn the full process from cultivation at the associated farm to production of wine. Many graduates of the course are employed by wineries in the Kyoutou region.

The school’s farm received JGAP accreditation in December 2017, and provides a wide-range of specialist education relating to agriculture.

**g) Resilience to weather-disasters and environmental change**

**i) Building resilience through initiatives to protect the Onshirin commons and other forests**

The alluvial fan land where the Kyoutou Region is located has a history of disastrous landslides and flooding. In the Meiji period (1868-1912) in particular, as forest management and utilization practices established during the long Edo period changed. The growth of silk production led to land being cleared to plant mulberry trees, and demand for firewood grew rapidly, resulting in uncontrolled logging that devastated forests. These circumstances led to serious landslides and flooding disasters on at least a dozen occasions. There were major disasters with substantial flood damage in 1907 and 1910. In 1907, landslides occurred on mountainsides throughout the region, and many lives were lost. Homes were washed away, fields were buried or eroded, and roads and bridges were damaged. The level of damage was unprecedented. Sadly, the flooding completely wiped out the “peaches of Tanaka” that had been acclaimed in the *Kai Soki*.

The Meiji emperor was appalled at what had happened, and in 1911, he bestowed all the Imperial estates in the area to the people of Yamanashi. The estates are now known as Onshirin, or the Onshirin commons. The prefecture began work to restore the devastated mountainsides, established regulations for protection and management of the Onshirin in order to ensure that the forests recovered. It also reflected income from sales of timber and other products in the prefectural accounts to bring stability to the lives of prefectural residents. These measures steadily reduced the extent of flood damage, and helped farmers and other local residents to live more stable lives.

Since the recovery from flooding, the Onshirin has provided materials for the lives and occupations of local residents, generating income that plays a substantial part in the livelihoods of the people of Yamanashi Prefecture. Residents of each region that is closely connected to the Onshirin are required to form a forest conservation group based on relevant ordinances, to take responsibility for the protection of the forest, and to take action to preserve it. In the Kyoutou region there are a total of 26 such groups. In addition to protecting the Onshirin, in some locations the groups plant trees, produce timber or otherwise protect the forestland (Table 11).

These conservation activities and protective measures protect the produce of the Kyoutou region. Together, they are one of the factors maintaining resilience against natural disasters.

Table 11 Forests in the Kyoutou region, including the Onshirin

Forest	Area of coverage	Planted		Natural		Others	
		Area	%	Area	%	Area	%
Kyoutou reg. forest	56,458.27 ha	28,426.96 ha	50.4 %	25,573.77 ha	45.3 %	2,457.54 ha	4.4 %
Onshirin	26,730.88 ha	14,056.42 ha	52.6 %	10,872.15 ha	40.7 %	1,802.31 ha	6.7 %

Source: Upper Fuji River Forest Plans

## ii ) Resilience to weather disasters in recent times

Damage due to flooding and landslides in the Kyoutou region has declined, but Japan is now facing climate change, including typhoons, continual rain, insufficient sunshine, and other conditions that impact fruit quality and income from fruit production. To ensure the stability of farming operations, it is necessary to predict such circumstances in advance and take action to mitigate the damage.

The measures required have been compiled and accumulated under the instruction of entities such as the prefecture and agricultural cooperatives. A system has been set up enabling expertise on technical measures to be taken before and after the occurrence of damage to be shared between farmers, local government, and agricultural groups throughout the region.

In recent years, there has been major weather damage in the Kyoutou region that is thought to be caused by global warming. Such events include a snowfall exceeding 70 cm in 1998, and an unprecedented 140cm snowfall in 2014, both of which resulted in major damage to vines and fruit trees and to agricultural facilities (Photos 44, 45).

Communities were key to recovery from these disasters. In each case, farmers helped each other, determined to recover from the disaster. The prefecture, cities, agricultural cooperatives, ordinary citizens, and industries associated with agriculture each provided support and assistance to restore the damaged vineyards, orchards, and agricultural facilities such as greenhouses that had been hit. The cooperation of communities and cooperation between entities has ensured the continuation of fruit farming in the region after each of the many occasions over the years when damage has occurred.



Photo 44. Vineyard trellises collapsed under heavy snows in 1998



Photo 45. Agricultural facilities damaged by heavy snows in 2014

## iii) Resilience through diversity of fruit types and varieties

Fruits such as grapes and peaches can only be harvested once a year. Fruit growth and quality are greatly influenced by the weather and by weather events in any particular year. Storm and flood damage due to typhoons and similar events in the harvesting season impact crop yields and quality, and can sometimes wreak immense damage. To ensure the ongoing stability of fruit farming, it is important to diversify and avoid weather risks.

In the Kyoutou region, farmers cultivate a diversity of fruits and varieties with different harvesting periods to mitigate the risk of weather damage and reduce the potential loss of income.

Farmers also take advantage of the varying conditions provided by the altitude differences and characteristics of the alluvial fan topology to diversify cultivation, a mitigation strategy that minimizes the

risk of climate change. In doing so they have created a resilient fruit cultivation system, which plays a substantial role in ensuring the stability of farmers' livelihoods.

#### **h) Management of precious water resources (*segi* water channels)**

Most of the agricultural land in the Kyoutou region is situated on alluvial fans, which have a high proportion of sandy or gravel soil with poor water retention, particularly on the high or medium-high sections of an alluvial fan where rainwater permeates deep underground. Moreover, the region has few surface rivers on the fans, and the height difference between the catchment area and the fans has resulted in the rivers cutting deep into the ground. Water level in these rivers is typically much lower than the surrounding land, making water management difficult in most areas, even for farms that are located close to a river.

Furthermore, underground water runs deep, and only in limited areas could water be obtained by digging wells. These circumstances meant that if there were little rain in the period from spring to summer (the growing period for crops), and the area remained hot and dry, crops would be damaged by drought, and if the situation continued, there was not even enough drinking water for local residents. Water management was consequently an extremely important issue for farmers.

In areas where water was difficult to obtain, local residents found a solution in open channels called *segi*\* that run throughout the district to provide the water essential for life and livelihood. The *segi* convey cold fresh water from the upstream of local rivers, and provide more than just water for agricultural purposes. They are lifelines that have long provided drinking water and water for firefighting, sustaining the lives and livelihoods of local residents.

The oldest *segi* were dug hundreds of years ago. For instance, the Sashide Segi irrigation canal dating back to 1688-1704 extends for 12 km, watering over 500 ha of farmland, and at one time provided drinking water and met the domestic water needs of people in 18 villages, making a major contribution to everyday lives. It is still maintained today (Photo 46).



Photo 46. Sashide Segi water channel, constructed more than 300 years ago, is still managed and used by groups of local farmers

Other examples of such water channels include the Oyashiki Segi and the Kyodo Segi. Altogether, over 300 water channels were constructed in the Kyoutou region (Figure 37). To this day there are records of how each community's residents worked together as *segi builders*, following the tradition of jointly cleaning and repairing *segi* in their locality.

Some areas had organizations that managed the water in local *segi* before water rights were established with the enactment of the River Law of 1896. After the law was enacted, the name of these organizations evolved from "ordinary water use unions" to "land improvement districts" as they continued to operate while adapting to changing times.

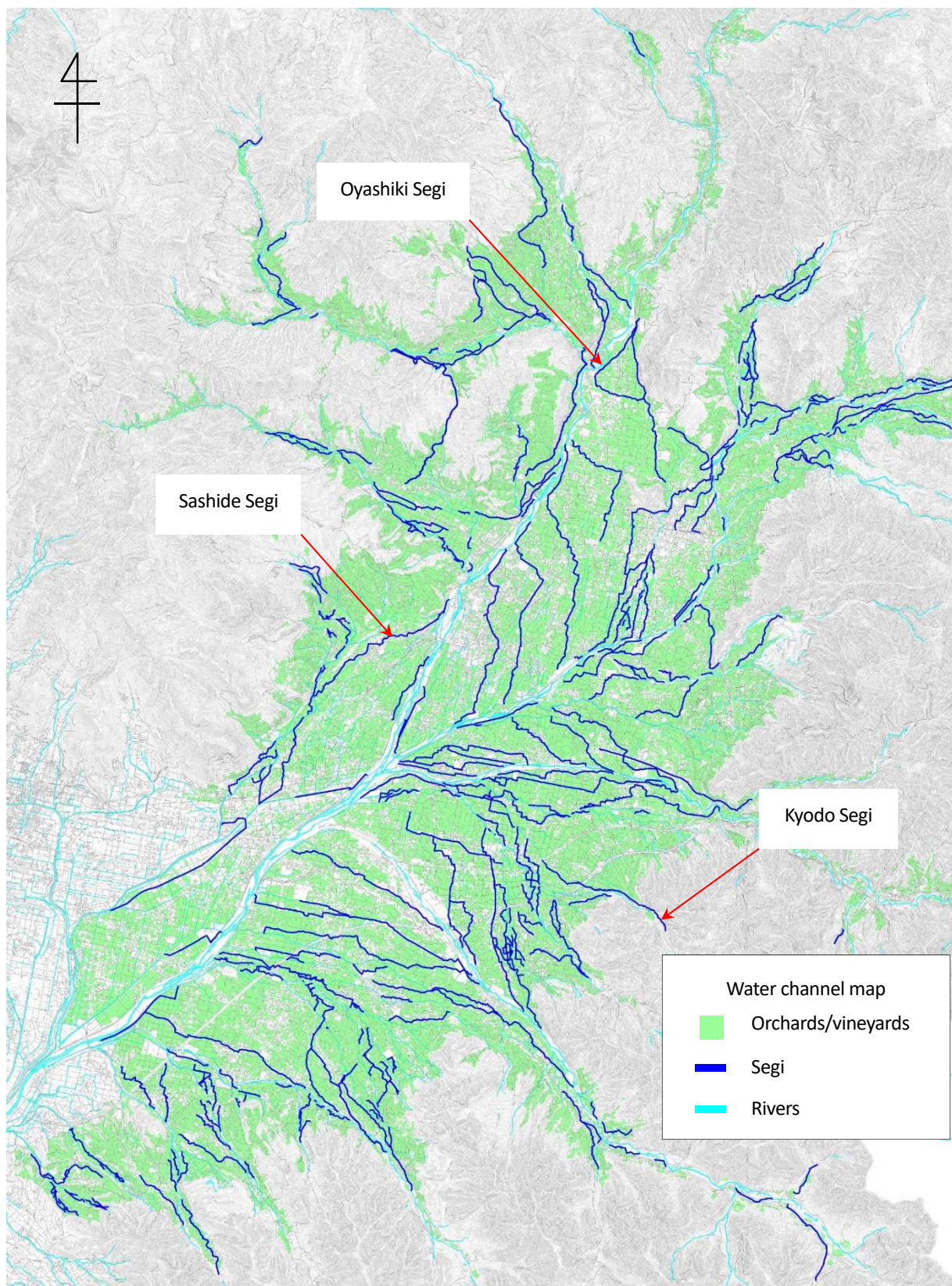
These types of organizations, organized by *segi* and adapting the format and content of their operations, continue to function today in each community. They provide a source of resilience by forming connections between the people in each community, and have survived many a natural disaster to continue to support the fruit cultivation system.

The segi are public water channels designed mainly to provide the water essential for life and livelihood. They are still collaboratively managed by local people. For instance, the Oyashiki Segi is managed by a total of 661 households organized into three self-governing associations that each cover a section (*ku*) of the segi: Oyashiki, Upper Mikkaichiba, and Lower Mikkaichiba. Each of these associations is led by a section head, who is responsible for opening and closing the segi inlet to adjust the water level. Sector heads are chosen by discussion among the residents, and serve for two years.

Most of the segi channels are fed by river water, so have plenty of water at all times. When water is needed for firefighting, the inlet is opened to increase the amount of water available. In contrast, when there are heavy rains, the inlet is closed so that the segi can function as a drain. In the past, local households used water from the segi for washing dishes and produce, and for doing laundry.

Frequency of cleaning varies according to the locality. The Oyashiki segi is cleaned twice a year: once in spring, with all residents participating, and once in autumn, by the officers of each association. This communal work enhances residents' sense of community.

\* *Segi* is a local dialect word for water channel.



The segi are open channels that convey cold fresh water from the upstream sections of local rivers. Most of the agricultural land has coarse soil that is well drained due to the alluvial fan. Without irrigation, the surface soil would dry easily in long periods of fine weather.

Figure 37. Segi water channels in the Kyoutou region

Source: Yamanashi Prefectural Land Improvement Projects Federation

#### 4) Cultures, Value Systems and Social Organizations

##### a) Handing down knowledge and techniques

Almost all of the fruit farmers in the Kyoutou area are small family-run businesses. In the past, the traditional knowledge and techniques that support fruit cultivation were passed from parent to child along with agricultural land and other elements comprising the management base of a family business.

Young farmers who inherited orchard operations have taken various steps to make it possible to secure a stable livelihood despite their location on alluvial fans. For example, local young growers established their own research group, where they continue to hand down existing knowledge and technologies while also studying the adoption of new technologies.

Tochu Club is an organization of young farmers from throughout the Kyoutou region. In addition to its regular activities, which include training in advanced technologies and good practices, and activities aimed at improving production technologies and business management, the group also makes use of its youthful sensibilities to carry out other activities, such as food-related education that increases local children's understanding of fruit cultivation (Photo 47).

Yamanashi Fruit Cultivation Association was founded in 1949 by key fruit-growing families in the Kyoutou region and other parts of the prefecture. Today it is a public interest incorporated association that plays an important role in the development of the prefecture's fruit farming. Its activities include holding various training and study events, conducting research, publishing a magazine, and working to maintain and pass on fruit cultivation techniques (Photo 48).



Photo 47. Young farmers organization, Tochu Club conducts a food education program for elementary schoolers in a peach orchard

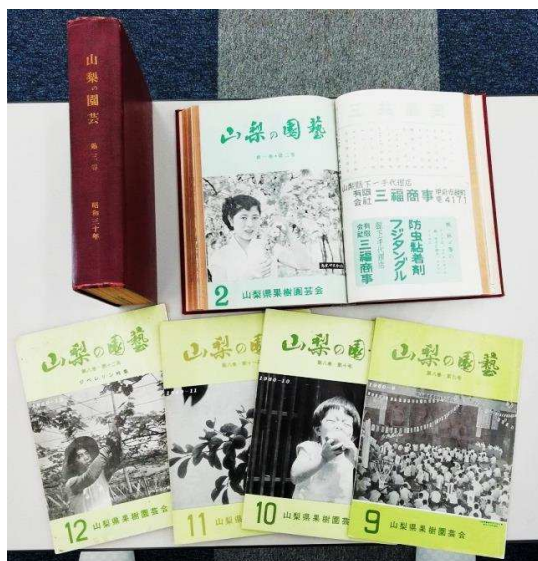


Photo 48. *Yamanashi Horticulture*, monthly magazine published by Yamanashi Fruit Cultivation Association  
Left: First editions, published in 1954  
Right: More recent editions

In addition, agricultural business guidance offered by Yamanashi Prefecture’s agricultural development and extension project and by agricultural cooperatives (currently two cooperatives: JA Fruits Yamanashi and JA Fuefuki) has played an important role in the transmission of knowledge and technology related to fruit tree cultivation in the Kyoutou region.

**b) Measures to address shortage of successors and labor shortages**

Since Japan entered a period of rapid economic growth in the 1950s, a growing number of children of farming families sought employment other than the family farm, and the number of young people taking up farming decreased rapidly.

Now there is an increasing need to pass on technology and knowledge to newcomers to the field who have no agricultural experience, as well as to middle-aged or older people with little experience, including “U-turn farmers” who left another career or location in order to take up farming (Photo 49).



Photo 49. Middle school students get hands-on education in traditional fruit cultivation methods

Left: Tending grapevines Right: Making Korogaki dried persimmons

Therefore, Yamanashi Prefecture created a system for securing next-generation farmers by pairing young people who are just starting to work in fruit tree cultivation with *agrimasters* who have been commissioned to provide one-on-one guidance and training due to their high proficiency in both farming techniques and farmer training.

Currently, 99 agrimasters have been commissioned in the Kyoutou region and have accepted students who aspire to work in fruit cultivation. In the eight years from 2010 to 2017, 73 trainees began working in agriculture (Photo 50).



Photo 50. Training with an agrimaster

In addition, each city and locality is working to pass on important knowledge and skills by taking action to find and train new farmers.



**c) Social structures supporting efforts to hand down and preserve the fruit cultivation system**

**i) Organizations maintaining segi water channels that protect lives and support livelihoods**

Irrigation channels called *segi* are maintained and managed by farmers organized into community groups (Photo 51).



Photo 51. Maintaining segi water channels

**ii) Local residents conserve the Onshirin commons**

*Onshirin*, a commons bestowed to the people of Yamanashi by the Meiji Emperor in 1911, has played a major role in the lives of local residents by providing a source of materials and profit that supports their livelihood. Residents of each region that is closely connected to the Onshirin are required to form a forest conservation group based on relevant ordinances, to take responsibility for the protection of the forest, and to take action to preserve it. In the Kyoutou region there are a total of 26 such groups, including 7 in Yamanashi City, 11 in Fuefuki City, and 8 in Koshu City. In addition to protecting the Onshirin, in some locations the groups plant trees, produce timber, or otherwise protect forestland.

Their activities include conducting patrols of the forests to prevent or stamp out fires, theft, improper logging, defilement, invasion and other harmful acts, deterring or eradicating harmful creatures, preserving border markers and signs, and caring for young trees (Photo 52).

These activities also contribute to the protection of other forests in the Kyoutou region and to this day continue to provide a basis that allows local residents to enjoy stable lives on the region's alluvial fans.



Photo 52. Onshirin conservation activities  
(fire prevention)

**iii) Handing down wine culture through winemaking cooperatives organized by farmers**

Wine production began in the Kyoutou region in 1877, and gradually expanded so that by the late Meiji period (which ended in 1912), more than 1,000 individuals and groups produced wine, both for personal consumption and for sale.

Later, changes in the society led to the establishment of winemaking cooperatives (“block wineries”) consisting of groups of individual farmers, or groups of just a few people or a few organizations. Production expanded, and eventually the Kyoutou Area had more wineries than any other part of Japan.

Today, most block wineries have been merged or consolidated into larger companies. In some areas where block wineries continue to operate, farmers join with neighbors, combining grapes from their vineyards to make wine together, thereby continuing the unique wine culture of the Kyoutou region (Photo 53).



Photo 53. Winemaking equipment used in a block winery from the early Showa era (late 1920s) to the present.

#### d) Traditional culture associated with fruit

##### i) Fruit culture in everyday life

In the Kyoutou region, home-grown grapes, peaches and other fruits have become established as an important and valuable part of everyday culture. They are offered on household altars during the Bon and New Year holidays, and are given to close friends and relatives as gifts or expressions of appreciation.



Photo 54. Bottled peaches in syrup

Fruits that are unfit for sale due to blemishes, malformation, or poor coloring, etc., are used for

household consumption or shared with acquaintances. Since olden times, farmers have also used various means of preserving fruits, including bottling them or making them into jams (Photo 54).

During winter and early spring, when there are few fresh local agricultural products, processed fruit products are carried as gifts when visiting relatives or acquaintances. They also serve to prevent farmers from spending cash. Processing fruits has become part of the typical food culture among most of the fruit growers in the Kyoutou region.

Since people have been making processed foods for a long time, they came up with various processing techniques and tools, and appreciation for processed foods gradually increased. Once they were offered for sale at farm stands and local tourist attractions, they became very popular and sales increased.

The practice of making processed products from fruits that could not be sold has led to greater sales revenues. In the Kyoutou Area, farmers have eagerly embraced an agricultural business model that integrates production, processing and sales, including consumption by tourists. Today there are many new fruit-based processed products, leading to expectations for increased profits for growers and tourist farms.

**ii) Kyoutou’s unique wine culture**

Winemaking in the Kyoutou region began during the Meiji period. Because sake was expensive, grape growers obtained winemaking licenses and made wine for home consumption.

After that, based on instructions from the national government and the revision of the liquor tax law, farmers and small groups began forming winemaking cooperatives (“block wineries”) until we reached the current state of winemaking. Nevertheless, the Kyoutou region retains its unique local wine culture, where locals refer to wine by its more familiar, old-fashioned Japanese name, *budoshu* (grape spirits).

At rite-of-passage ceremonies run by the community, the only alcoholic beverage served was *budoshu*. The community purchased 1.8-liter bottles of wine by the case, then transferred it to 720ml bottles and served it in ceramic beakers. Grape juice (called *budoeki* or grape liquid) was available in 1.8-liter bottles for children and non-drinkers (Photo 55).

The unusual custom of offering grape wine even on a Japanese household altar has continued to this day, showing just how much wine has become part of the Kyoutou culture (Photos 56, 57).



Photo 55. 3 bottles on left: 1.8-liter bottles of wine unique to Kyoutou region



Photo 56. Wine dedicated to Ichinomiya Sengen Shrine



Photo 57. Wine used as sacred sake

Koshu City has taken various actions to promote and increase public awareness of local wine, for example by enacting an ordinance promoting the use of Koshu wine for toasting, and the designation of October 10 as “Wine Day.” Yamanashi is Japan’s No. 1 prefecture when it comes to wine consumption.

### iii) Other cultural features related to fruit trees

Many of the local folk songs have lyrics related to the fruits for which the area is famous.

“Katsunuma Ondo,” “Budo-go Kouta,” “Kyoho Ondo” are among those that mention grapes, while “Ichinomiya Ondo” describes grapes and peaches along with local traditional events and natural features, showing clearly how deeply these fruits are entwined with the lives of the region’s residents.

### e) Festivals and culture that communicate ties with agriculture

The Kyoutou region has developed fruit cultivation as a major industry, and has inherited various festivals and events related to agriculture.

The region’s yearly events are strong colored by rituals that cover the whole agricultural cycle, from preliminary prayers for a good harvest to thanksgiving celebrations at harvest time.

Legend has it that Daizen-ji Temple is the birthplace of ‘Koshu’ grapes. The Fujikiri Festival held at the temple is said to be based on a historic event, when En no Ozunu, founder of the Shugendo religion, came to Mt. Omine to kill a giant snake. The festival has been celebrated every year without fail, since the Middle Ages (Photo 58).

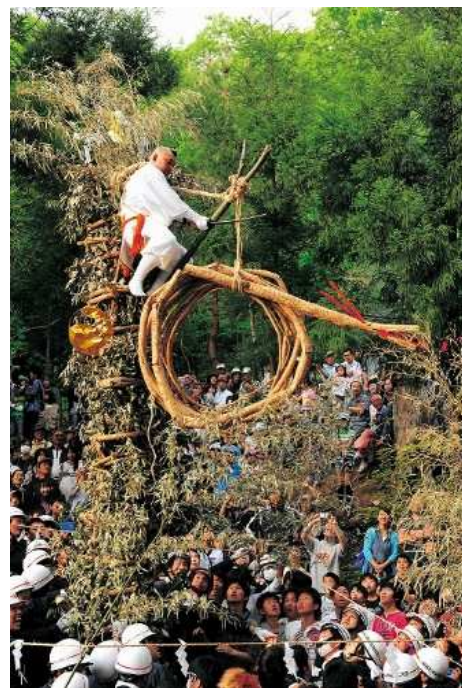


Photo 58. Fujikiri Eshiki ceremony at Daizen-ji Temple

The festival includes prayers for a bumper crop of grapes and a satisfying grain harvest. The crowd competes for pieces of a massive wisteria vine that is tied up to imitate a giant snake. This “Fujikiri-Eshiki” ceremony is regarded as one of Yamanashi’s three major traditional festival events. It has been designated as an Intangible Folk Cultural Property by Yamanashi Prefecture and a national folk cultural property worthy of recording.

The Dososhin Festival is held in various places, traditionally on the lunar New Year, to pray for a good harvest. In the Kyoutou region, the prayer is for a rich fruit harvest, and the Lion Dance performed in Yamanashi City’s Shiodaira district has been designated by the prefecture as an Intangible Folk Cultural Property (Photo 59). In the Fujiki Dososhin Festival, held in Koshu City since the Edo period, Kabuki actors riding on three large taiko drums call out to each other across a blazing flame as they perform a famous scene from a Kabuki drama. The festival, which has been designated by Koshu City as an Intangible Folk Cultural Property, includes people dressed like Kabuki actors who pray for a jackpot of dried persimmons, and “miyage,” or the hanging of rings of dried persimmons on the “neck” of an object shaped like that year’s Chinese zodiac animal.

The Omiyuki Festival held every year on April 15th in Ichinomiya-cho, Fuefuki City, is said to have begun in 825, during the Heian period, as a prayer for flood control. However, the characteristic of holding back rain can also be reflected in the form of a prayer for adequate water (Photo 60).



Photo 59. Shiodaira Lion Dance (Shishimai)



Photo 60. Omiyuki Festival

The Sekison festivals held in the Kyoutou region also originated as prayers for rain. And the 300-year-old Sekison Festival at Tenjin Shrine in Fuefuki City is held to protect farmland from drought and flooding over the summer, and to ask for abundant crops. The “Okoritori” ritual that takes place within the shrine precincts is mainly performed by people who splash water on each other and is one of various rituals that symbolize the scarcity of water rights that characterizes the region (Photo 61).



Photo 61. Sekison Festival at Tenjin Shrine

Another legend about the origins of the ‘Koshu’ grape holds that Kageyu Amemiya discovered it by the roadside in 1186, while on his way to the Sekison Festival.

Torii-yaki (Shinto gate-burning) is held in Koshu City to drive out pests from grape crops and to pray for an abundant crop each year. It was traditionally held in August along with two other bonfires, Muroyama Oigata-yaki held in Kasugai-cho, Fuefuki City, and the Okubo-san Daimonji-yaki held in Ichinomiya-cho, Fuefuki, to mark the end of the local Obon festival. But now it has become known as a major event in the Kyoutou region where more than 100,000 tourists join local people each year, and it is held on the first Sunday of October in conjunction with the Katsunuma Grape Festival celebrating the harvest (Photos 62, 63).



Photo 62. A burning torii Shinto gate sings the night sky



Photo 63. The Katsunuma Grape Festival

Symbolizing a sense of respect for fruit trees, the “grapes of Katsunuma Tomi-machi,” commonly called “Koryu,” are the oldest vines of ‘Koshu’, which is Japan’s oldest grape vine. The average productive lifespan of a grapevine is about 20-25 years, but Koryu is over 130 years old and is the oldest own-rooted (as opposed to rootstock) vine in Japan. It is a designated cultural property of Koshu City (Photo 64).



Photo 64. 130-year-old grapevine (Koryu)

Koryu’s trunk is covered by a roof and ritually bound with a “*shimenawa*” rope, showing that people worship natural things like grapevines and have cherished this grapevine and held it in awe.

**f) Initiatives such as urban-rural exchange to encourage participation of a variety of entities and boost appreciation of the fruit cultivation system**

In addition to training the next generation of farmers, it is important to bring in new farmers from the outside and to increase the number of people interacting with the Kyoutou region in order to maintain the region’s fruit cultivation system.

Toward this end, several entities are promoting exchanges with city dwellers in order to deepen their understanding of Kyoutou fruit cultivation by providing opportunities to experience farming.

Locations have been established for exchange between city and country people, including Fuefukigawa Fruit Park, Koshu Katsunuma *Budounooka* (Grape Hill), and Katsunuma Grapeland Culture Hall. In addition to serving as visitor centers that explain to visitors about the local history and the fruits that are grown locally, these facilities hold various seasonal events and function as local landmarks.

In concert with these facilities, tourist-oriented fruit farms actively broadcast information about local attractions via social networking sites and other media, and serve as important venues for interaction between urban and rural residents.

Furthermore, a walking path has also been established, where visitors can access historical resources related to orchards and fruit trees. An NPO is taking the lead in establishing a tourism program using this type of footpath. People from the entire region are working together through urban-rural exchanges to enhance opportunities for visitors to understand local fruit production, to set up systems that allow diverse players to participate, and to form relationships that support fruit cultivation.

## 5) Landscapes and Seascapes Features

### a) Distinctive landscapes of the Kyoutou region

Kyoutou region farmers have adapted to the complex topography of the alluvial fan and its weather conditions to ensure that fruit farming provides a stable livelihood. Based on knowledge and techniques developed over a long history, they have built a fruit cultivation system that provides vineyard and orchard environments where a very diverse range of plant and animal species can live. The interaction of fruit cultivation and nature creates a beautiful and distinctive landscape.

The fruit cultivation system of the Kyoutou region has been supported by the local ecosystem, including the grasses and other native vegetation that provide ground cover. Local cultural practices relating to fruit cultivation have developed over the years, and fruit cultivation in the region has developed in harmony with local ecosystems and the local environment.

Grapevines and fruit trees have roots that go much deeper than rice and field crops, which makes them resistant to drought. They prefer well-drained land, so the alluvial fan land of the Kyoutou region with its relatively low rainfall and good drainage is appropriate. Soil, water availability, and weather differ from place to place, and in accordance with the conditions at individual locations, farmers select the most suitable fruits and varieties from a diverse range of grape, peach, and other trees. This land utilization is distinctive.

The strategy of selecting the most suitable fruit trees for each location diversifies risks to prevent catastrophic damage due to natural disasters such as storms and flooding or due to climate change as a result of global warming. Thus, the landscape is the result of a strategy that provides stability to farmers' livelihoods.

Furthermore, some 75% of the land in the Kyoutou region is forested, and agricultural land accounts for only 9.8%. The amount of arable land per farm household is low, and individual plots of land are small and irregularly shaped, so farmers have constructed stone walls to enable more efficient use of sloping land in the small, irregularly shaped plots.

Based on long years of experience, Kyoutou region farmers select suitable fruit types and varieties for each individual tract of land. This approach enables land utilization in accordance with the specific conditions and weather characteristics of the complex alluvial fan land, sustaining cultivation despite the disadvantages of the location (Photo 65).

This distinctive land utilization produces a mosaic landscape, and the vineyards and orchards provide a home for a diverse range of plant and animal life.

This landscape produced by human activity becomes one with the natural scenery of the surrounding satoyama (woods and mountains), creating a beautiful agricultural landscape that changes from season to season.



Photo 65. Vineyard trellises cover the sloping land (Koshu City)

## b) Choice of suitable crops for the alluvial fan conditions and climate

Grapevines and peaches are perennial crops with a productive life that can exceed 20 years. Conditions associated with the specific planting location, such as soil characteristics and water availability, together with altitude and topology effects on the weather, can make a big difference to production over the years. For this reason, Kyoutou region farmers take advantage of the years of experience passed down over the generations to make good use of the awkward alluvial fan conditions by selecting the optimum fruit and variety on each occasion, sustaining the ability to farm this land.

In order to be cope with the varied environments offered by the alluvial fan, including differences in soil, gradient, altitude, temperature, and sunshine, farmers maintain a diverse range of fruit types and varieties to select from, and this diversity gives the Kyoutou region its distinctive patterns of land utilization.

### i) Selecting fruit types according to soil

The alluvial fan land was formed from earth and sand carried down from the surrounding mountains by rivers. As a result, the local soil is a complex mix of soils with differing characteristics. The characteristics of each of the soils determine its compatibility with different crops. Farmers have learned to select types of fruits and varieties that go well with specific soil characteristics (Figures 38, 39).

#### i. Brown lowland soil

The areas surrounding the upstream sections of the Fuefuki River, Omogawa River, and Hikawa River that created the alluvial fan land have brown lowland soil. This soil consists of clay, sand, and gravel. It is a fertile soil that drains well and is well aerated. The farmland where this soil is present has relatively gentle slopes. In the past, in areas with good water availability it would have been used to produce good rice or cereal crops, or for mulberry plantations. As good farmland, it can be used for a variety of crops.



Photo 66. Peaches planted in brown lowland soil  
(Yamanashi City)

Today, it is mainly used for cultivating tree fruits such as peaches, plums or persimmons, which like a fertile soil with good aeration and drainage (Photo 66).

#### ii. Light colored Andosol (volcanic ash soil)

In and around the higher alluvial fan areas in the south of Fuefuki City, ash deposited from volcanic eruptions has produced a light colored Andosol (volcanic ash soil).

Light colored Andosol holds water well, is well aerated, and has a good depth of usable soil, but soil pH is low and phosphorous uptake is blocked. Without soil improvement, it is unsuitable for any type of cultivation.

Much of the farmland in areas with light colored Andosol had poor water availability, so in the past, soil improvement agents and fertilizer were added to improve the soil sufficiently to enable its use for mulberry plantations.



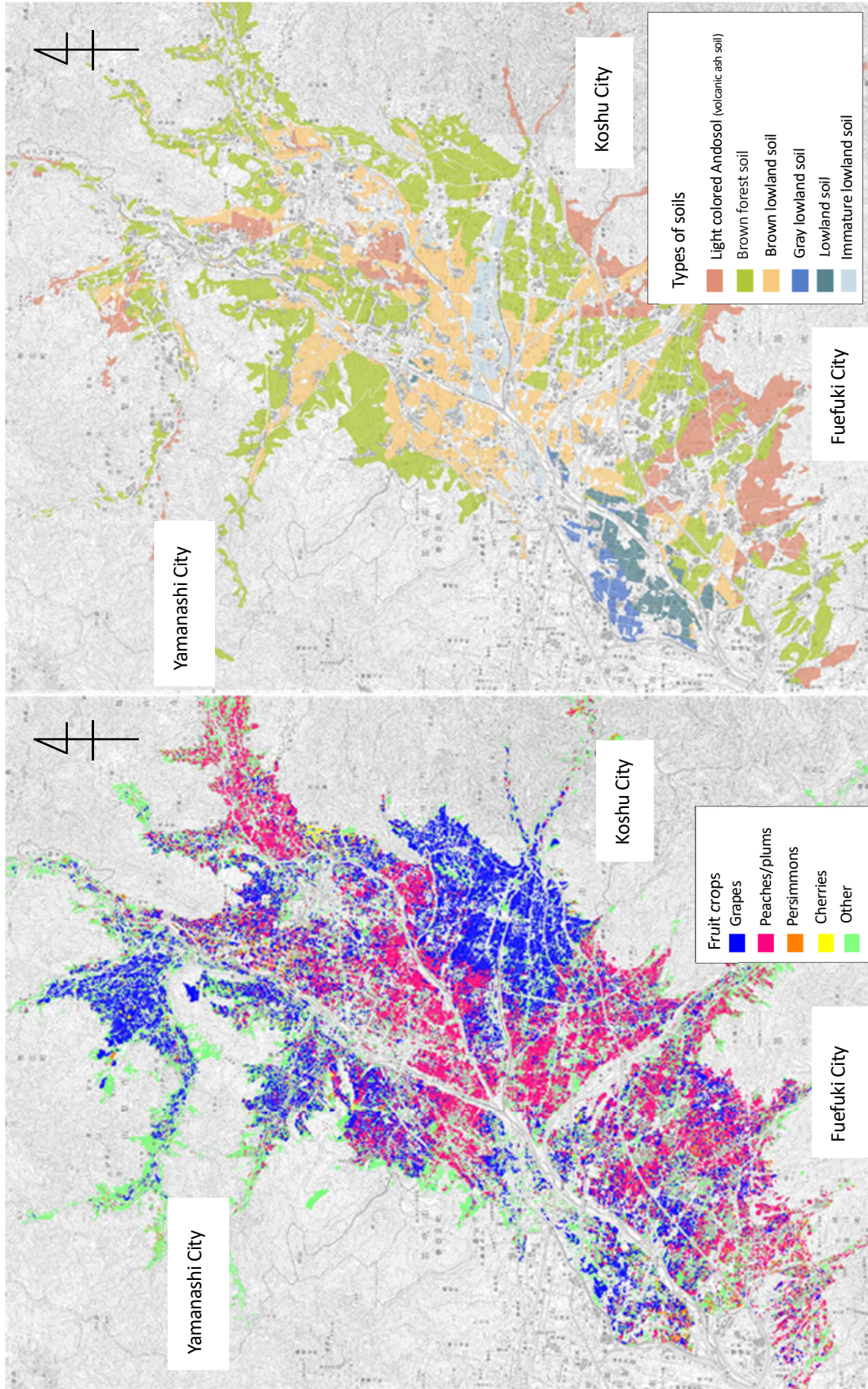


Figure 38. Land utilization in Kyoutou region

Figure39. Arable soils in Kyoutou region

Source: University of Yamanashi (Yoichi Shimazaki, Yuki Shinahama, Moena Nakajima, Ayumi Nakaya, Taisei Yamamoto), Yamanashi Prefectural Land Improvement Projects Federation

Today, most of the light colored Andosol has already been improved. With good drainage and aeration, it has become very fertile soil. In soil like this, grapevines tend to grow vigorously, making adjustment difficult, so it is mainly used for peaches (Photo 67).



Photo 67. Peaches growing in light colored Andosol high on the alluvial fan (Fuefuki City)

### iii. Brown forest soil

In the Kyoutou region, brown forest soil is distributed throughout the alluvial fan land. Brown forest soil originates in leaf litter from broadleaf trees that has decomposed and been deposited as humus. It would normally be seen as highly productive soil, but Japan's high precipitation levels tend to erode the soil components, and in many cases it has become a strongly acidic soil.

This soil ranges from heavy clay to clay loam. Drainage is not good. It becomes muddy when there is rain, but in a drought it becomes hard and tight. The usable depth is shallow, and the soil tends to be unproductive, so it needs to be improved by adding organic matter.



Photo 68. Grapevines growing in brown forest soil on sloping land (Koshu City)

Many of the areas with brown forest soil are hilly, with poor water availability. In the past, they were used for mulberry plantations, but today, soil with these sorts of characteristics is used for grapes. It can produce high quality grapes with high sugar content (particularly the 'Delaware' variety introduced to Japan in the Meiji period), so the soil is mostly used for grapevines (Photo 68).

### iv. Gray lowland soil, lowland soil

These two types of soil mainly form around the lower reaches of rivers. In this region, they are largely distributed in the lower parts of Fuefuki City. These are areas where the water table is high, making them unsuitable for peach cultivation. Consequently, they are largely used to produce grapes and persimmons, but there are also rice paddies and fields producing other vegetables such as sweetcorn and eggplant.

This sort of soil is sandy and has low fertility, but in the Kyoutou region, it is found in areas at low elevations with warm temperatures, making it suitable with sweet persimmons. Some of the land is used to produce high quality sweet persimmons that have gained a high reputation nationwide.

## **ii) Selection of fruit according to topology**

The agricultural land in this region is distributed throughout the alluvial fan land, and individual tracts of land slope in different directions and have different inclinations. Orchards and vineyards on sloping land are difficult to work efficiently, and soil can be easily eroded by rainfall. For this reason, the fruits cultivated are selected according to the gradient. Stone walls are also constructed to reduce the slope, and native vegetation ground cover or similar approaches are used for floor management, enabling good use of the sloping land on the fan.

In general, tree fruits such as peaches and plums are cultivated on trees that can grow to a height of several meters. In such cases, work at heights using ladders or other equipment is required for management work and harvesting. Because of the inconvenience and safety issues with this sort of work, peaches, plums, and similar tree fruits are not planted on steep slopes. Instead, grapes are planted, as the trellises facilitate work on sloping sites.

Although grapes can be grown on sloping sites, for steep slopes there is a tendency to plant varieties such as 'Delaware' or 'Koshu' that can be cultivated with less labor.

## **iii) Adaptations for effective use of sloping land**

### **i. Stone walls using natural stone**

Tracts of land on the alluvial fan have stones of various sizes deposited by flooding or by landslides. On plots with relatively long slopes, natural stones found on or nearby the plot are piled up on the ground surface without dressing to construct stone walls that reform the plot into a series of less steeply sloping areas, enabling it to be used more efficiently (Photo 69).

### **ii. Native vegetation ground cover**

Sloping land is prone to erosion of soil and nutrients, particularly during the rainy season or during typhoons and at other times when there are large amounts of precipitation. Preventing such erosion of soil and fertilizer is one of the reasons why native vegetation ground cover was introduced in orchards and vineyards.



Photo 69. Natural stone walls in vineyard

Fully covering the ground with native vegetation provides appropriate control of erosion. In addition to preventing the loss of soil and nutrients, this approach has many other advantages, and farmers throughout the Kyoutou region have decided to adopt this approach.

iii. Use of differences in altitude (differences in growing speed) to distribute labor requirements

The whole of the alluvial fan land is suited to the cultivation of deciduous fruit trees, but there are temperature differences between land at different altitudes within the region. Such differences can lead to substantial differences in growing speed despite use of the same variety. For instance, there can be a two-month difference between harvesting times for ‘Kyoho’ grapes depending on the elevation.)

Farmers actively use such differences in growing speed and harvesting time to spread out labor requirements and to diversify weather disaster risks (Figure 40).

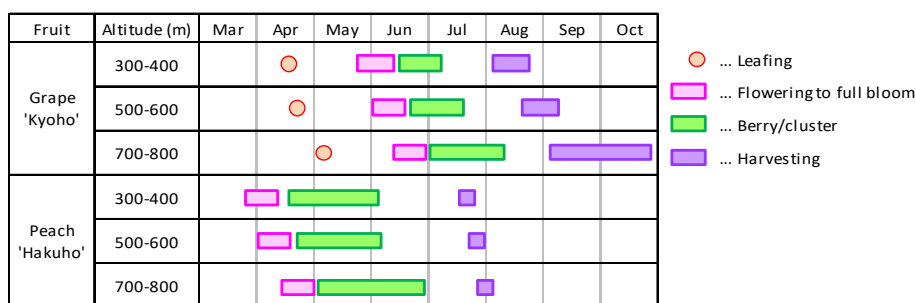


Figure 40. Growth stage timing shifts with altitude

**c) Beautiful fruit farm scenery in conjunction with the surrounding woods and mountains**

The Kyoutou region has a basin climate, an inland climate typical of basins, making it suitable for vineyards and orchards cultivating a variety of fruits, including grapes, peaches and plums. The scenery created by these fruit farms joins with the natural scenery of the Onshirin and the other surrounding satoyama (woods and mountains) to produce a beautiful distinctive landscape that changes from season to season and is unlike any other landscape in the world (Photo 70).

The orchard scenery with its different attractions according to the season provides an engaging and calming experience to visitors, and is a valuable tourist resource.



Photo 70. Orchard zone spreads across the alluvial fan land

The areas has walking routes and footpaths for touring historical resources associated with fruit farms or fruit cultivation. There is also wine tourism, focusing on wineries, and including opportunities to explore local food and culture while walking around the area where wine began in Japan.

During times such as the flowering season in Spring and the Harvesting season in autumn, many different events are arranged, attracting some 5.6 million visitors to the Kyoutou region (Photo 71).



Photo 71. Locally-themed events in the Kyoutou region

The Togenkyo Walk in Fuefuki City is a walking event timed to match the peach blossom. The Kyoho-no-Oka Marathon in Yamanashi City takes runners around the vineyard areas. The Grape Festival in Katsunuma, Koshu City is an opportunity to try a great variety of local grapes and wines for free.



Photo 72. Orchard zone scenery changes with the seasons (spring, summer)



Photo 73. Orchard zone scenery changes with the seasons (autumn, winter)

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