

# **Damyang Bamboo-field Agriculture System**

**-Application-**

**Globally Important Agricultural  
Heritage System (GIAHS)**

**February 17, 2020**



**Damyang County**




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# I. Summary

<p><b>Name/Title of the Agricultural Heritage System:</b> Damyang Bamboo Field Agriculture System</p>
<p><b>Requesting Agency/Organization:</b> Damyang County, Jeollanamdo Province, Korea</p>
<p><b>Responsible Ministry (for the Government):</b> Ministry of Agriculture, Food and Rural Affairs of Korea</p>
<p><b>Location of the Site:</b> Latitude 35 19' 30"N / Longitude 127 0' 31"E (County Hall as its center)</p> 
<p><b>Accessibility of the Site to Capital City or Major Cities</b></p> <ul style="list-style-type: none"> <li>·Air: Damyang~Gwangju: transit(22km), Gwangju~Seoul(50mt) or Gwangju~Busan(50mt)</li> <li>·Automobile: Damyang ~Seoul (3hr or 330km)</li> <li>·KTX train: Damyang ~ Gwangju ~ Seoul(150mt)</li> </ul>
<p><b>Area of Coverage:</b> Area of Damyang County 44,500ha</p> <ul style="list-style-type: none"> <li>·Area of Damyang Bamboo-field Agriculture System: 2,420ha</li> </ul>
<p><b>Agro-Ecological Zones (for Agriculture, Forestry and Fisheries)</b></p> <ul style="list-style-type: none"> <li>·Bamboo cultivation of temperate, sub-continental zone</li> </ul>
<p><b>Topographic Features:</b> Northward with gentle slope mountains is higher than the South with flat wide plains</p>
<p><b>Climate Type:</b> Temperate continental climate with annual average temperature 14.2℃, annual precipitation 1,366mm</p>
<p><b>Approximate Population (Beneficiary):</b> 46,535 persons</p>
<p><b>Ethnicity/Indigenous population:</b></p>
<p><b>Main Source of Livelihoods:</b> Agriculture-Forestry.Livestock Industry 46.6%, Tourism Service 32.4%</p>

## Executive Summary

Damyang is home to bamboo farming over 1000 years, bamboo culture and humanities.

Sejongsillokjirigi (1454, The Annals of King Sejong -Geography) was the manual and detailed guideline for national administration of the Joseon Dynasty. Damyang's fine bamboo and *Phyllostachys bambusoides* Sieb. Et Zucc were offered for King and the government officially with Damyang's specialty of *Phyllostachys nigra* (Lodd.) Munro.

Damyang holds the optimum conditions for bamboo, including warm continental climate, 1,366mm of annual precipitation, average temperature of 14.2°C in the topography of higher north and lower south with low hills and plains.

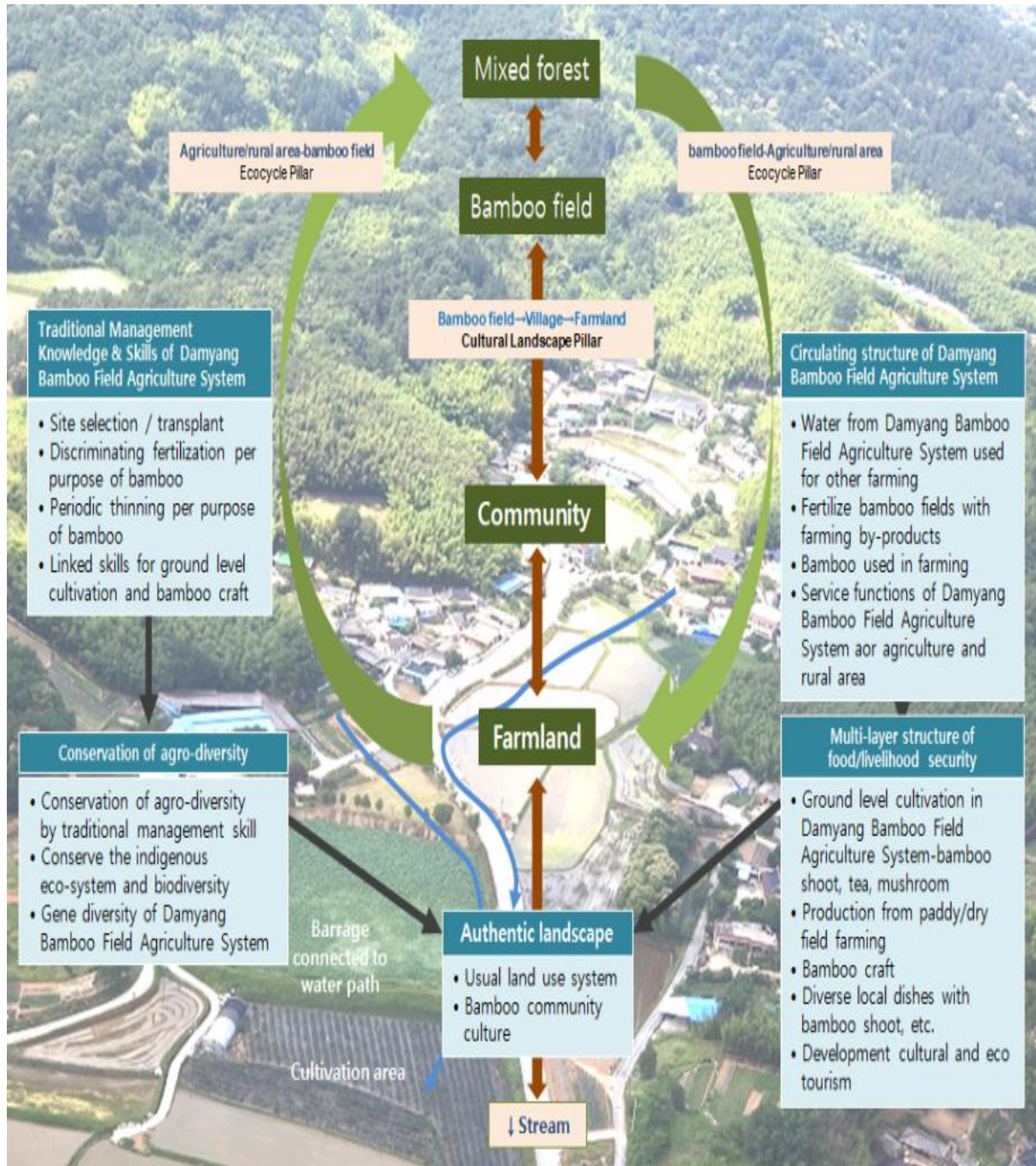
'Security of food and livelihoods' has existed in Damyang Bamboo-field Agriculture System. Damyang's indigenous knowledge and skill of bamboo thinning and lumbering process secure the circulation of air and sunlight in bamboo-field, supporting best timber produce. The ground level cultivation of mushroom and Jukro tea, bamboo crafts, bamboo shoot and foods, tourism of ecology and culture are additional bamboo-farming culture. Damyang Bamboo-field Agriculture System is a cradle of agro-biodiversity. Bamboo managing thru traditional fertilization and thinning with rice husk, straw and leaf mold has offered clean environment for our modern world.

The circulation system between farming and diverse environmental elements has been foundation of rich agricultural productions. Farmers built water ways and reservoir to secure water from Damyang Bamboo-field Agriculture System and used for other farms. By-products from the rice paddies and dry fields are utilized for bamboo fertilization as to support each other.

'Traditional land use structure in rural Damyang area' is formed in 'forest - bamboo field-village-cultivation area-stream' formation, and rich agro-biodiversity and cultural landscape of bamboo farming and crafting are fruitful results of the structure. Bamboo farming will secure sustainability of many aspects of living environment following designation of GIAHS Damyang Bamboo-field Agriculture System.

GIAHS designation will alert and motivate public about the threats and challenges for sound conservation and utilization of Damyang Bamboo-field Agriculture System while promoting new farmers' interest in bamboo farming. Damyang County will support and work together with aging bamboo farmers to ease their work-load and build GIAHS value and continuation of bamboo farming based on their wisdom and lifelong experience.

GIAHS designation will also initiate the value inheritance in people's philosophy, culture, literature and landscape of Damyang Bamboo-field Agriculture System, and Damyang County will take full responsibility to bring another 1000 years advance for Damyang Bamboo-field Agriculture System. (Here in after also called SYSTEM) for farmers' pride and agriculture.



**<Damyang Bamboo-field Agriculture System>**

# II. Description of Damyang Bamboo-field Agriculture System

## 1. Value and meaning of applicant site

### i . Features of Damyang Bamboo-field Agriculture System

#### 1) Bamboo fields settled in village

Birth of Damyang Bamboo-field Agriculture System goes back over 1000 years in the forms of management and cultivation of bamboo. Records of 'Royal tribute' and 'Jukchwil planting day' in 'The Annals of King Sejong (1454)' talks about the existence and utilization of Damyang bamboo.

Most bamboo fields are settled in gentle and lower hilly areas in the natural farming. Damyang holds optimum climate and topographic condition for bamboo growing naturally, and increase of bamboo value and bamboo demand brought more bamboo farming in bamboo fields.

In Damyang Bamboo-field Agriculture System, bamboo is 'cultivated' as a farming crop in the bamboo fields and 'managed'. The SYSTEM 'produces' timber bamboo, bamboo shoot and other crops in the ground level together with bamboo crafts.

Damyang Bamboo Field Agriculture System in the very villages has been a central axis for region's economy, society, culture and landscape. Farmers' ecological knowledge and management technique were systemized, developing the cycling farming system. Community level bamboo work put rural villages as bamboo community.

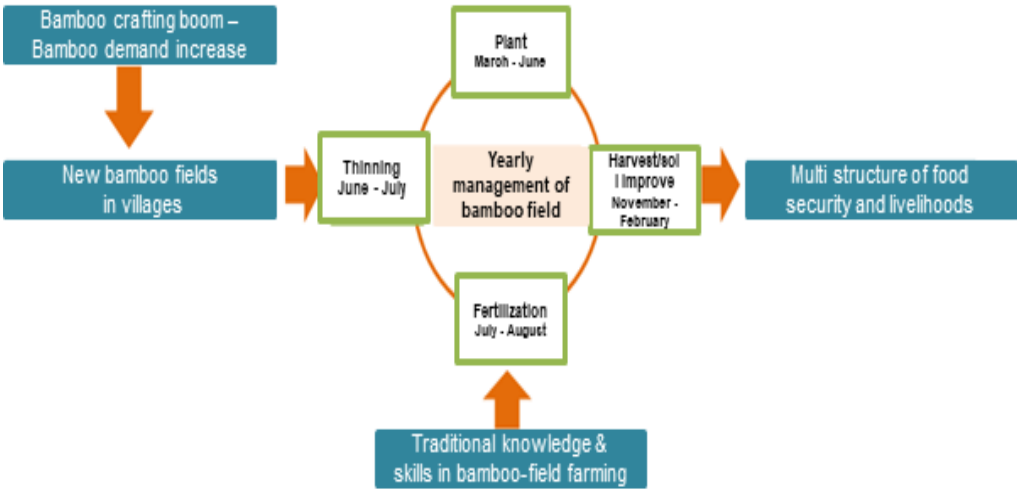


Image 1. Establishment of bamboo-field farming and annual management



## **2) Multi structure of food security and livelihoods**

Bamboo fields are not limited for timber production but bamboo shoots and tea plants are grown under the bamboo, too. In addition, the cyclic-interactions between water from bamboo fields and rice straw and husks of other farms support each other, improving yield of each other. The multi structure of SYSTEM includes  $\Delta$ Timber production  $\Delta$ Ground level cultivation  $\Delta$ Cross-supporting production system thru its material cycling with other farms and  $\Delta$ Bamboo eco-tourism program.

Produced bamboo timbers are sold in original or processed state. Particularly bamboo craft has secured itself as a major industry in Damyang. Living up to its reputation, the home for the best bamboo handicrafts in Korea, it has played a role to help villagers support their livelihoods. Considering the geographical characteristics of Damyang bamboo fields, located in the northern limited region in terms of distribution of bamboos, they have played a critical role as the base to supply bamboo crafts and timber to the Korean peninsula and Manchuria. With industrial modernization proceeding, bamboo craft has been on the downgrade, but it is still seeking to strengthen a capacity as a culture and tourism industry.

Ground level cultivation has been successful. Bamboo shoots were protected by mulching with rice husks. A bamboo grove is also a perfect place for nurturing tea plants. Roots of bamboo trees grow laterally, shallow, and those of tea plants grow deep, hence, growing tea plants within bamboo fields is a desirable option. Bamboo trees also serve to protect tea plants, which are susceptible to the cold-weather damage. The features of bamboo field include rich moist and organisms, and special crops like mushrooms are cultivated as well. A vast range of edible mushrooms such as *Dictyophora indusiata* and *Liriope muscari* (Decne.) L.H. Bailey are grown, which has become a source of income. It makes full use of quality of high humidity that bamboo fields have.

## **3) Biodiversity and Its Ecological Service**

Damyang's *phyllostachys* oriented bamboo farming is active in areas below the northern limit boundary. The same bamboo farming is in much smaller scale for bamboo growth is limited in colder climate. Damyang bamboo farming requires continuous management of planting and fertilization to survive in the northern limit boundary area. For bamboo's resistance against cold weather is high, bamboo has evolved a great deal over a long period of time, resulting better environmental adaptability with varieties of bamboo genes and *polyphasy-polymorphism*. The evolved Damyang bamboo's much better intensity and flexibility has brought enhancement in bamboo craft and bamboo farming.

The circular management system for Damyang bamboo field and its agriculture contribute to conserve and promote agricultural biodiversity. Nutrients and moisture from bamboo groves go to farming lands, and their byproducts return to the bamboo groves in a cycle. Aside from rice farming, it helps growth and development of a wide range of farm produces. In addition, it is worth noticing the preservation of agricultural biodiversity such as tea plants, bamboo shoots, mushrooms, etc. that grow between the plants in bamboo groves.

In short Damyang bamboo field's agricultural system has direct association with creation of multilayered structures of securing food and livelihoods via conservation and promotion of agricultural biodiversity. Farmers in Damyang brought bamboo groves into their villages, providing habitats for a variety of species as well as preserving the diversity through their traditional agricultural system.

The level of humidity and nutrient accumulation in soil is high, creating conditions for an indigenous ecosystem. It hosts many mushrooms and macro invertebrates. The bamboo habitat also brings in diverse species of birds. Moreover, it turned out that Damyang bamboo has such high genetic diversity and polymorphism that it has developed excellent adaptability to the environment. Ecological environment survey on bamboo plantations in Damyang and surrounding areas conducted in 2015 identified a total of 358 taxonomic groups as vascular plants with 93 families, 315 species, 1 different species, 39 varieties, and 3 kinds. The fauna totals in 97 family and 152 species.

The birds in bamboo fields help the pest control, and bamboo helps the air flow in farming lands and villages. In the process, a circular loop of biodiversity is created among upper mixed forest~bamboo fields~villages~farming land.

The management for bamboo field contributes to the preservation of biodiversity. One of the most critical elements in managing Damyang bamboo fields is thinning. Thinning discriminates between shoots and timber and it includes a method for securing optimal positioning. Periodical thinning and appropriate lumbering according to the age of the bamboo timber increase the penetrability of sunlight. Cyclically bringing earth from another place and changing the soil environment according to when the bamboo was planted, contributes to the preservation of biodiversity.

Initial planting of bamboo groves and application of fertilizers for germination of bamboo shoots also enhances biodiversity. When creating a bamboo field or cultivating bamboo shoots, farmers spread agricultural byproducts including manure and rice husks and straw. Transplantation and plantation can also help conserve biodiversity by enhancing soil environment.

'The Jeollanam-do Institute of Health and Environment and its Research Institute of Forest Science' conducted a comparative analysis of environmental effects for 6 arboreal species in 150 plantations in Korea over three years. Results showed one hectare of the bamboo field absorbed 29.34 metric tons of carbon dioxide, an absorption rate 3.8 times higher than that of pine trees. Amounts of carbon dioxide absorbed per hectare: bamboo, 29.34 tons; tulip trees, 15.4; Mongolian oak, 9.99; Pine trees, 7.68; *Pinus koraiensis*, 7.23. It well demonstrated the considerable effect of bamboo on environment. The amount of oxygen emitted by bamboo was 35% higher than other trees, and the biomass produced annually was 16 tons, 7.68 times that of pine trees. During the summer, more than twice as many phytoncides were measured in Damyang bamboo (667) than that in cedar forest (328). The results have proved the environmental impact of Damyang bamboo fields.

## ii. Cycling system within Damyang Bamboo-field Agriculture System

### 1) Water utilization in Damyang bamboo fields

Following settlement of bamboo cultivation in Damyang, management between bamboo fields and other farming has been tied in a good harmony. Water resource use by rice paddy near bamboo field is a good sample. The branches of the Youngsan river is not practical resource for farm lands in hilly area. Meanwhile, bamboo fields with abundant moisture tend to hold puddles with natural water paths. Farmers have managed the puddle and the water way, connecting to their cultivation area.

Common spatial structure for Damyang villages with bamboo field shows a pattern of upper mixed forest~bamboo fields~villages~farming land. Water from bamboo fields is taken into other farming area by the land use system. Water way is built from bamboo field. Barrage or reservoir is built for dry season. The Youngsan River goes through Damyang region. Fields of paddy and dry along the river or fields located at higher altitude than the river have used the water from bamboo fields. In spite of advanced up to date water resource management system, water from the nearby bamboo fields are still used frequently, supporting agro-biodiversity in Damyang.



Image 2. Application of water from Damyang Bamboo-field Agriculture System

## 2) Resource circulations between bamboo fields and other farming

Various material circulations among bamboo field to paddy and dry field has been practiced in Damyang region. From the old times, bamboo was used to make farming implements such as samtaegi (basket for carrying manure or crops), doriggae(flail), etc. and protective structures for rice seedbed, as well as structural components such as booms. Recently bamboo vinegar and bamboo charcoal are being made for agricultural use such as soil conditioners, and serve as a momentum to spread eco-friendly agriculture.

Bamboo plantations also harbor birds which aid in pest control, and improve seasonal air flow, protecting crops. In return, agricultural byproducts are utilized for managing bamboo fields. Rice straw is used to plant a bamboo grove, and rice husks are important in cultivating bamboo shoots. Farming villages provide bamboo fields with manure.

As it will appear in the later part of the application, nutrients from bamboo fields get transferred down to other farming area per its cyclic water utilization structure, helping other crops' growth. Likewise, the agricultural system for Damyang bamboo plantations create circular systems for ecology among bamboo groves, rural villages, and agriculture as well as multi-layer structures for securing food and livelihoods on the basis of circular systems for bamboo fields on agriculture.

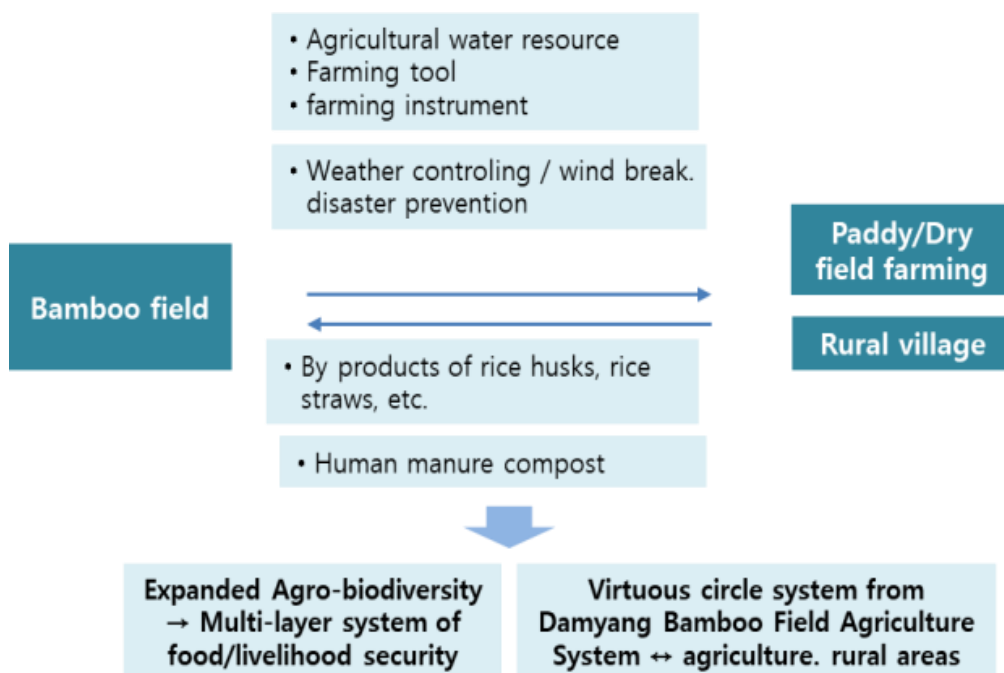


Image 3. Cycle of Damyang Bamboo-field Agriculture System with other farming area

### iii. Cultural landscape of bamboo community

#### 1) Land system and cultural landscape

Most rural villages in Damyang have a gentle landscape flowing from mountains with bamboo groves through villages and farmland to streams. The area enjoys a special cultural landscape created through classical use of land from long ago, during the cultivation of bamboo plantations and development of a sustenance regime. In its different aspects of culture still live together. The challenge of cultivation and management of bamboo within their life cycle has played a pivotal role of farmers in Damyang, laying the foundation for creating both tangible and intangible culture.



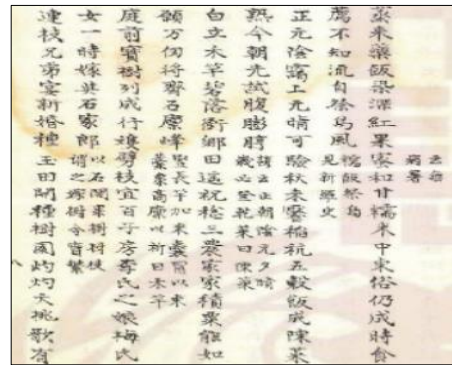
Picture 1. 'Damjiptaewugi' culture of Wolsan village, Damyang County

One representative aspect of Damyang culture is bamboo crafts. Bamboo grove management in Damyang started with these crafts, which have come to represent rural culture in Damyang; it has become a primary income source. For a very long time, virtually every household in every village has engaged in bamboo crafts, weaving together a communal culture together with canes and strips of bamboo. Bamboo trees have always been available for everyday life items and farming tools, as well as themes of folk religion, games, and culture and art. All of this suggests that bamboo trees are not just growing everywhere in Damyang, but also filling the lives and the mental world of residents.

The cultural landscape of Damyang has been created in the history of the bamboo agricultural system, and that landscape is a key element of the system itself. Since this cultural landscape has been nurtured within the community, it serves as a core element to suggest excellent sustainability for the bamboo agricultural system.

## 2) Historic value of Damyang Bamboo-field Agriculture System reflected in 'Jukchwiil day culture'

Jukchwi-il is described as a festivity observed from the Goryeo Dynasty in *Sesi-pung-yo* (traditional seasonal customs or festivities). Literally Jukchwi-il means the day when bamboo plants get drunk from rain, so people could transplant bamboos, which are environmentally very sensitive, without the plants realizing because they were drunk. The fact that people set the day for transplanting bamboos carefully. The ritual shows that farmers valued bamboo's production value. Bamboo was a main resource to secure food and livelihood of family and their region. In other words, Jukchwi-il was a festivity observed as part of ways to realize income by meeting the demand for bamboo products.



Picture 2. 'Jukchwiil Day' record in 'Sesipungyo'

Jukchwi-il in Damyang has ever so much to do with bamboo crafts. Booming of bamboo crafts in Damyang naturally increased the demand of bamboo, which in turn raised the need to plant more. So Jukchwi-il became a ritual where new plantations could be started, and communities came together as they worked in bamboo crafts as well. To farmers, bamboo field was an object of cultivation and management.

May 13th lunar calendar day is set for bamboo planting. Residents would plant bamboo in designated places and drank Jukyeop-ju, or bamboo-leaf drinks, together for their friendships and unity. Juksinje worship service is held and games are played where residents and tourists can participate.

There can be several meanings in the Jukchwi-il festivity.

First, planting bamboo means that there is no massive bamboo producer, so it is essential to keep planting bamboo to meet the market demand. Bamboo fields in Damyang are the result of the economic demand with the natural background suitable for growing bamboos. Establishment of bamboo fields in unused space or lower hills nearby their village has created the indigenous land use system and cultural landscape.

Second, planting bamboo also means that people had related expertise and skills. In order to plant it in various ways, including methodical transplanting beyond simply digging up naturally occurring plants, it is necessary to understand the conditions under which bamboos can grow. Appropriate management is also required after planting. Then, knowledge and skills regarding a series of management processes until harvest time are needed, in order for planting efforts to be made worthwhile. Of course, the knowledge and skills were developed through trial and error over a long period of time. Thus, the traditional knowledge and skills were formed and shared by communities.

Third, these meanings show correlations between Damyang bamboo fields and agricultural heritage. Bamboo field management requiring knowledge and skills, working together out of economic necessity of local communities, resulted in transmission systems. Transmission systems created tradition that rendered bamboo fields far richer in the process, through crop cultivation within the grove areas, such as bamboo shoots, and agriculture using bamboo by-products.

Working together as a community led to create culture in a natural way. People planted bamboo together and produced bamboo crafts together after harvesting. Produced crafts led to the formation of markets. When ringing in a new year, people set up bamboo piles and set them on fire, wishing for the best for the year. Every household had bamboo plants surrounding their house and made their tools for farming and for daily life out of bamboo. Planting bamboo had impact on both physical and spiritual spaces in Damyang.

As such, based on traditional knowledge and skills, Damyang bamboo fields have helped make a living for a long time and created a representative culture. Damyang bamboo agriculture has woven several factors of Damyang into a system, like the weft and warp.

Damyang residents still gather together on May 13th every year to plant bamboo. This is because they understand the meanings Jukchwi-il has and acknowledge that agricultural heritage still living in Damyang is bamboo field agriculture.

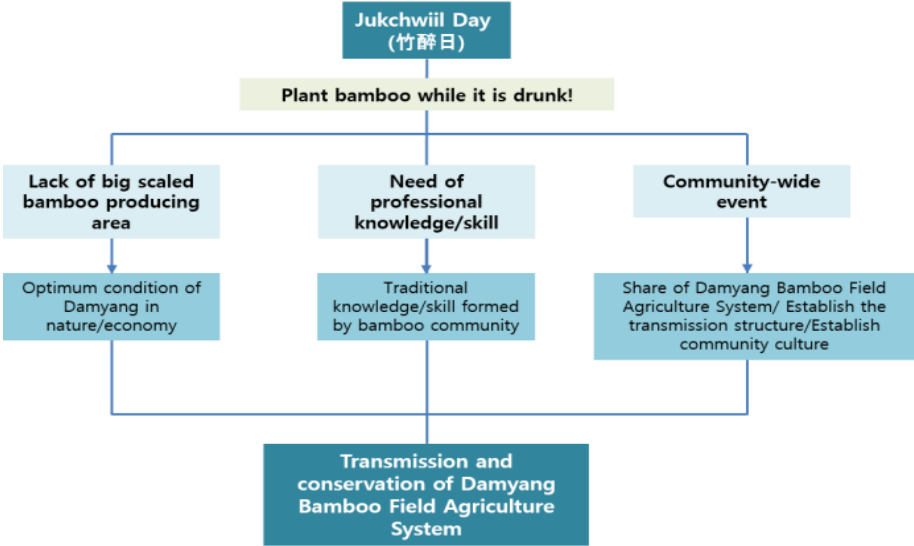


Image 4. Historic value of Damyang Bamboo-field Agriculture System reflected in 'Jukchwiil day culture'

### 3) Tradition of Bamboo Crafts

Bamboo craft has been the most essential background to create Damyang Bamboo Fields. Increased bamboo demand for 'Gongmul or gifts to King and the government' meant more bamboo fields in villages.

Several pieces of ancient literature describe the tradition of bamboo crafts in Damyang. Farmers cultivate bamboo all year long in Damyang, but bamboo crafting is mainly produced during agricultural off-season. Bamboo crafts go through a division of labor such as splitting, twining and pyrography, called nakjuk. Therefore, each household does part of labor to make bamboo crafts such as households for splitting, for weaving, etc. This division of labor allows a whole village as a unit to produce a variety of bamboo crafts efficiently.



Picture 3. 1900s. Boys from Damyang selling bamboo baskets



Picture 4. 1930s, Ladies from Damyang crafting bamboo baskets



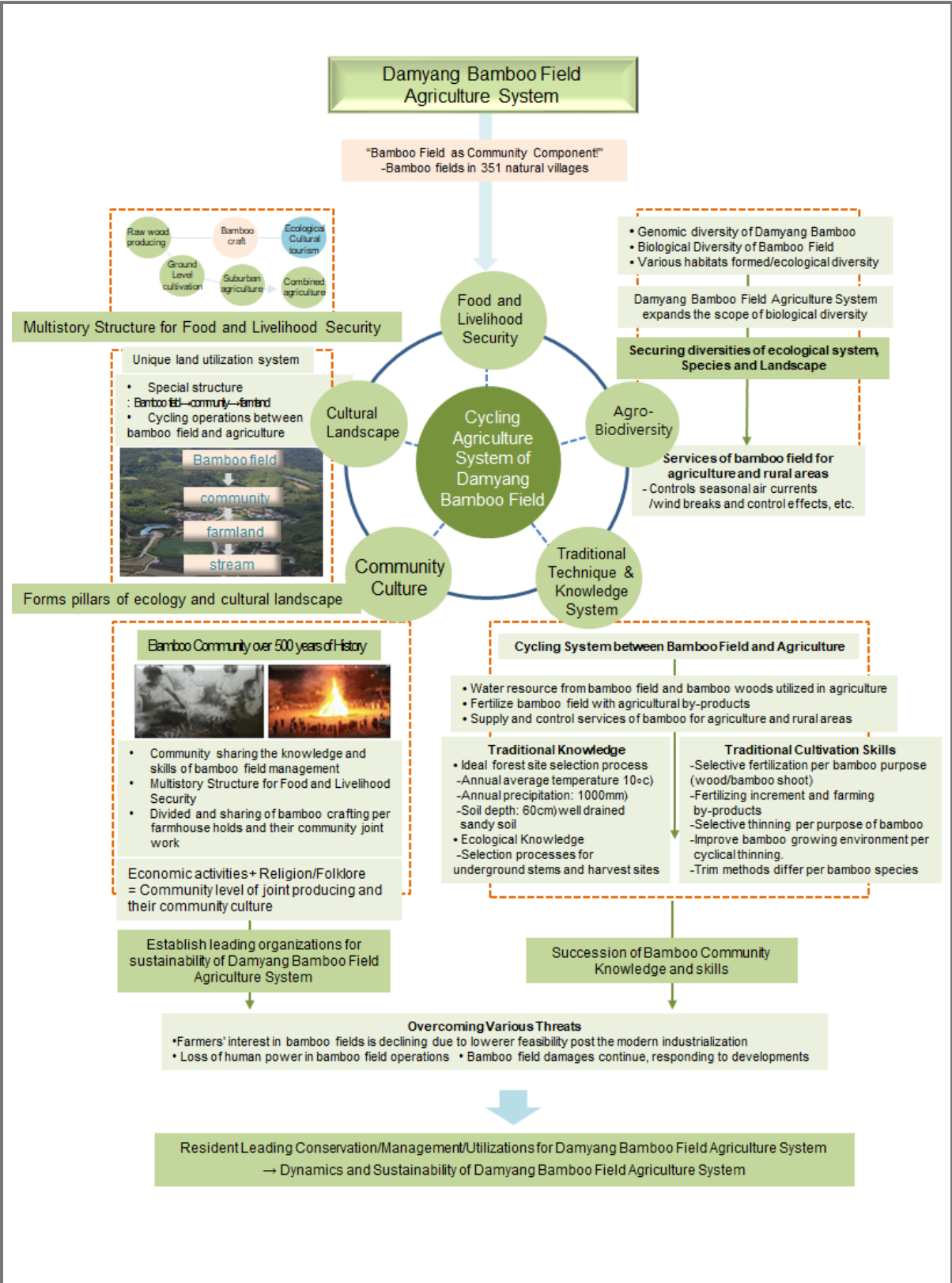


Image 5. Summary of Damyang Bamboo-field Agriculture System

#### **iv. Common value of Damyang Bamboo-field Agriculture System in terms of UN SDGs**

In order to gauge the value as an agricultural asset, it is useful to see how well the characteristics of Damyang Bamboo-field Agriculture System fit the UN's Sustainable Development Goals (SDGs). SDGs serve not only as comprehensive national action plans but also a global agenda for cooperation to mitigate common factors that threaten the sustainable development worldwide, including poverty, economic and social polarization, social inequalities, and destruction of the global environment. It can thus be judged whether or not the Damyang Bamboo-field Agriculture System is an agricultural heritage that can help alleviate these threats and achieve sustainable development.

Various countries or regions have differing perceptions toward bamboo or bamboo plantations. Bamboo is recognized as an income resource, or as an environmental species, and is often considered harmful to the environment by blocking the growth of other plant life. These differences in perception result in differences in methods employed for bamboo management and different growth outcomes.

However, proper management of any species can be beneficial to the environment and people. The agricultural system of Damyang bamboo field starts from a positive point of view toward bamboo. If properly managed, bamboo farming can be beneficial to the environment and mankind.

##### **1) Improvement of bamboo value in agriculture**

Bamboo fields in Damyang are smaller than those in other countries, but their noticeable characteristics are that most of natural villages do hold bamboo fields. This is the result of the development of bamboo fields in each village based on awareness of the value of bamboo. The Damyang bamboo field is managed in the form of family farming for efficient management. It enables the sustainability of the agricultural system by harmonizing between bamboo grove, rice paddy and field farming, local environment and cultural landscape.

Damyang's family farming bamboo has a strong tie with the history of bamboo crafts of Damyang. Each farm-household takes responsibility of a single task in Damyang's unique division of work system and the whole community participates in the process of bamboo crafting together to differentiate and maintain the originality and creativity of each village. That has been a basic foundation of diverse and unique Damyang bamboo craft.

Damyang's combined farming for an adequate size of bamboo field and paddy and dry field farming was drawn from the family-farming style management of near-by bamboo fields in the village, emphasizing the resource circulation between the bamboo field and other farming

area. Bamboo timber and water resource are widely used in for agriculture and by-products from the paddy and dry field farms are utilized for the bamboo field. Bamboo contributes a great deal in the farming operations as timber, farming tools and as to supply the ground cultivation area. The community level participation in bamboo crafting thru their division of work system per farm household has offered income for the participating farm families and community cooperation. The SYSTEM represents its value as a farming objectivity sufficiently and various means of benefit for farmers and their community development.

Neglect of bamboo as an object of industrialization or the inability to appreciate the value of bamboo as a resource could result in relinquishing the agricultural value of bamboo fields that Damyang's Bamboo-field Agriculture System has well demonstrated. The fastest reproduction rate of bamboo is believed to damage the flora and fauna system of the area, but bamboo no longer is an invader plant with constant management and care of bamboo field. As a result, the agricultural value of bamboo trees and the direct and indirect linkage of Damyang bamboo fields to UN SDGs, which have been shown by the agricultural system of the Damyang's bamboo fields, renew the awareness of bamboo as an agricultural heritage.

## **2) Food security and livelihoods, vitalize the local economy**

The agricultural system of Damyang's bamboo fields has multi-layer structure for securing food and livelihoods. This is related to SDGs Goal 1, No Poverty, and Goal 2, Zero Hunger, in terms of promoting the alleviation of poverty and sustainable agriculture. The creation of income generation resources is connected to Goal 8, Decent Work and Economic Growth.

In addition, bamboo crafts involving village people, establishment of bamboo cooperative associations, and the recent efforts toward industrialization utilizing bamboo resources have been linked to Goal 9, Industry, Innovation, and Infrastructure.

Bamboo guaranteed a high return for villagers, as Damyang residents called the bamboo field saeng-geumbat (meaning gold-mining field). The farming practices associated with the bamboo field also generated revenues. In particular, the production and sales of traditional bamboo timbers, bamboo shoots and bamboo handicrafts have increased the productivity of bamboo fields by linking them with making a diversity of local dishes and tourism.

The profitability of primary products of bamboo fields including bamboo timber, bamboo shoots, bamboo sap, bamboo leaves, and bamboo sheath is so high that the bamboo field produces revenue five times the total cost of production. It includes medicinal herbs such as tea plants, maekmundong and goji berry; bamboo crafts as bamboo-processed products, and a wide range of foods including boiled bamboo shoots, Jukro tea, dried medicinal herbs and daetongbap rice. Lastly, profitability has been increasing through bamboo-themed tourism products.

The bamboo timber is widely used as a material for furniture and handicrafts because of its excellent plasticity and low shrinkage from dryness, which makes deformation and coloring easier. The amount of bamboo timber produced in Damyang is about 70% of the total production amount in South Korea. Bamboo shoots grow very fast and are rich in nutrients and fiber. The production amount of bamboo shoots produced in Damyang has accounted for 60 to 70% of the nation's total production since 2010

### **3) Conservation of the environment and landscape**

As bamboo trees started to emerge as a plant species that can acclimatize to climate change, bamboo trees are aligned directly with Goal 13, Climate Action, among SDGs and indirectly with targets of Goal 3, Good Health and Well-Being for People, in that ecological and environmental characteristics of bamboo plantations and the landscape can be well preserved.

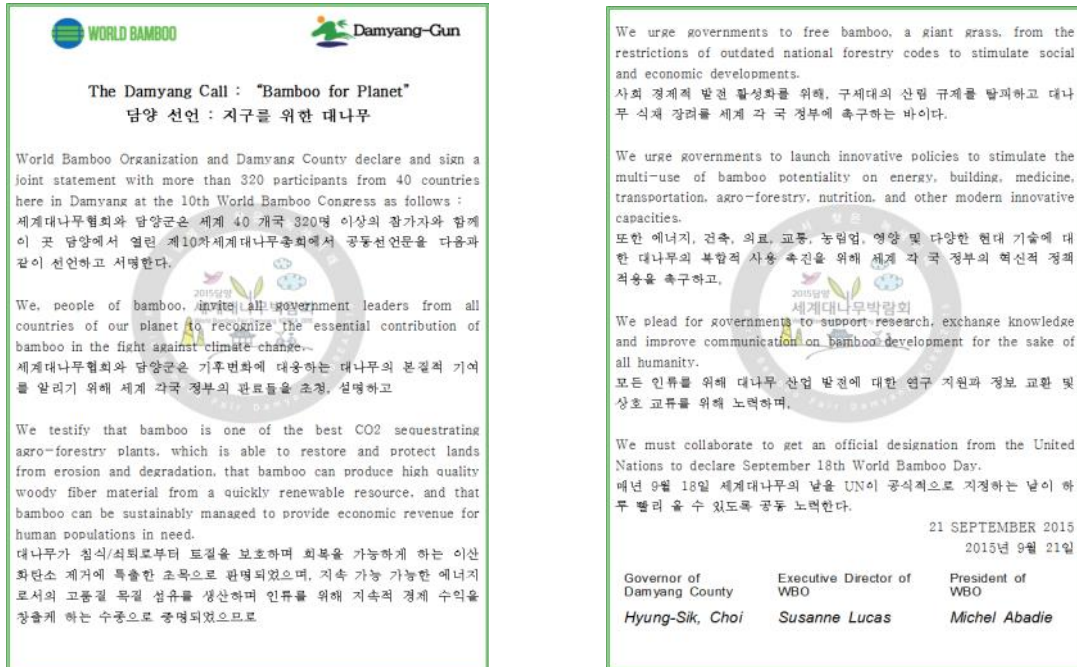
Bamboo trees can absorb more carbon dioxide and release more oxygen than many other forestry species, with carbon dioxide absorption of 29.34 ton per hectare. Bamboo trees have higher environmental value, releasing twice as much phytoncide as fir trees in summer and 35% more oxygen than other species with the contents of negative ions in the air 7.4 times those in urban areas.

Bamboo trees are also good for maintaining good soil quality and preventing landslides. Bamboo is the fastest growing plant on the planet and very helpful to protect the ecosystem from mudslides, especially in Damyang which has many mountains and much rain.

At a time when global environmental problems are worsening by day, these are some roles that bamboo trees play to contribute to solving certain big problems. The World Bamboo Organization has also expressed this point. The 10th World Bamboo Congress held in 2015 in Damyang announced a joint declaration "The Damyang Call" which calls for each country to make efforts to understand ecological and environmental values of bamboo trees and make the most of them.

*The World Bamboo Organization and Damyang County invite all government leaders from all countries of our planet to recognize the essential contribution of bamboo in the fight against climate change. We testify that bamboo is one of the best CO2 sequestering agro-forestry plants, which is able to restore and protect lands from erosion and degradation, that bamboo can produce high quality woody fiber material from a quickly renewable resource, and that bamboo can be sustainably managed to provide economic revenue for human populations in need. We urge governments to free bamboo, a giant grass, from the restrictions of outdated national forestry codes to stimulate social and economic development...."*

Such efforts to utilize the ecological and environmental values of Damyang bamboo fields should eventually lead to the preservation of agricultural heritage. Agricultural heritage is not about the past, but a way of life to both carefully preserve and utilize it with the future generations together.



Picture 5. Declaration 'The Damyang Call' between Damyang County and the World's Bamboo Association during the 10th World's Bamboo Assembly

#### **4) Keeping land use system and cultural dynamics**

The way of preserving the bamboo field agricultural system and keeping the system for rural land use according to traditional knowledge and skills is in connection with Goal 15, Life on Land, and directly related to Goal 11, Sustainable Cities and Communities, since it guarantees the sustainability of conditions to continue to live in rural villages in Damyang. The fact that various values of bamboo resources are utilized in connection with the primary, second and tertiary industries shows its alignment with Goal 12, Responsible Consumption and Production.

The Damyang bamboo agricultural system contains culture of Damyang created over a very long time. With bamboo fields as background, residential areas can be seen together with farmland. This kind of typical system for land use and its sustainability has created the cultural landscape that can only be found in Damyang. Economic lives and social, cultural lives are intermingled in this cultural landscape. Residents in Damyang within the "bamboo community" have planted and managed bamboo trees together, creating their own traditional culture and the system for transferring it while working together due to economic demand.

As time changes rapidly, things have changed. Advancement of the economy has made different kinds of jobs, and more and more of the young generations keep moving to larger cities. Damyang population in 1970 was more than 110,000 but it decreased to less than 50,000 in the 2000s. The power to continue traditional culture has been on the wane.

The key to deal with this crisis is, squarely, the agricultural heritage, the Damyang bamboo fields. Agriculture here still accounts for almost 50% of its industry, making it a farming-centered village region. Damyang's proximity to large cities has helped it to implement the farming paradigm in the urban areas, too, producing and selling a wide variety of agricultural products. This requires a new approach to the Damyang Bamboo-field Agriculture System: agricultural heritage needs to be based upon cultural dynamism.

Bamboo fields are agricultural heritage shared by residents in their everyday routines and spiritual life. Several examples can be found: January 15th on lunar calendar widely observed as Daetbul-noki, where bamboo trees and rice straws were piled to set ceremonial fire. Bamboo is planted every year exactly on the Jukchwi-il holiday, etc. These folk rituals show clearly that Damyang is still a bamboo community.

The significance of preserving agricultural heritage is not only about raising its economic value. It is more about keeping the dynamism of its cultural landscape alive, preserving various values of agricultural heritage. The dynamism of the Damyang bamboo field agricultural system equals the dynamism of bamboo community culture.

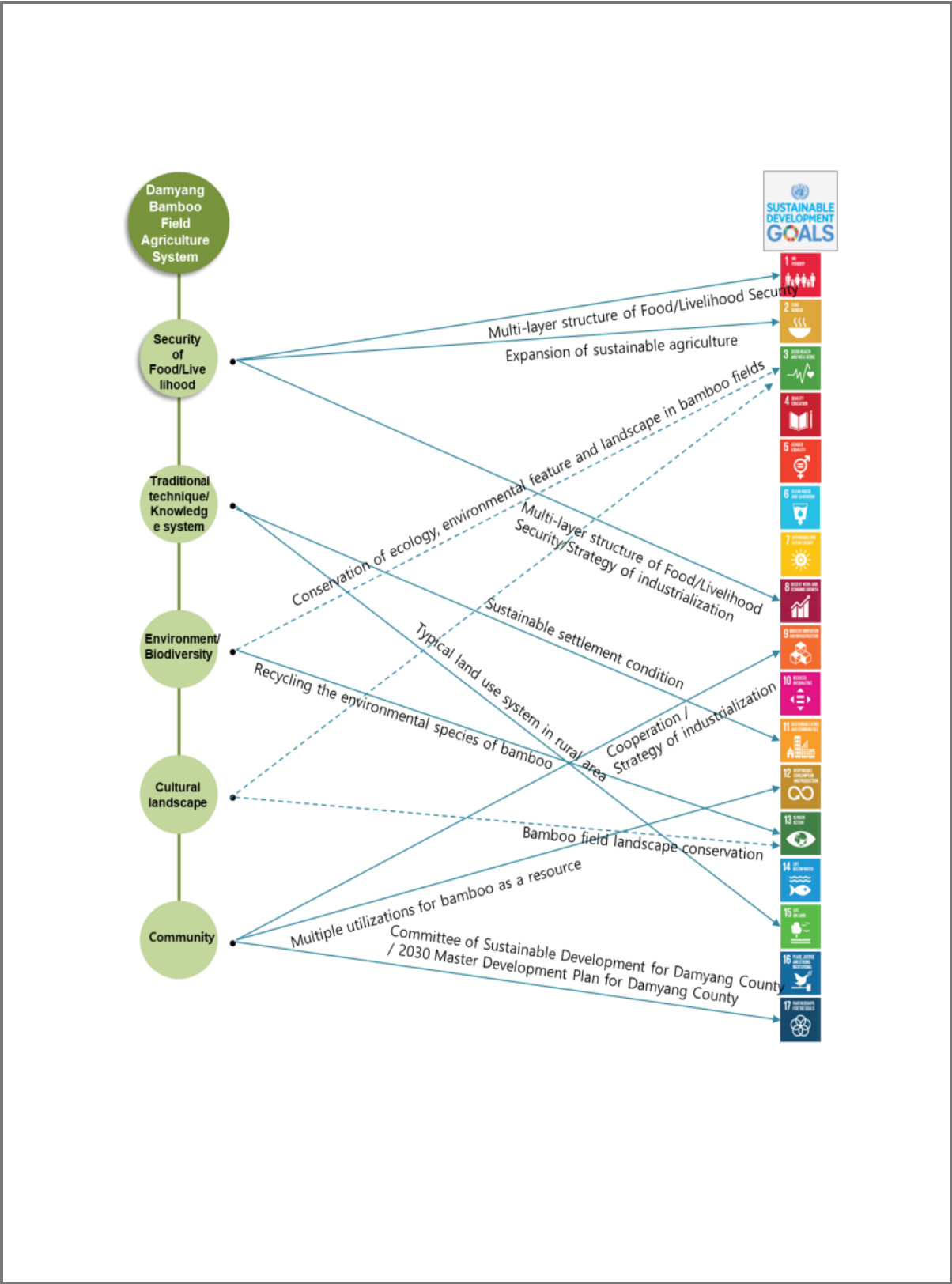


Image 6. Characteristics of Damyang Bamboo-field Agriculture System and Ties to UN SDGs

## 2. Features of Damyang Bamboo-field Agriculture System

### i. Security of Food and Livelihoods

#### 1) Bamboo “Money Tree” grows in Bamboo Grove the “Gold Mine”

##### (1) Damyang Bamboo Fields

Bamboo's straight feature is believed to represent 'constancy', 'loyalty' and 'holiness' from old days. Bamboo is a part of folk ritual, and the guardian god is believed to visit the village thru the hallow bamboo. Bamboo's winding root is frequently called a dragon, and snow-covered bamboo-field symbolizes for 'endurance'.

Damyang Bamboo-field Agriculture System holds more than 1000 years of history in its agro-diversity. Bamboo craft was a major source of income for communities in Damyang, and bamboo farming gradually expanded.

Majority of 354 natural villages hold bamboo fields of higher economic value species. Main species of Damyang bamboo includes *Phyllostachys bambusoides* Sieb. et Zucc. and *P. nigra* var. *henonis* for wood and crafting. Bamboo shoots is produced by *Phyllostachys pubescens* and *P. nigra* var. *henonis*, *Stapt ex Rendle*.

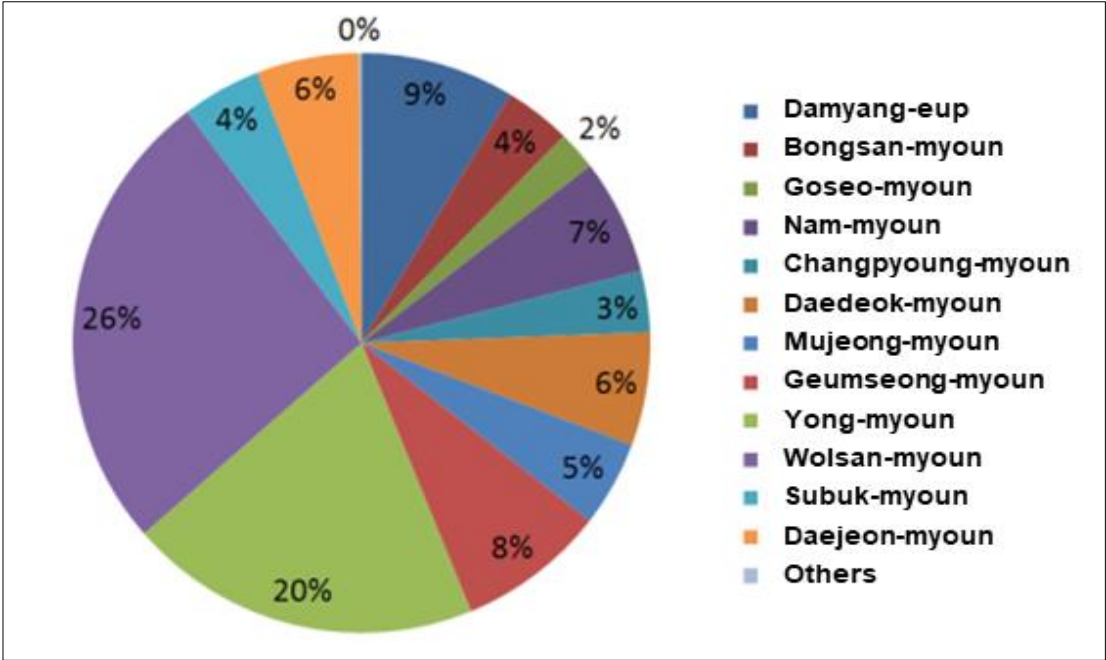


Image 7. Distribution of Bamboo per Eup/Myoun of Damyang county



Table 1. Distribution of Damyang Bamboo Fields

Region	Lot total	Size (ha)	Ratio (%)	Size per species(ha)				Other	Remark
				<i>Phyllostachys bambusoides</i> Sieb. et Zucc.	<i>P. niaravar. henonis</i>	<i>Phyllostachys pubescens</i>	<i>Pseudosasa iaponica</i> (Siebold & Zucc. ex Steud.) Makino		
Damyang-eup	657	192.50	7.95	76.92	87.59	14.13	11.85	2.01	
Bongsan-myeon	355	84.74	3.50	11.48	56.69	4.36	3.16	9.05	
Goseo-myeon	185	49.17	2.03	11.88	35.66	-	0.05	1.58	
Nam-myeon	466	143.16	5.91	30.64	92.15	-	4.42	15.95	
Changpyoungmyeon	375	77.28	3.19	16.06	55.10	2.50	1.51	2.11	
Daedeok-myeon	448	142.43	5.88	22.75	98.84	1.71	15.71	3.42	
Mujeong-myeon	494	124.64	5.15	43.50	73.50	1.68	0.00	5.96	
Geumseong-myeon	595	192.48	7.95	21.38	104.28	39.24	12.58	15.00	
Yong-myeon	301	543.95	22.47	10.82	37.34	2.00	258.76	235.03	
Wolsan-myeon	676	592.54	24.48	43.89	144.51	5.96	387.16	11.02	
Subuk-myeon	295	118.08	4.88	35.48	31.31	0.20	17.65	33.44	
Daejeon-myeon	323	156.62	6.47	13.91	48.75	2.71	46.78	44.47	
Others	-	3.03	0.13	-	2.30	0.73	-	-	Street trees
<b>Damyang county</b>	<b>5,170</b>	<b>2,420.62</b>	<b>100.00</b>	<b>338.71</b>	<b>868.02</b>	<b>75.22</b>	<b>759.63</b>	<b>379.04</b>	

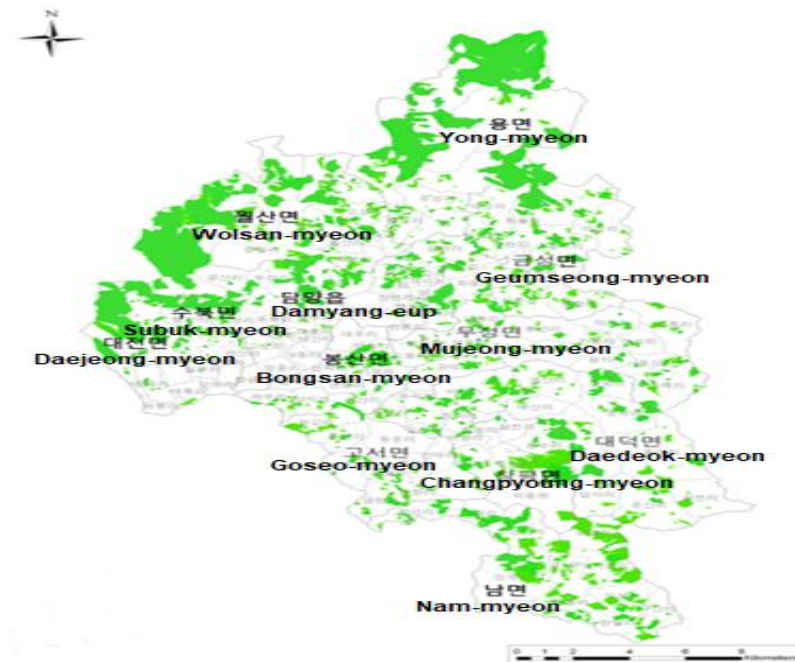


Image 8. Distribution of Damyang Bamboo Fields

## 2) Multi Structure of Food Security and Livelihoods

Bamboo is a high-value-added crop, bringing in about 5-fold profit to its production cost. The production cost of bamboo was lower than rice, barley, potato, sweet potato and apples, but brought in much higher net income. Net income from bamboo can be about 5 times higher than rice, and bamboo shoots was an additional income source for farmers.

Damyang, the home of bamboo and bamboo crafts has become pride of local farmers, tying with sustainability of Bamboo-field Agriculture System. Bamboo is also called as 'money tree', and bamboo field as 'gold mine' for its rich productivity. Demand for bamboo and bamboo shoot was high as diverse common living materials and goods before cheap plastic appeared.

Medicinal plants like *broadleaf Liriope*, wolfberries (goji berries) and special crop of mushrooms are cultivated in the ground level of bamboo-fields. And various bamboo processed products are traded in the consumer market.

Bamboo crafting was primary source of food security and livelihoods of farmers and Damyang. Bamboo crafting was either for daily tools or to earn living cost. Processed bamboo became diverse commodities for residents. Bamboo shoot was an important source of food during famine. Bamboo shoot and leaves' medical effect was widely used in old days.

Damyang Bamboo-field Agriculture System is related to rice farming. SYSTEM is usually formed in the lower hill ridges to a valley or in marsh area, and it is easy to find puddles nearby. Water from the puddle is to irrigate nearby rice paddies through channels. Rice husk is used to fertilize SYSTEM and conserve moisture for new bamboo shoots.

Combined agriculture with suburban farming has become a notable phenomenon. Damyang is adjacent to a large city of 1.5 million people of Gwangju, developing Damyang type of compound and high valued eco-friendly farming practices. Processed bamboo products such as bamboo vinegar and bamboo charcoal gave start to Damyang eco-friendly agriculture.

In addition to traditional methods to maintain food security and livelihood, various products and industries applying modern technologies have been developed. Bamboo has also become an interior design material, in addition to serving as a key element in creating tourism products.

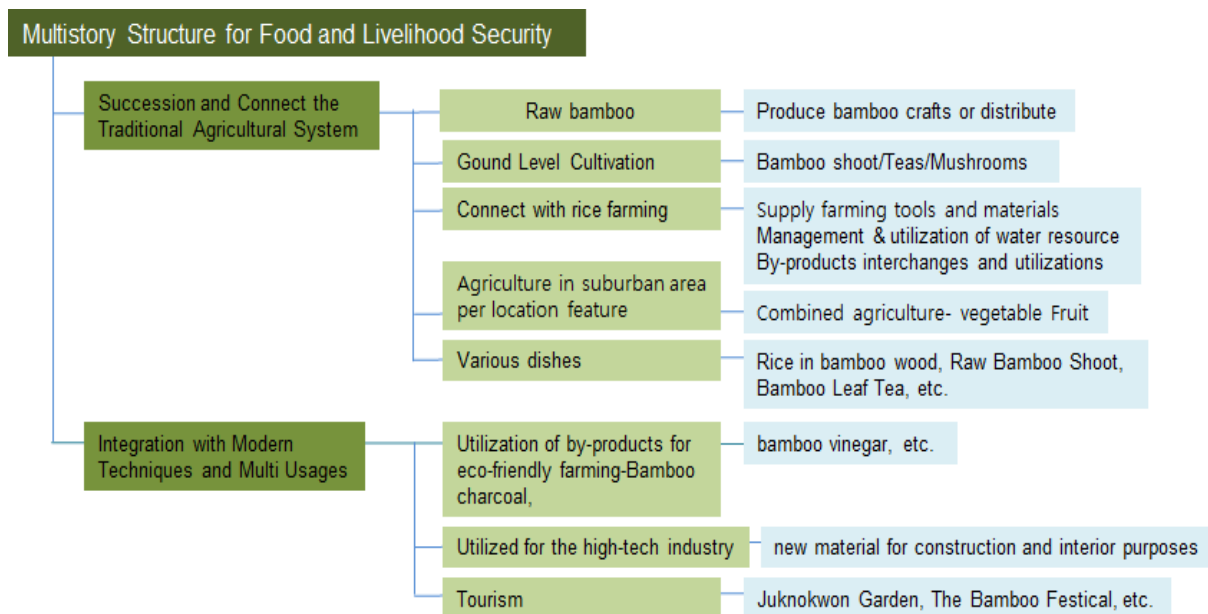


Image 9. Multi-level formation of Food Security and Livelihoods

### 3) Security of Food and Livelihoods per Each Bamboo Produce

Bamboo has been widely utilized in industries of primary, secondary and tertiary. Bamboo timber and bamboo shoot are in primary industry. Bamboo farmers have supported their livelihoods by various means of bamboo utilization like selling bamboo timber, bamboo shoot, and other crop from their field as in primary industry. Bamboo vinegar, bamboo charcoal, bamboo shoot dishes are secondary industry along with processed bamboo products like bamboo crafts, plant supporter, leaf tea, soap, materials of agriculture, architecture and eco-friendly gadgets. Tourism and food services are tertiary industry of bamboo. More farmers and communities are getting involved in the secondary and tertiary industry of bamboo. More added value is being produced for bamboo. Recent tourism trend thru 'well-being', or 'SLOW' improves value of rural tourism and drives the development of social economic changes. The following information would indicate bamboo's industrial value. The following table indicates the regional income from various industry of bamboo and 3 main bamboo villages for comparison. \$1:1150won rate has been applied.

Table 2. Agricultural income of county and 3 main bamboo villages (unit: ton, head, million)

	Damyang County			Naeda village Samdari			Daesil village Daegokri			Wolsan village Wolsanri		
	Farm house	Yield	Net income	Farm house	Yield	Net income	Farm house	Yield	Net income	Farm house	Yield	Net income
total	11,909	80,245	124	84	1,122	9.12	67	393.05	0.62	47	511.07	4.07
Food crop	11,843	29,809	27.1	53	247	0.24	28	73	0.08	28	211	0.17
Horticulture	10,045	46,827	66.0	57	138	0.30	41	78	0.23	39	135	0.29

Cattle	620	751	26.5	3	223	7.87	1	4	0.14	1	99	3.49
Bamboo timber	820	3,366	0.9	40	703	0.18	29	231	0.06	27	158	0.04
Bamboo shoot	1,093	233	2.0	40	32	0.28	29	11	0.10	27	7	0.06
Bamboo tea	177	10.2	1.4	38	2	0.25	1	0.05	0.01	2	0.07	0.01

Reference: The 58th Annual Statistics of Damyang County(2018) & 3 main bamboo villages  
Duplicate farmers excluded from 'Farm house'

Table 3. Detail and structure of bamboo farmers livelihood

	No of farm family	Ratio
Bamboo shoot, general farming	1,093	92%
Bamboo timber	820	
Jukrocha tea	177	
Bamboo crafting	54	6%
Bamboo good produce & trade	60	
Bamboo charcoal, bamboo vinegar	29	
Restaurant (bamboo dishes)	26	2%
Bamboo tourism	8	

Reference: The Internal Report of Damyang Bamboo Resource Research Institute

Bamboo farmers also run parallel agriculture with general farming. Some farmers cultivate bamboo for wood purpose or bamboo shoot solely. Some farmers cultivate bamboo wood, Jukrocha tea and still participate in off-season bamboo crafting. Some young farmers concentrate in new industry of charcoal and vinegar. Some richer farmers start up own restaurant or hospitality service business. No public or official statistics have been surveyed yet, and that would be a new objective for future goal.

### Jukjae (Timber bamboo)

In Damyang, bamboo technique has advanced to produce most daily necessities beside bamboo crafting, and national level supply for farming tool, furniture and handicraft are distributed, labeling Damyang, the center of bamboo industry.

Bamboo holds higher economic value than other timbers for its rapid growth and practical management. Bamboo timber is straight and holds solid nodes and enlarged ring with hollow inside. Bamboo's high elasticity and resistance to dryness offers optimum condition to be used for furniture and handicraft. Total yield of bamboo timber from Damyang is about 70% of national total.

Table 4. Yield of bamboo timber from Damyang (unit: bundle, %)

Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nation	154,848	146,920	150,123	35,919	33,572	33,572	118,278	38,584	30,209	18,971	20,875	24,285	22,800
Damyang	121,370	120,900	120,900	30,919	23,200	23,350	104,748	23,800	23,500	14,399	16,297	17,070	16,830
Ratio	78.4	82.3	80.5	86.1	69.1	69.6	86.9	61.7	76.8	75.9	78.1-	70.3	73.8

Ref: The Forestry Statistics Report No 49, 2019, Korea Forest Service, Annual Statistics of Jeollanamdo Province in all years, The 58th Annual Statistics of Damyang county (2018)

Table 5. Yield of bamboo timber from Damyang and produced income in 2017 (unit: bundle, household, \$)

Type	Yield	Household	Income
	16,830	820	\$877,391

Ref: The Forestry Statistics Report No 49, 2019, Korea Forest Service, Annual Statistics of Jeollanamdo Province in all years, The 58th Annual Statistics of Damyang county (2018)

### Juksun (Bamboo shoot)

Bamboo shoot grows incredibly quick and is a high-end food with rich fiber. Bamboo shoot is harvested in calm day with no wind and kept out of sun. 20 to 30cm size bamboo shoot is harvested from mid May to mid June. Bamboo shoot is good for eyes, diabetes, fever and beriberi. Yield of annual bamboo shoot is over 200,000kg.

Table 6. Bamboo shoot yield (unit: kg)

Year	2011	2012	2013	2014	2015	2016	2017
Yield	305,515	836,306	361,900	154,855	341,335	263,200	233,324

Ref: The 58th Annual Statistics of Damyang county (2018)

Bamboo shoot is either sold raw or processed. Boiled bamboo shoot is sold for higher price than fresh. The fresh bamboo shoot brings in about \$31.3 million (\$1:1,150w). But farm-households' income is expected to increase even more for the boiled bamboo



Picture 6. Bamboo shoot harvest



Picture 7. Juksun

shoot is sold at much higher price. It's remarkable comparison to others like rice for \$45.8m, strawberry (\$50.2m), bell tomato (\$12.9m), melon (\$26.5m), grape (\$4.3m), beef (\$91.3m) and pork (\$22.9m).

The income from boiled bamboo shoot brings in about little less than 5 times against the raw bamboo shoot. That figure surpasses other products like rice (\$460), red pepper (\$1321), Chinese cabbage (\$852), Korean beef (\$252) and pork (\$235) per unit area of 10ha. Bamboo shoot matures in about 3 months, considering some other crop take up to one full year. These factors have greatly contributed for economic growth in rural areas in Damyang.

### Tea cultivation

Bamboo field ground with adequate shade and humidity offers essential condition for tea tree growing.

Jukrocha tea is a traditional Korean tea made from small, tender tea leaves plucked individually by hand in late summer. During the Joseon Dynasty, Jukrocha was known as the king's tea. The precious leaves are limited in quantity and expensive, but the tea unfolds on the palate with elegance. The cultivation size for Jukrocha is increasing and about 170ha in Damyang Bamboo-field Agriculture System is estimated to grow Jukrocha tea as listed below.



Picture 8. Tea Leaf Harvesting



Picture 9. Phallus luteus

Table 7. Jukrocha tea field distribution with yield, income (unit: ha, ton, \$ million)

Type	Tea field distribution	Household	Yield	Income(round off)
Grand Total	170	177	10.20	1.40
Sub total	127.42	127.42	7.65	1.04
Damyang-eup	47.00	56	2.82	.38
Bongsan-myeon	4.14	17	.025	.03
Goseo-myeon	-	-	-	-
Nam-myeon	6.83	5	.41	.06
Changpyoung-myeon	9.39	9	.56	.08
Daedeok-myeon	11.18	26	.67	.09
Mujeong-myeon	4.49	9	.27	.04
Geumseong-myeon	12.40	16	.74	.10
Yong-myeon	12.14	15	.73	.10
Wolsan-myeon	15.10	15	.91	.12
Subuk-myeon	1.18	8	.07	.01
Daejeon-myeon	3.57	1	.21	.03
Wild tea	42.50		2.55	.40

Reference: Damyang Bamboo Resource Research Institute

The tea harvest from field-cultivation is reported for 7.65ton and 10.2ton with wild tea. The gross income from tea is about \$1.4million including \$1.04 million from cultivated tea and .40 million from wild tea.

Jukrocha tea is divided in 4 types, including teuk-u-jeon(top), u-jeon (1st class), se-jak (2nd class) and jung-jak (3rd class) depending on harvest time. Sold price per 30g of teuk-u-jeon is ₩120,000(\$104), ₩68,000(\$59) for u-jeon, ₩38,000(\$33) for se-jak and ₩30,000(\$26) for jung-jak.

**Special Crops**

Medicinal plants like big blue lily, goji berries, Solomon's seal tea, mushrooms, and landscaping plants are cultivated in the ground level, contributing for agricultural profitability. About 24 type of edible mushrooms including *Dictyophora indusiata* is found in Damyang Bamboo-field Agriculture System. The special crops are known to help lower blood pressure and cholesterol levels, and the demand for plants is increasing.

Table 8. Specialty crop gross yield from ground level cultivation of Damyang bamboo field (unit: kg)

Type	2011	2012	2013	2014	2015	2016	2017
Medicinal Plant	10,060	10,000	10,240	4,717	4,764	14,068	7,828
Mushrooms	141,200	42,986	94,302	256,000	410,253	218,866	177,235

Reference: The 58th Annual Statistics of Damyang county (2018)

**Agricultural products from combined farming**

Farmers do other type of farming simultaneously on top of bamboo farming. The usual agricultural products include rice, strawberry, cabbage and pears. 29,809 MT of grain crops like rice, barley was harvested in 2017, and rice accounts for 97%, or 29,036ton.

Main fruit/vegetable harvested include strawberry, melon, watermelon and tomato. Harvested strawberry has recorded 13,535 M/T in 2017 followed by melon (4,562M/T), tomato (10,309M/T), watermelon (2,906M/T) and cabbage (3,302M/T). In addition, spinach, lettuce, radish, carrot, pepper, green onion, garlic, ginger, and onions are produced. Damyang offers ideal condition for suburban farming. Additionally, orchard crops of apple, pear, peach, grapes, black raspberry and persimmon are harvested, among which, persimmons were harvested 1,740M/T in 2017, followed by grapes(475M/T), pear(48M/T) and peach(192M/T).

Table 9. Agricultural Yield in Damyang county for 2017(measured by: ha, M/T)

Type	Food crop*	Vegetable**	Fruit***
Extent	5,861	696.4	261.4
Yield	29,809	31,678	3,137

\*Food crop: Rice (paddy, dry field), Barleys (rye, unhulled barley, wheat, beer-barley), Grains (corn, buckwheat), Beans (bean, red bean, mung-bean), Roots (sweet potato, potato), etc.

\*\*Vegetables: Strawberry, melon, watermelon, tomato, Korean melon, Leafy vegetables (cabbage, spinach, lettuce, etc), Root vegetables (radish, carrot, taro), Condiment vegetables (pepper, green onion, garlic, ginger, onion)

\*\*\*Fruits: Apple, pear, peach, grapes, raspberry, persimmon, etc.

Reference: The 58th Annual Statistics of Damyang county (2018)

## Bamboo craft

There have been bamboo fields in each village of Damyang area for a long time, and majority households made bamboo products to sell. Bamboo crafts played an important role for individual and regional economy.



Picture 10. Bamboo Market's Yester-year and Today (from left: Road to Bamboo Market in 70s. Bamboo Market in a Cold Day. Bamboo Market Today)

"Master of bamboo crafts" is nickname for Damyang people, and techniques were developed from earlier time. Industry association of Jin-so-gye (bamboo comb craft men association) was found in 1916, and bamboo craft industry expanded and the commercialization of bamboo products began in earnest in 1930s. The development of the bamboo craft industry was largely influenced by Jukmul Market, the 300-year-old local bamboo market of Damyang. Jukmul market was held in every 5 days along Damyangcheon stream. More than 30,000 bamboo satgat(hat) were sold in a day in 1940s. By 1980s, about 62,000 bamboo products (126 type) were sold in a day. 62 types of bamboo goods were exported, earning about \$460,000/yr. Jukmul Market, which long represented bamboo handicrafts and was prosperous enough to attract foreign buyers, has been on the wane as the bamboo crafts industry experienced the paradigm shift within the domestic economy since 1990s.

Recently, demand for bamboo goods is increasing for its high eco-friendly value. Jukmul Market moved to Samda-ri, Damyang-eup in 2010 and reopened as Cheong-juk Market, producing daejari mats, daebal bamboo blinds, and bamboo fans. 29 companies produced about 81,000 units in 2014, with total sales of about \$17.2 million. The next and complete report will be announced in 2020.



Table 10. Yield of Bamboo Goods and Bamboo Related Produced-goods (Measure: unit)

Type	Bamboo Product*		Processed Bamboo Product*	
	2013	2014	2013	2014
Number of Manufacturer	29	29	29	29
Yield/Sale volume	78,352	81,126	335,504	376,110
Amount of sales (in million won)	6,015	7,978	18,569	19,826

\* Next nationwide basic statics will be taken in 2020 (5 years term)

\*Bamboo product: Bamboo mat, health massage bar, blind, Fan, Tea table, Household items, etc.

\*\* Processed Bamboo Product: Bamboo charcoal, Bamboo salt, Sausage in bamboo stalk, Traditional bean paste, Forest bed, Hangwa Traditional sweet snack, Bamboo charcoal toothbrush, etc.

Ref: Damyang county, The Basic Statistics Report on Bamboo Related Business (2015)

## Bamboo Delicacies

Stems and leaves of bamboo and bamboo shoots are important food ingredients. Bamboo is well known for its nutritious value in fat, protein, carbohydrate, glucose, dietary fiber, vitamin E, beta-carotene, calcium, sodium, potassium, iron and magnesium.

Table 11. General Component Elements of Bamboo

Type	Calory (kcal/100g)	Water (g/100g)	Fat (g/100g)	Protein (g/100g)	Calcium (g/100g)	Carbohydrate (g/100g)	Sugars (g/100g)	Fiber (g/100g)	Vitamin E (mg/100g)	Beta-carotene (mg/100g)	Ca (mg/100g)	Na (mg/100g)	K (mg/100g)	Fe (mg/100g)	Mg (mg/100g)
P. nigra var. henonis (root)	187	51.9	0.3	2.0	1.7	44.1	1.56	36.8	0.1	0.0	9.3	40.3	376.8	14.6	24.1
P. nigra var. henonis (stem)	196	49.8	0.4	1.7	1.6	46.5	1.83	41.7	0.1	0.0	5.6	26.0	679.6	1.6	15.2
P. nigra var. henonis (leaf)	205	45.6	1.6	9.8	5.1	37.9	1.19	30.8	4.7	3.4	193.1	36.3	396.4	10.4	61.3

Reference: Damyang Bamboo Resources Research Center

Bamboo stems are key ingredients for daetong-bap (rice in bamboo stem), daetong-gui (grilled in bamboo), daetong-sul (bamboo liquor), juksu-aek (bamboo sap), juk-ryeok (bamboo oil) and jukyeom (bamboo salt). Bamboo leaf is ingredient for tea, noodles, bean curd, traditional liquor and taffy candy(yeot). Bamboo shoot is a key ingredient for juksun-hoe (raw bamboo shoot), representing Damyang's local cuisine. Also, boiled bamboo shoots are served together with freshwater snails, vinegar, red pepper paste and sugar. In addition, the shoots become an ingredient for juksun gui(grilled bamboo shoots), juksun naeng-chae(bamboo shoot cold salad), juksun kimchi(bamboo shoot kimchi), juksun jeonggwa(candied bamboo shoot), juksun namul(dried bamboo shoot), juksun jang-ajji (pickled bamboo shoot), juksun galchi jorim (braised cutlassfish with bamboo shoot), juksun doenjang(soybean paste with bamboo shoot) and juksun gochujang(red pepper paste with bamboo shoot). These foods are produced by 27 local companies, and the total sales in 2014 was about \$7 million.

Table12. Gross Sale Volume of Bamboo Dishes

(unit: US million)

Type	2013	2014
Number of Business	27	27
Amount of Sales	\$5.94	\$6.72

Main food item: Grilled Short Rib Patties with Bamboo, Rice in Bamboo Stalk, Braised Short Ribs with Bamboo Shoot, Sausage in Bamboo Stalk, Ground Loach in Hot Bean Paste Soup with Bamboo Shoot, Bean Paste Soup with Bamboo Shoo, Raw Bamboo Shoot, etc.

Ref: Damyang county, Basic Statistics Report on Bamboo Related Business (2015)

\* Next nationwide basic statics will be taken in 2020(5 years term)

## Chapter Summary

Damyang bamboo is used extensively, from industry of primary to secondary and tertiary, and getting into new industry from a traditional industry of bamboo timbers, bamboo shoots and handicrafts.

The direct economical effect of Damyang bamboo industry was estimated at \$62 M in 2010. Some \$0.28 M was from primary industry; \$23.9 M from secondary and tertiary industries; and \$37.8 M from bamboo tourism. And the economical effect of Damyang bamboo industry was estimated at \$69.6 M in 2015. With that background, it is fair to estimate its economic effect will exceed \$87 M.

Table 13. The Estimated Direct Effect of Bamboo Industry (2015)

Type	Total	Timber	Bamboo shoot	Jukrotea	Bamboo craft	Food	Tour site admission fee **
Production Volume	\$69.4 M	\$.22 M*	\$31.36 M	\$95,819	\$24.22 M	\$6.7 M	\$6.8 M

\* 2014 volume applied for the 2015 Production with mere volume

\*\*Calculation based on Juknokwon Garden and Accommodations without free admission visitors. Actual tourism income is expected to be higher.

Ref: Annual Statistics of Damyang County, Basic Census Statistics for Bamboo Businesses (2015)

Next nationwide basic statics will be taken in 2020(5 years term)

The county of Damyang has produced the statistics in 2018 for sound “ECO Damyang Bamboo City”. The table shows bamboo related income of Damyang Country with 3 main bamoo villages status for a comparison. 1093 farm-household are involved in direct bamboo farming and produces about \$122 million annually. The bamboo related income includes income of direct bamboo farming and indirect food crop, horticulture and Korean native cattle raising around bamboo fields. The bamboo related income signifies the absoluteness of bamboo farming in local economy.

Table 14. Agricultural income of county and 3 main bamboo villages (unit: ton, head, million)

	Damyang County			Naeda village Samdari			Daesil village Daegokri			Wolsan village Wolsanri		
	Farm house	Yield	Net income	Farm house	Yield	Net income	Farm house	Yield	Net income	Farm house	Yield	Net income
total	11,909	80,245	124	84	1,122	9.12	67	393.05	0.62	47	511.07	4.07
Food crop	11,843	29,809	27.1	53	247	0.24	28	73	0.08	28	211	0.17
Horticulture	10,045	46,827	66.0	57	138	0.30	41	78	0.23	39	135	0.29
Cattle	620	751	26.5	3	223	7.87	1	4	0.14	1	99	3.49
Bamboo timber	820	3,366	0.9	40	703	0.18	29	231	0.06	27	158	0.04
Bamboo shoot	1,093	233	2.0	40	32	0.28	29	11	0.10	27	7	0.06
Bamboo tea	177	10.2	1.4	38	2	0.25	1	0.05	0.01	2	0.07	0.01

Reference: The 58th Annual Statistics of Damyang County & 3 main bamboo villages (2018)  
Duplicate farmers excluded from 'Farm house'

Damyang was born, blessed and developed on the bamboo value. People of Damyang was able to recognize the multi value of bamboo in human life thru farming, culture, history and economy. Bamboo farmers have depended their food security and livelihoods entirely or partially on bamboo for the longest time, knowing the very agri-culture will have to be passed down for another thousand years.

Currently, most bamboo farmers are among old generation and it is essential to honor the old farmers' contributions in human historic development and seek the way to pursue the regional bamboo agriculture as a role-model industry for those future generation.

The young people require value, honor and rewording on top of sufficient income for job search. GIAHS Damyang Bamboo-field Agriculture System can motivate young people with their purpose, and bamboo farmers of Damyang are destined for successful inheritance of bamboo-field farming culture

Table 15. Population of Damyang County & 3 main bamboo villages (2019)

		Damyang County	Samdari Naeda village	Daegokri Daesil village	Wolsanri Wolsan village
Households		23,521	84	67	47
Total population		47,221	161	134	99
Gender	Total	47,221	161	134	99
	Male	23,922	90	74	49
	Female	23,299	71	60	50
Age group	Total	47,221	161	134	99
	~20 yr	5,558	11	18	14
	~29 yr	5,235	9	12	10
	~39 yr	4,342	11	14	9
	~49 yr	5,580	12	10	7
	~59 yr	8,342	34	21	18
	~69 yr	7,618	31	23	14
	~79 yr	6,328	26	10	16
	80 yr ~	4,218	27	26	11

Reference: Internal statistical data of Damyang County

Table 16. Damyang hospitality establishment, 2018

	Lodge	Restaurant/bakery	Spa/Beauty	Hygiene/Service
Damyang County	55	1,255	161	46

Ref: Damyang Bamboo Resource Research Institute

Remark: The Lodge figure doesn't include private and civic sector(lodge).

Table 17. Earned admission fees from bamboo attractions

	Juknokwon Garden	Metasequoia Land	Soswaewon Garden	Bamboo Museum	Gasa Bamboo Literary House	Gamagol Ecological Park	Total
2019	\$1,730,434	\$449,565	\$208,695	\$33,043	\$21,739	\$25,217	\$2,468,695
2018	\$1,709,565	\$440,869	\$206,086	\$37,391	\$23,478	\$36,521	\$2,453,913

Ref: Internal statistical data of Damyang County

table 18. the number of tourists

Year	Visitor	Paid attraction visitor	Unpaid attraction visitor
2018	6,161,547	1,573,607	4,587,940
2017	7,159,663	1,875,155	5,284,508
2016	7,198,325	1,926,736	5,271,589

Ref: Internal statistical data of Damyang County

## Bamboo the future resource

The bamboo industry of Damyang is in transition from the traditional handicraft-centered industry to new industry. In other words, Damyang bamboo is being utilized not only as an industrial resource but also as an ecological and cultural tourism resource making the best use of the bamboo's environment and landscape value. Damyang's ecology and culture-themed tourism is steadily growing, with 7.25 million visitors in 2015 as its peak. The number of visitors has slightly decreased for past two years due to national circumstances in economy, but ECO CITY DAMYANG promotion is expected to increase visitors back to Damyang again.

Damyang bamboo farmers do other paddy and dry field farming and further participate in tourism directly or indirectly with their bamboo production. They expand their economic horizon by creating more crafts, food item and rural tourism program.

Bamboo is used as an industrial resource, especially in biotech, including bamboo leaves, stems, roots, bamboo sap and bamboo charcoal; bamboo has recently shown its noticeable applicability in eco-friendly agriculture and in the food and pharmaceutical industries.

In addition, extensive research has been undertaken to increase the utilization of bamboo in the textile industry and architectural interior. In summary, starting from traditional handicrafts, Damyang bamboo is now expanding its application into ecology and cultural tourism, local delicacies and processed food development through its linkage to agriculture.

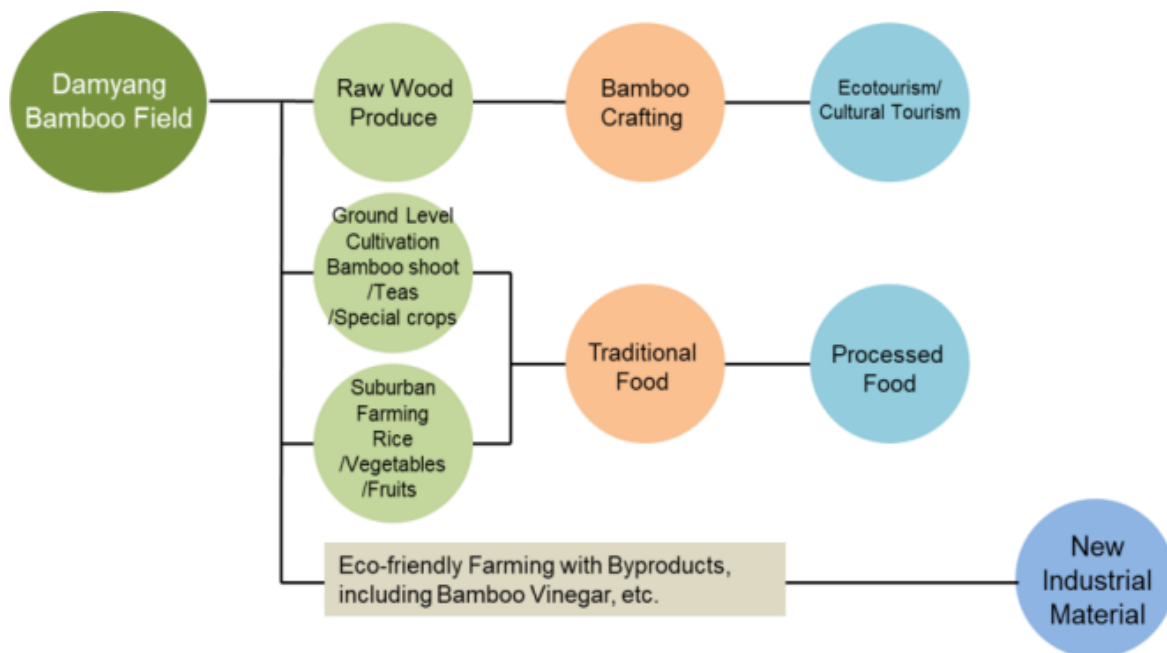


Image 10. Role of Damyang Bamboo in for People's Livelihood

## ii. Agro-biodiversity

### 1) Variety of Bamboo Species

#### (1) Origin and cultivation of Damyang Bamboo

Damyang bamboo farming of the economical *Phyllostachys* genus is practiced in near northern boundary line area of Korean bamboo cultivation. Some further northern areas also maintain the *Phyllostachys* genus but in much smaller scale due to the cold weather and growth difficulties. The *Sasa* genus which is smaller than the *Phyllostachys* genus is found in much higher latitude. The *Sasa* genus is not cultivated for its smaller size and economic benefit. Utilization of the *Sasa* genus is limited to small size house good purpose.



Image 11. Global bamboo distributions and boundary line of Korean bamboo field formation

#### (2) Global distribution of bamboo

The Southeast Asia and Hanam region of China are the home of bamboo, growing in the temperate zone, the warm temperate zone and subtropical climate zone. Most bamboo forests are located in the Southeast Asian region, including 3 million ha in India, 1.5 million ha in Burma, 170,000ha in Taiwan, 170,000ha in Japan and 5,000ha in Korea. About 7 kind 120 genus and 1,250 species of bamboo are distributed in the world. The global bamboo distribution is separated into 3 geological zones.

#### Asia and the Pacific

The zone of Asia and the Pacific takes up the largest portion, and the major bamboo producing countries are China, India, Laos, Taiwan, Bangladesh, Cambodia and Vietnam.

## Latin America

Distribution is concentrated in northeastern side of American continent, and there is no natural bamboo species except the white membrane inside bamboo (Daecheongrijuk) and 2 subspecies. The concentrated area includes Mexico, Guatemala, Honduras, Colombia, Venezuela, downstream region of Amazon river in Brazil.

## Africa

The bamboo distribution in African region is relatively small, covering south part of Senegal, Guinea, Liberia of the west coast of Africa and Ivory Coast, Nigeria, Congo, Zaire and island of Madagascar of the east coast of African region.

Table 19. Species of global bamboo

Country	China	Japan	Korea	India	Malaysia	Burma	Philippines	Africa
Species	500	662	12	31	31	42	30	11

Ref: Bamboo Resource Research Institute of Damyang County

Table 20. Species of Korean bamboo and local species

Type	Korean	Scientific name	Remark
Damyang local species	Wangdae	<i>Phyllostachys bambusoides</i> Sieb. et Zucc	
	Ojuk	<i>Phyllostachys nigra</i> Munro	
	Somdae	<i>Phyllostachys nigra</i> var. <i>henonis</i> Stapf	
	Juksundae	<i>Phyllostachys pubescens</i> Mazel	
	Yidae	<i>Pseudosasa japonica</i> Makino	
	Joritdae	<i>Sasa borealis</i> (Hackel) Makino	
Korean species	Jajuyidae	<i>Pseudosasa japonica</i> Makino var. <i>purpurascens</i>	
	Seomjoritdae	<i>Sasa kurilensis</i> (Rup.) Makino et Shibata	
	Jejejoritdae	<i>Sasa queipaertensis</i> Nakai	
	Gotdae	<i>Sasa chiisanensis</i> (Nakai) Y. Lee, comb. Nov.)	
	Goryeojoritdae	<i>Sasa coreana</i> Nakai	
	Haejangjuk	<i>Arundinaria simonii</i> (Carr.) Riviere	

Ref: Bamboo Resource Research Institute of Damyang County

Damyang bamboo farming around the northern boundary line area requires continuous management of planting and fertilization to maintain. The strong species against cold weather has been selected for farming of long history in. The species in Damyang Bamboo-field Agriculture System holds high timber value based on its intensity and flexibility. Bamboo craft with high quality Damyang bamboo timber has vitalized bamboo farming in Damyang region. 148 introduced species have been planted for environmental analysis in Damyang County and the list of them are attached as Appendix 10.

*Phyllostachys bambusoides* Siebold & Zucc. is settled in the Korean Peninsula long ago for its diverse usage. Damyang bamboo holds its history of about 1000 years from the Goryeo Dynasty. Bamboo root spoils, get hard and stop growing once it is exposed in the air, so it is anticipated the bamboo was carried by man from the southern China or Southeast Asia area.




The *Phyllostachys nigra* var. *henonis* (Bean) Stapf ex Rendle is one of varieties from *Phyllostachys nigra* MUNRO. The *Phyllostachys nigra* var. *henonis* (Bean) Stapf ex Rendle grows well in barren environment, strong against cold weather and good for crafting. *Phyllostachys pubescens* came from China to Japan then settled in the Korean Peninsula in 1898. Damyang bamboo farming has settled by man-cultivation oriented farming with high economic value species and referred as Anthropophyten.

### (3) Features of Damyang bamboo species

The economic feasibility of each specific bamboo species cultivated is an essential factor to consider when establishing a new plantation. Species are planted with high value for food, living and industrial use. The economic efficiencies of the species are directly linked to sustainability, and species of bamboo in Damyang includes *Phyllostachys pubescen* Mazel ex Lehaie, *Phyllostachys nigra* var. *henonis* (Bean) Stapf ex Rendle, and *Phyllostachys bambusoides* Siebold & Zucc

Bamboo farming in Damyang originated mainly for economic purposes, and most of the bamboo species cultivated was *Phyllostachys nigra* var. *henonis* (Bean) Stapf ex Rendle (35.4%) because it was necessary to obtain materials for handicrafts. At that time, *Phyllostachys nigra* var. *henonis* (Bean) Stapf ex Rendle was highly valued for making bamboo crafts and bamboo shoot. On the other hand, the cultivation area of *Phyllostachys pubescen* Mazel ex Lehaie (3.0%) harvested primarily for bamboo shoot and *Phyllostachys bambusoides* Siebold & Zucc (13.8%) for bamboo timbers is relatively small.

Table 21. Environmental features and usage per species

Species	Feature	Purpose
<i>Phyllostachys bambusoides</i> Siebold & Zucc	 <ul style="list-style-type: none"> <li>• Has thick stem, tough fiber, fine grain, good flexibility.</li> <li>• Stem height: 10~30m, Diameter: 5~13cm</li> <li>• Introduced from China and Southeast Asia</li> </ul>	Timber Craft
<i>Phyllostachys nigra</i> var. <i>henonis</i> (Bean) Stapf ex Rendle	 <ul style="list-style-type: none"> <li>• Relatively small compare to</li> <li>• <i>Phyllostachys bambusoides</i> Siebold &amp; Zucc or <i>Phyllostachys pubescen</i> Mazel ex Lehaie.</li> <li>• Stem height: 10~20m, Diameter: 5cm</li> <li>• Variety of <i>Phyllostachys nigra</i> (Lodd.) Munro</li> </ul>	Timber Craft Bamboo shoot
<i>Phyllostachys pubescen</i> Mazel ex Lehaie	 <ul style="list-style-type: none"> <li>• Down-ward has shorter joint distance and thicker branch. Height get over 20m.</li> <li>• Stem height: 20m, Diameter: over 40cm</li> <li>• Introduced from China to Japan then to Korea</li> </ul>	Bamboo shoot Landscaping

Reference: The Bamboo Resource Research Institute



Among them, *Phyllostachys bambusoides* Siebold & Zucc, which is highly utilized as bamboo timbers, is estimated to have arrived relatively early on the Korean peninsula. Apparently, bamboo seeds were introduced from southern China or Southeast Asia, rather than active rhizomes which do not transport well. *Phyllostachys nigra var. henonis* (Bean) Stapf ex Rendle was born as a variant while growing a type of black bamboo called ojuk. The cultivation area of *Phyllostachys nigra var. henonis* (Bean) Stapf ex Rendle expanded because it grows well in cold weather and on barren soils, and it lends itself well to handcrafts. *Phyllostachys pubescen* Mazel ex Lehaie came to the Korean Peninsula from China through Japan in 1898.

Thus, these highly valued bamboo species that consists of Damyang's bamboo fields are deemed anthropophyrene because they exist and spread only through human cultivation.

Bamboo trees grown in Damyang are selected and cultivated according to the needs of each farmer in genetic difference. Comparative analysis of genetic diversity of *Phyllostachys pubescen* Mazel ex Lehaie, *Phyllostachys nigra var. henonis* (Bean) Stapf ex Rendle and *Phyllostachys bambusoides* Siebold & Zucc in Damyang showed that their initial shooting period, the shapes of branch, leaf, stem, flower and the taste of bamboo shoots are unique.

Table 22: Genomic Diversities of Damyang Bamboo

Type	<i>Phyllostachys pubescen</i> Mazel ex Lehaie	<i>Phyllostachys nigra var. henonis</i> (Bean) Stapf ex Rendle	<i>Phyllostachys bambusoides</i> Siebold & Zucc
Sprouting time	ÿ Early April~ early May	ÿ Late April~late May	ÿ Mid May ~ Mid June
Silky hair	ÿ Short/small	ÿ Shorter than Wangdae/acute angle to branch	ÿ Long/right angle to branch
Ligule	ÿ Long shape	ÿ Circle shape/lower than Wangdae	ÿ Long/sawtooth shape
Bamboo shoot pill	ÿ Dark brown spots ÿ Rough fur	ÿ Pale red/hairy surface ÿ Vertical red line marks	ÿ Dark red spots ÿ Smooth/no fur
Bamboo shoot taste	ÿ Sweet	ÿ Sweet	ÿ A little bitter taste
Branch & leaf	ÿ Many branches/similar leaf to Somdae ÿ More leaves attach to branch than Somdae	ÿ More branch than Wangdae ÿ Less leaf than Wnagdae	ÿ Less branch than Somdae and Juksundae ÿ Larger leaf
Joint	ÿ One annual ring	ÿ Two annual rings ÿ Similar (bottom to top)	ÿ Two annual rings ÿ Thicker top.
Stem	ÿ Turquoise color with white powder on its surface	ÿ Pale green color with white powder on its surface	ÿ Turquoise color with smooth surface
Stem & Angle of stem	ÿ Acute angle	ÿ Acute angle	ÿ Right angle
Flower	ÿ 3 Stamen, 1 Pistil, 3 Stigma	ÿ 3 Stamen, 1 Pistil, 3 Stigma	ÿ 3 Stamen, 1 Pistil, 3 Stigma

Reference: The Bamboo Resource Research Institute

Bamboo has excellent mechanical properties. As shown in the table below, *Phyllostachys bambusoides* Siebold & Zucc and *Phyllostachys pubescens* Mazel ex Lehaie are more flexible than Japanese cedar. *Phyllostachys bambusoides* Siebold & Zucc is superior in mechanical properties to *Phyllostachys pubescens* Mazel ex Lehaie, so they are used differently.

Table 23. The Mechanical properties of Damyang Bamboo

Type	Modulus of Elasticity in Bending(ton/cm <sup>2</sup> )	Deflection Strength (kgf/cm <sup>2</sup> )	Tension Strength (kgf/cm <sup>2</sup> )	Compression Strength (kgf/cm <sup>2</sup> )	Shearing Strength (kgf/cm <sup>2</sup> )
<i>Phyllostachys bambusoides</i> Sieb. et Zucc.	155	1900	2480	740	170
<i>Phyllostachys pubescens</i>	125	1440	1760	780	170
<i>Cryptomeria japonica</i>	75	650	900	350	60
<i>Fagus engleriana</i> Seemen ex Diels	120	1000	1350	450	130

Reference: Park Sangbeom, The Brief Review for Development of Korean Bamboo Industry, Korea Bamboo Symposium (2018)

#### (4) Flora and fauna in Damyang Bamboo-field Agriculture System

Ecological environment survey on bamboo plantations in Damyang and surrounding areas conducted in 2017 identified a total of 358 taxonomic groups as vascular plants with 93 families, 315 species, 1 different species, 39 varieties, and 3 form. 2 tables below show the status of flora and fauna in Damyang Bamboo-field Agriculture System.

Table 24. Flora in Damyang Bamboo-field Agriculture System

Category \ System	Family	Species	Subspecies	Variety	Forma	Total
Articulatae	1	1	-	-	-	1
Pteridopsida	5	7	-	2	-	9
Progymnospermopsida	4	8	-	1	-	9
Anthophytes	83	299	1	36	3	339
Dicotyledons	72	241	1	25	3	270
Monocotyledons	11	58	-	11	-	69
Total	93	315	1	39	3	358

Reference: The Ecological Environment Survey Report of Damyang-gun County and Nearby Area (2017)

Table 25. Fauna in Damyang Bamboo-field Agriculture System

Type Category	Site Research	Main Species (including interview)	Document Review
Mammal	7 family 10 species	Elk, Raccoon, Otter, Wildcat, etc.	10 family 14 species
Birds	23 family 32 species	Sparrow, Vinous-Throated Parrotbill, etc.	25 family 47 species
Amphibian	4 family 6 species	<i>Pelophylax nigromaculatus</i> ( <i>Rana nigromaculata</i> ), <i>Hyla japonica</i> (Günther, 1859), etc.	5 family 9species
Reptile	2 family 4 species	<i>Gloydus ussuriensis</i> , <i>Rhabdophis tigrinus</i> , etc.	2 family 4 species
Insecta	61 family 120 species	<i>Lepidopter larva</i> , <i>Odonata</i> , <i>Hemiptera</i> , etc.	45 family 123 species

Reference: Ministry of Environment, The 3rd National Natural Environment Survey for Damyang (2017)

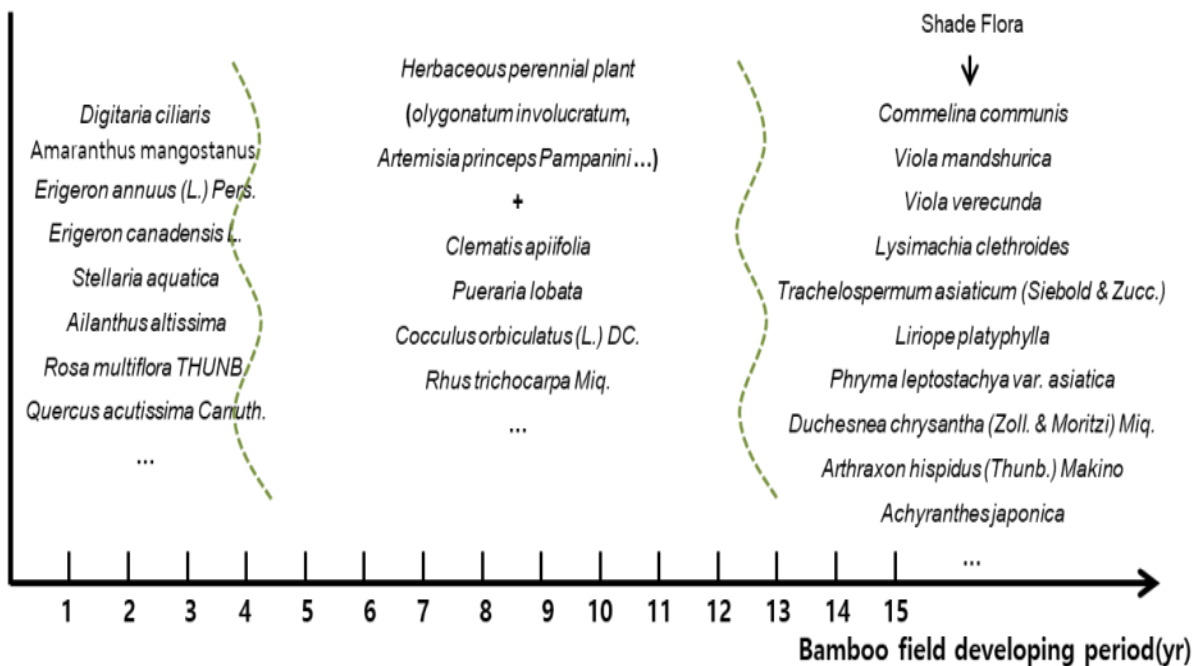
Reference: The Ecological Environment Survey Report of Damyang-gun County and Nearby Area (2017)

### Changes in flora according to timing of initial bamboo plantation

Since nutrients that have accumulated in the soil vary depending on the age of bamboo trees and the period during which the bamboo field is created, species of flora live in the field will vary. (Ecological environment survey report on bamboo fields in Damyang and surrounding areas, Damyang County [2017]; Distribution of bamboo resources and stands management technology, Nambu Research Institute of Forest Resources, National Institute of Forest Science [2017].)

Southern crabgrass, *Amaranthus mangostanus*, annual fleabane, Canadian horseweed, *Stellaria aquatica*, *Ailanthus altissima* (tree of heaven), baby rose, and sawtooth oak inhabit around bamboo. Five years after a bamboo plantation is created, herbaceous perennial plants such as *Polygonatum involucreatum* var. (Franch. & Sav.) maxim, Japanese mugwort, and virgin's bower (*Clematis apiifolia* var. DC), kudzu vine, *Coculus trilobus*, East Asian sumac, etc., form the flora. After 13 years, common dayflower (*Commelina communis*), Manchurian violet, *Viola verecunda*, *Lysimachia clethroides*, Asiatic jasmine, maekmundong, Asian lopseed, false strawberry, hairy-joint grass and *Achyranthes japonica* become shade plants.

As such, bamboo fields are a repository of ecosystems that are inhabited by such diverse living organisms because of their unique environment that change according to the period during which the bamboo field is created, also enabling the cultivation of special purpose crops considering the soil environment.



Reference: The Ecological Environment Survey Report of Damyang County and Nearby Area (2017)  
 Image 12. The Flora Variations per the Forest Formation Period

### The birds and fungus improve the value of Bamboo-field Agriculture System

The birds and fungus are found to improve value of Damyang Bamboo-field Agriculture System. The presence of 14 families and 23 species of birds, including Eurasian tree sparrow, parrot bill, and brown-earned barrel, has been identified by direct sighting or bird sounds. In particular, *Sasa borealis* forests help small birds belonging to the order of Eurasian tree sparrows overcome spring impoverishment by providing early edible fruits and shelter from raptor. In winter season, in addition to egrets that often form large flocks together in breeding places, other birds such as brambling, hawfinch, rustic bunting are identified.



Picture 11. Birds in Damyang Bamboo-field Agriculture System  
 (from left: Bubulcus ibis, Ardea cinerea, Egretta alba modesta)

For example, white heron's chick gets out of its nest, hanging on the edge of bamboo and cry for food around mid-July. The mother bird search for baby feed from the paddy and dry fields in nearby area, controlling the area's pest problems. The migrating bird white heron then leaves Bamboo-field by October for the south.

The bamboo field offers a habitat for the bird and the bird controls pest of nearby farmlands in return, creating harmonious Damyang Bamboo-field Agriculture System.

A total of 108 species of mushrooms including *Phallus luteus*, *Pholiota jahnii* var. *Tjall.*-Beuk. & Bas., *Collybia dryophila*, *Marasmius rotula* var. (Scop.) Fr., *Cystoderma neoamianthinum* hongo, *Agaricus campestris*, *Armillariella mellea*, all grow naturally in a bamboo field that provides an environment suitable for a variety of living species with abundant shade and organic matter. Among them are 24 kinds of edible mushrooms, 6 varieties of medicinal mushrooms and 12 types with anti-cancer properties, which play an important role as food resources.

In particular, *Phallus luteus* grows only in bamboo fields, and after it is fully grown within 4 hours from its first sprouting moment, it has a net-shaped cape, which gives it a nickname "net-bat mushroom. It boasts a magnificent appearance, locally called "a queen of mushrooms."

Edible mushrooms like *Phallus luteus* is a gift for farmers from Damyang Bamboo-field Agriculture System. *Phallus luteus*'s effect for high blood pressure and cholesterol control is improving farmers' income, and the yield of *Phallus luteus* in 2015 was recorded for 410,000kg.

Medicinal plants, including *Liriope muscari* (Decne.) L.H. Bailey, Chinese matrimony vine and Solomon's seal grow in the ground level of Bamboo-field Agriculture System. Total yields of medicinal plants was 4,764kg in 2015. The mushrooms and fungus from Damyang Bamboo-field Agriculture System are essential components of multi-level structure for food security and livelihoods.



Picture 12. The Fungus Ecology in Damyang Bamboo-field Agriculture System

## 2) Variety of bamboo genes

An analysis was done to see Damyang bamboo's gene diversity. Bamboo genes from Jinju city, Geojeodo island and Yangsan city of Gyoungsangnamdo province were analyzed against Damyang bamboo of *Phyllostachys bambusoides* Sieb. et Zucc., *Phyllostachys nigra* var. *henonis* Stapf, *Phyllostachys pubescens* Mazel and *Phyllostachys nigra* Munro. The gene diversity of Gyoungsangnamdo province showed to be 0.07 ~ 0.08 while Damyang bamboo showed 0.10.

The polymorphic locus of Damyang bamboo was 49% which is the highest among samples.

The analysis confirmed Damyang bamboo with high diversity, meaning it is tuff against insects. Damyang bamboo is the same bamboo in Donguibogam (Principles and Practice of Eastern Medicine) with many good effects for people.

Table 26. Analysis result of bamboo per species

Species	PP	A	Ae	H	I
<i>Phyllostachys bambusoides</i> Sieb. et Zucc. (GSS)	32.78	1.1639	1.1311	0.0729	0.1043
<i>P. nigra</i> var. <i>henonis</i> (JND)	49.18	1.2459	1.1967	0.1093	0.1565
<i>P. pubescens</i> Mazel (GUD)	39.34	1.1967	1.1574	0.0874	0.1252
<i>P. nigra</i> Munro (GJG)	39.34	1.1967	1.1574	0.0874	0.1252
Mean	40.16	1.2008	1.1607	0.0893	0.1278

Pp: The percentage of polymorphic Loci.

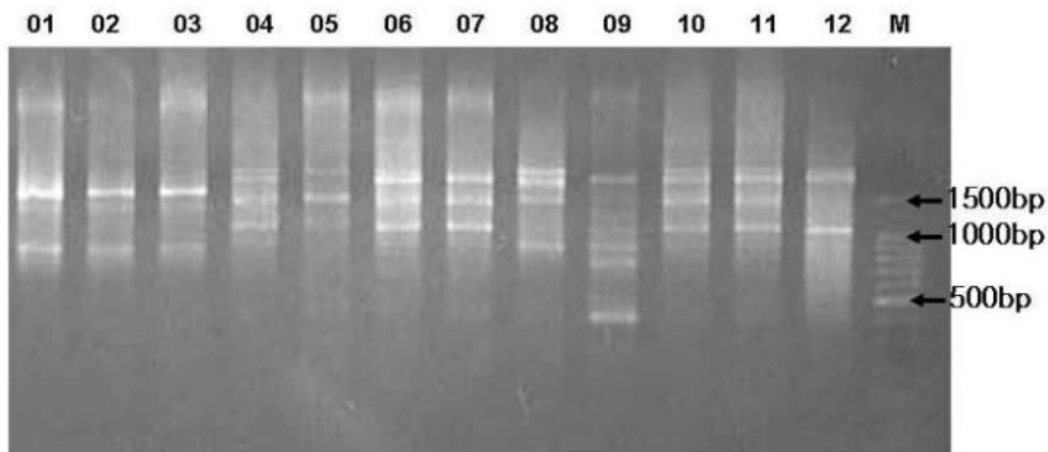
A: The Mean number of alleles per polymorphic Locus.

Ae: The effective number of alleles per locus ,

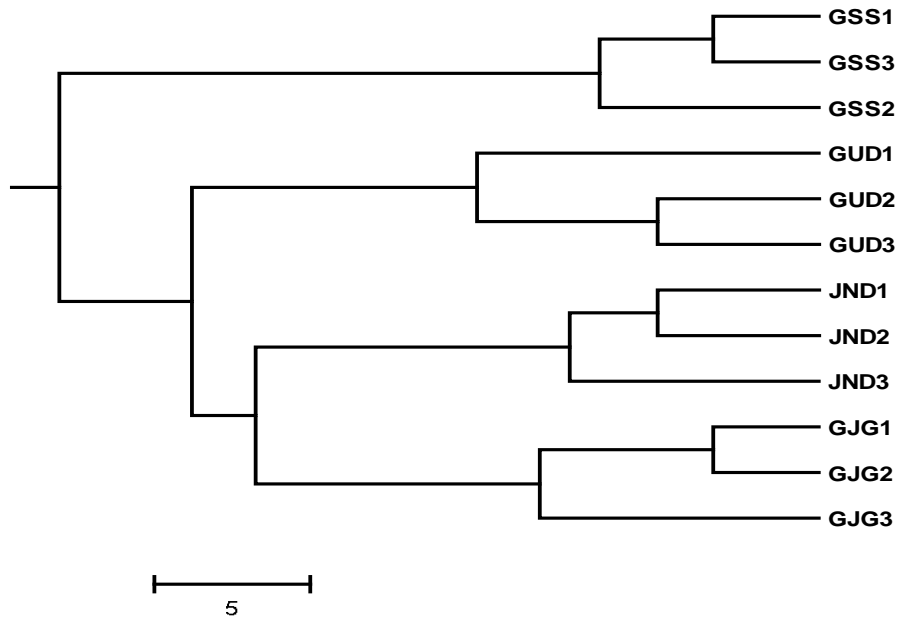
H: Nei's (1973) gene diversity

I: Shannon's Information index [Lewontin (1972)]

Ref: Bamboo Resource Research Institute of Damyang County



Ref: Bamboo Resource Research Institute of Damyang County  
 Picture 13. *Phyllostachys bambusoides* Sieb. et Zucc(A): 1~3, *P. nigra* var. *henonis*(B): 4~6, *P. pubescens* Mazel(C): 7~ 9, *P. nigra* Munro(D) : 10~ 12



Ref: Bamboo Resource Research Institute of Damyang County  
Image 13. Diagram based on ISSR analysis

### 3) Diversity of ecosystem and landscape in bamboo farming

#### (1) Ecosystem structure of Damyang bamboo farming

Damyang bamboo fields have their own land-use systems associated with agriculture, which runs smoothly from the bamboo planted along hilly ridges to the residential and agricultural areas, and streams. This spatial structure plays an important role in ecological cycles and cultural landscapes. Each space serves as habitat for many species and forms its ecological exchange system between objects and energy, and further secures biodiversity and provide the ecological services.

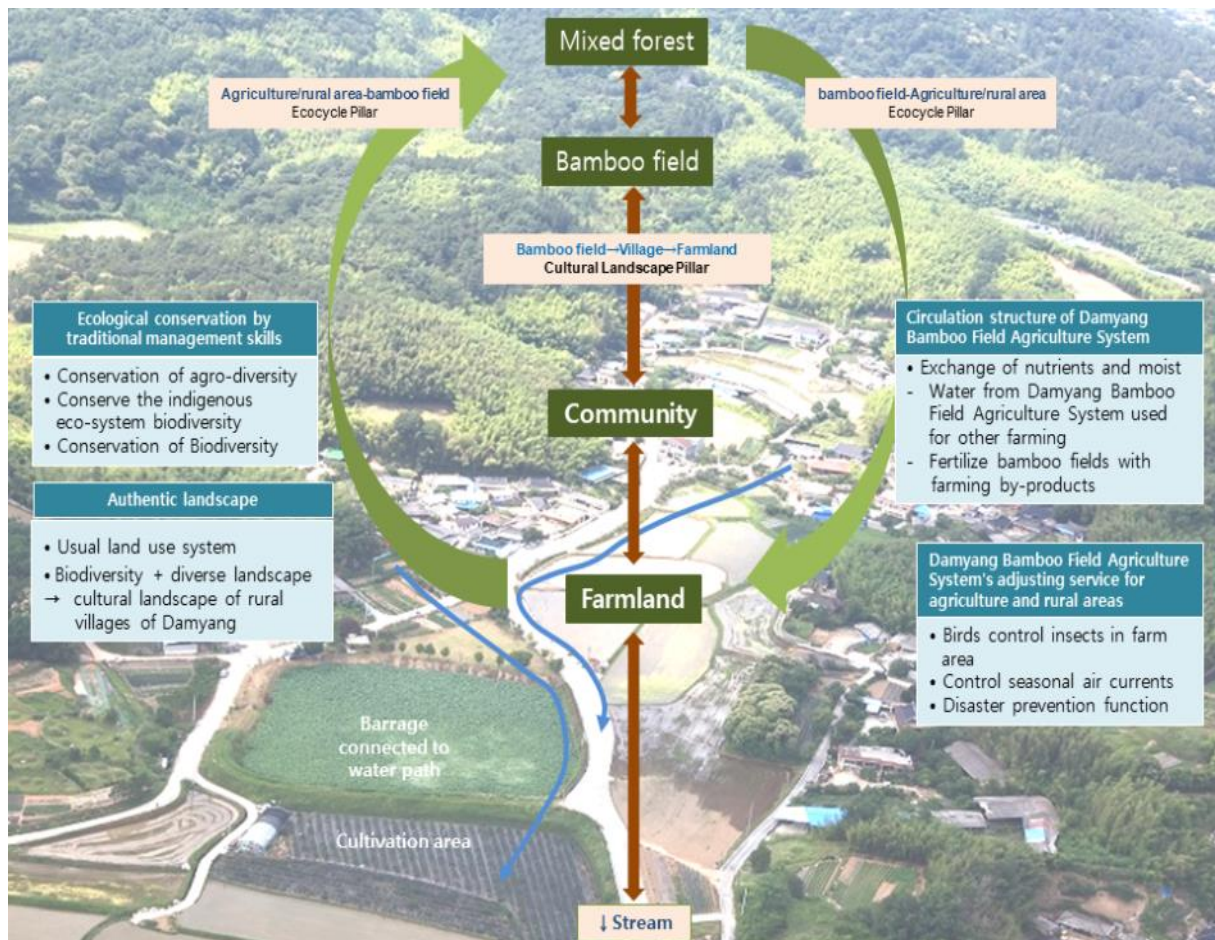


Image 14. Function of Damyang Bamboo-field Agriculture System in the ecological supply and control

Analysis of water and soil was conducted to see water resource from bamboo forest supports other farming area with nutrients and water. Soil analysis of site A: MB-1~2 with good management bamboo field, B: WB-1~2 with poor management and C: WO-1~2 of general pine forest. The condition of water's nutrient and pollution.



Table 27. Soil condition and management status of test sites from Damyang County

Site	Test	Location	Manage	Soil series	Soil condition	
					Deep soil	Surface
Mansung 1 (Bamboo field)	MB-1	Mansungri san10	○	Fine loamy, nonacid, mesic family of Dytric Fluventic Eutrudepts	clay loam soil	loamy soil
Mansung 2 (Bamboo field)	MB-2	Mansungri san10	○	Fine loamy, nonacid, mesic family of Dytric Fluventic Eutrudepts	clay loam soil	loamy soil
Wolsan 1 (Bamboo field)	WB-1	Wolgyeri 684-1	×	Fine loamy, mixed, nonacid, mesic family of Aeric Endoaquepts	clay loam soil	loamy soil
Wolsan 2 (Bamboo field)	WB-2	Wolgyeri 684-1	×	Fine loamy, mixed, nonacid, mesic family of Aeric Endoaquepts	clay loam soil	loamy soil
Wolsan 3 (Other forest)	WO-1	Wolgyeri san 10	×	Fine loamy, mixed, mesic family of Typic Dystrudepts	clay loam soil	loamy soil
Wolsan 4 (Other forest)	WO-2	Wolgyeri san 10	×	Fine loamy, mixed, mesic family of Typic Dystrudepts	clay loam soil	loamy soil

Note: Soil sample was natural-dried and particles under 2 mm size was used. Hue, value and chroma of munsell soil color chart was used for soil coloring. Samples' pH against the hydrogen-ion concentration was 1:5 rate to minimize the effect of salt in soil. Sample's hydrogen-ion concentration rate was measured after 30 minutes mixing at 150rpm at 1:5 rate of soil with 0.01M CaCl<sub>2</sub>.

Ref: Damyang Bamboo Research Institute, 2018.

Table 28. Soil Comparison Analysis from Damyang bamboo fields to general forest

Type	pH (1:5)	Organism (g/kg)	Available phosphate (cmol+/kg)	Potassium (cmol+/kg)	Calcium (cmol+/kg)	Magnesium (cmol+/kg)	Electrical conductivity (dS/m)
WO-1	4.5	29	10	0.12	0.1	0.1	0.1
WO-2	4.5	6	10	0.12	0.1	0.1	0.1
WB-1	5	58	17	0.24	3.1	1.5	0.2
WB-2	5.3	1.3	22	0.11	2.2	0.6	0.2
MB-1	4.5	96	40	0.19	2.4	0.7	0.3
MB-2	4.9	18	13	0.11	1.3	0.4	0.1

Ref: Damyang Bamboo Research Institute, 2018.

Study found the essential micronutrient of P, K, Ca, Ma to improve soil fertility and crop growth showed satisfactory. But it was a bit higher in Mansungri site with good management.



A



A



B



B



C



C

A: Mansungri bamboo field (MB-1~2), B: Wolgyeri bamboo field (WB-1~2), C: Wolgyeri general forest (WO-1~2)  
 (Sample site named 'ri' of location. '-1', indicates soil depth of 0~20cm, and 20~40cm is marked '-2'.)

Picture 14. Soil collect sites in Damyang Bamboo Fields

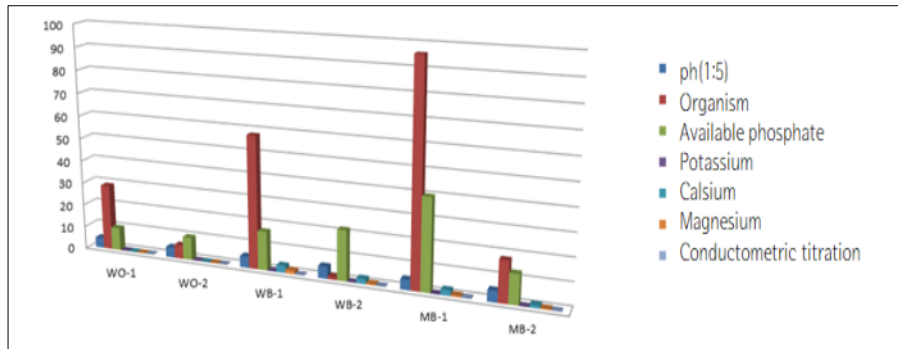


Image 15. Soil Comparison Analysis from Damyang Bamboo Fields to general forest

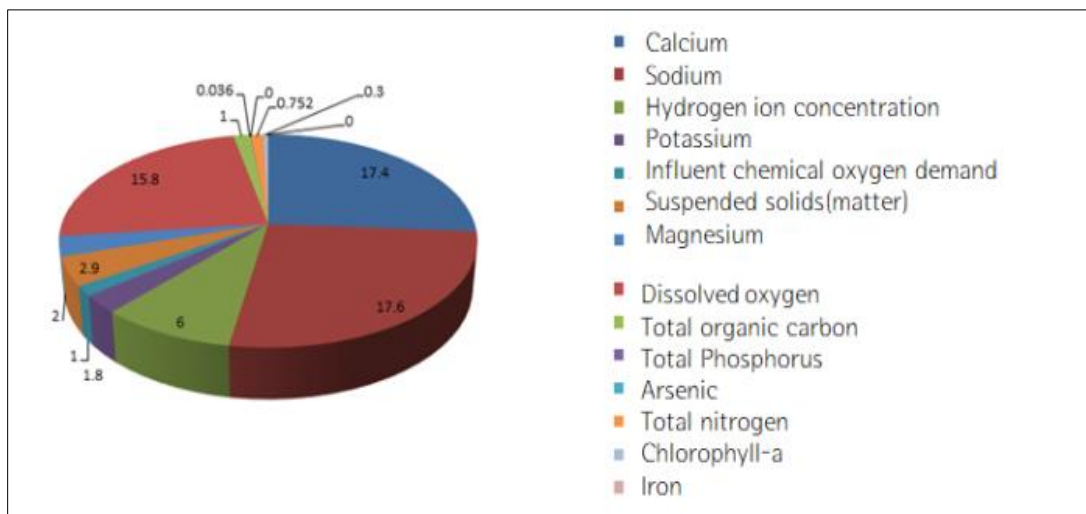


Image 16. Water Analysis on Damyang Bamboo-field Agriculture System

Definition of a site with good management means bamboo field being fertilized with leaf mold, rice husk and bamboo leaves, and the good site showed high rate possession of essential micronutrient and organisms which also provide an optimum environment for coexistence of various species.

The water test was conducted, comparing the water condition of bamboo field against the reservoir. The circulative system of Damyang Bamboo Field Agriculture System starts from the upper mixed forest-bamboo field-village-reservoir-other farming area-stream. The test result showed no toxic substance like arsenic was found but high level of essential micronutrient. The test showed the water from the bamboo field can be used as water for agricultural use.

The massive inorganic substances and organic substances from bamboo field are deposited into a reservoir via rainfall. Bamboo field filters the surplus amount of water before its transmission into reservoir.

Well managed bamboo fields improve soil fertility and contains richer P, K, Ca, Mg, supporting bamboo growth. Well managed bamboo fields hold high nutrients by fertilizers of

bamboo leaf, rice husk and leaf molds and also provides habitat for flora and fauna structure in the SYSTEM.

It can be concluded the biodiversity in bamboo fields starts with (1) bamboo's photosynthesis, (2) utilize the bird's secretion, dead bamboo leaf, leaf mold and rice husk and (3) utilize water from lower area or underground within the cycling system of Damyang Bamboo-field Agriculture System finally offer rich habitat for flora and fauna structure.

The birds in bamboo fields control pests in the nearby farmlands while bamboo fields block the cold north winds and supply cool air in the summer season. The bamboo prevents flood, as well.

The unique land use system of rural villages in Damyang embodies landscape diversity. Rural communities with bamboo fields have typical land-use systems, but each bamboo grove displaces a unique landscape depending on its location and size. The combination diversity over ecosystem and landscape contributes to the unique landscape of rural communities in Damyang's uniqueness and wherever a village is located there's bamboo field in Damyang.

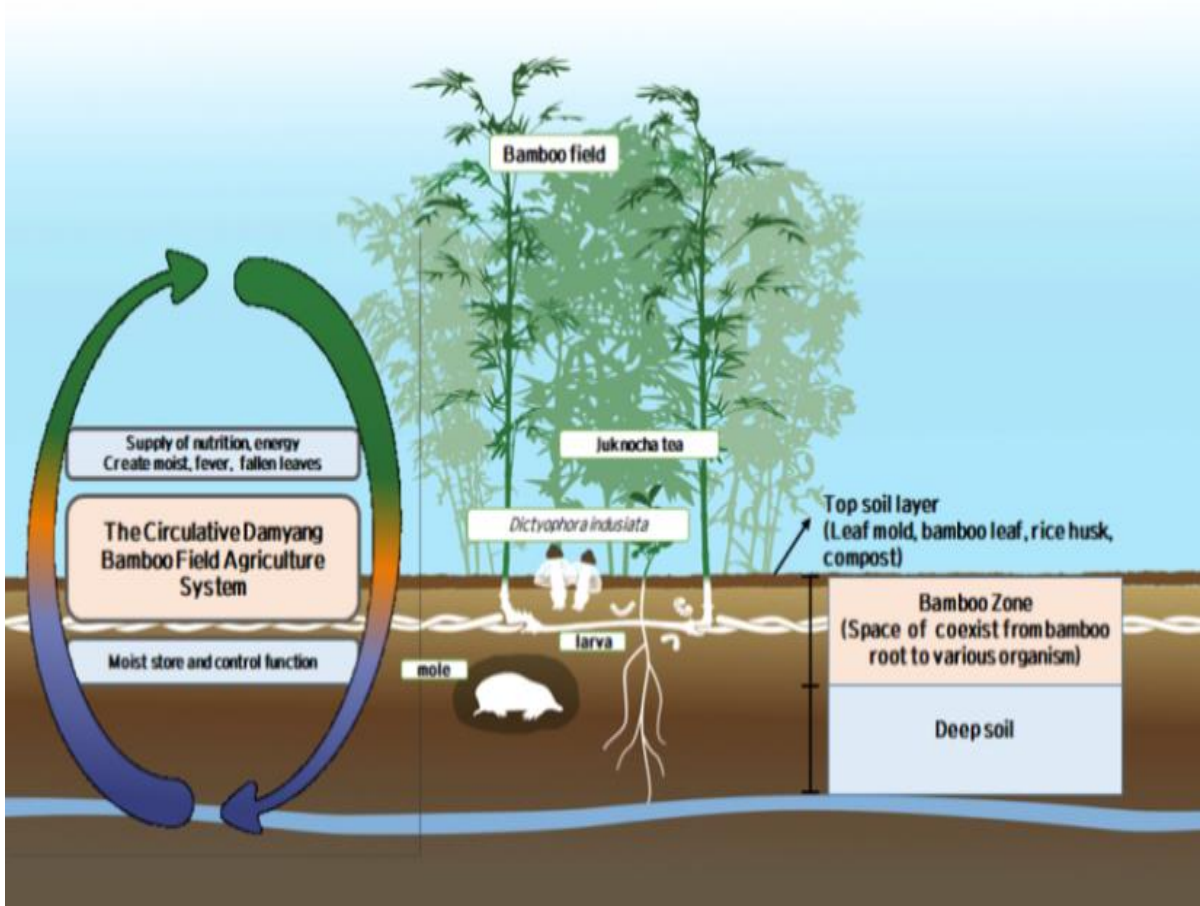


Image 17. Circulative system of resource in Damyang Bamboo-field Agriculture System

#### 4) Agro-biodiversity and ecological service of Bamboo-field Agriculture System

Damyang Bamboo-field Agriculture System brings about agricultural biodiversity. As seen in Damyang bamboo's genetic diversity, bamboo fields consisting of various bamboo species have been created to meet economic needs; and bamboo shoots, tea plants and special purpose crops such as mushrooms are also cultivated. In the Damyang region, a variety of agricultural activities have been employed including rice paddy farming and cultivation of vegetables and fruits as well as bamboo farming, meaning multilayered security for food and livelihood were established. The genetic diversity of Damyang bamboo results from the fact that different bamboo species including *Phyllostachys nigra var. henonis* (Bean) Stapf ex Rendle, *Phyllostachys bambusoides* Siebold & Zucc, *Phyllostachys pubescen* Mazel ex Lehaie and *Sasa coreana* Nakai, were selected according to different economic needs. And the appearance of bamboo variants has been attributed to the adaptation of bamboo to the environment in Damyang area over a long period of time, showing the relations between bamboo and environmental characteristics in the Damyang area.

In addition to bamboo shoots, bamboo field became habitat of teas, mushrooms, and medicinal herbs such as goji berry, big blue lily turf, and Solomon's Seal, all of which have contributed to preserving wide variety of agricultural species.

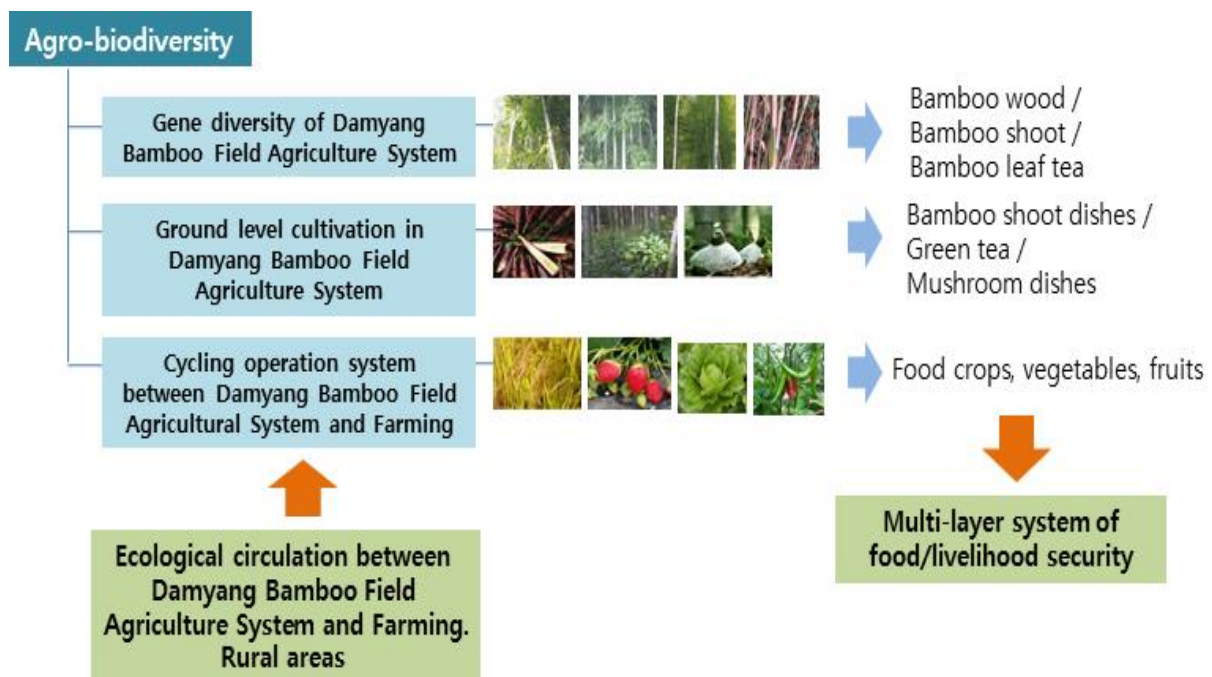


Image 18 Agro-biodiversity in Damyang Bamboo Field Agriculture System

Linkage to rice paddy farming and field farming, which features in the cultivation system of Damyang bamboo, also supports multiple agricultural practices on suburban agriculture, growing staple crops such as rice, barley, beans, vegetables including strawberries, cabbage, tomatoes, pepper, garlic, carrots and spinach, and fruits such as pears, apples, peaches, and grapes.

Farming is the major industry of Damyang region, forming 46.6% of local economy by 4,164 farm households and 11,909 individuals in the farming industry as of 2017. The 4,164 farm-household means 18.3% of 22,710 overall households in Damyang region, and 11,909 persons in farming industry means 25.2% of total resident of 47,285 persons. Out of 9,114ha cultivation area, 6,623ha (72.7%) is for paddy farming with average cultivation area of 1.73ha per a household. But majority of 2,347 farm households cultivate between 0.1~0.5ha, and it is fair to say most regional farmers secure their food supply and livelihoods by combined farming.

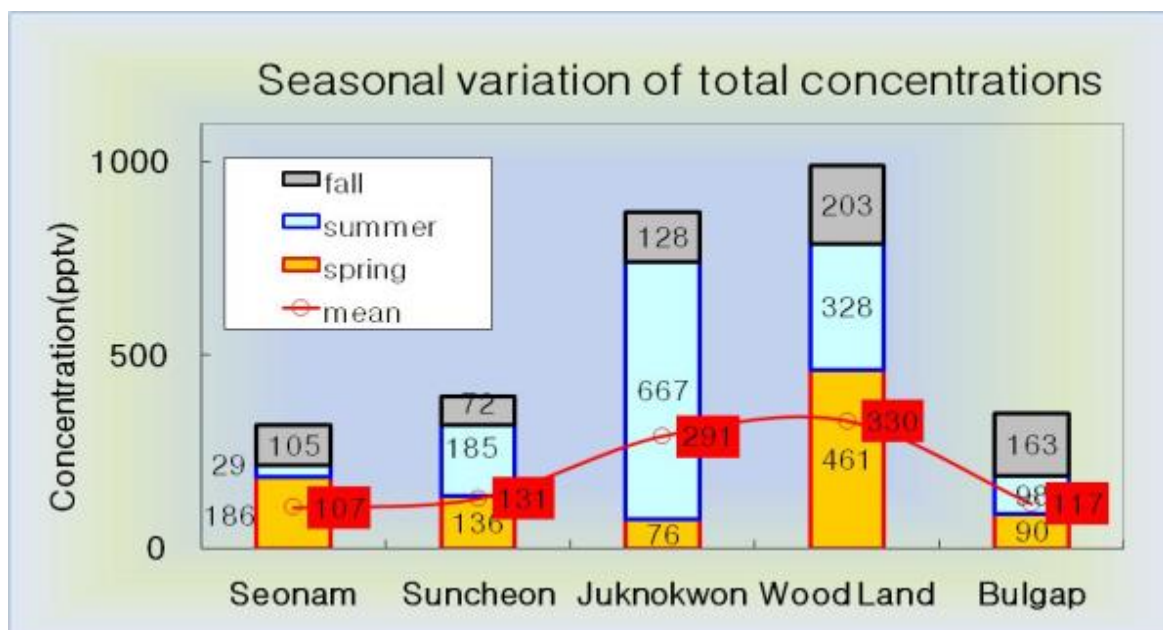
Table 29. Status of flora in Damyang Bamboo -field Agriculture System

■ Bamboo and ground cultivation crops (2017)												
Type		Timber		Bamboo shoot		Teas		Herbs		Mushrooms		
Yild/size		16,830 bundle		233,324kg		170ha		7,828kg		177,325kg		
■ Bamboo-field farming related crops (2017)												
Type	Food crop		Vege/fruit		Leef/root vege		Supplement		Special crop		Fruit	
Total	5,861(ha)		696.4		84.4		185.9		16.22		261.4	
	29,809(M/T)		31,678		4,827		7,173		12.8		3,137	
Size (ha) / Yield (M/T)	Rice	5,660	Strawberry	383	Cabbage	55	Pepper	115	Sesame seed	10.8	Apple	2.3
		29,036		13,535		3,302		5,642		7		56
	Barley	90	Melon	137	Spinach	0.4	Green onion	1.0	Perilla seed	5	Pear	1.5
		367		4,562		6		34		4		48
	Wheat	27	Watermelon	57	Lettuce	1.0	Garlic	56	Peanut	0.42	Peach	12.4
		56		2,906		41		683		1.8		192
	Beans	62	Tomato	113	Radish	28	Onion	13.9			Grapes	29.3
		98		10,309		1,478		814				475
			Others	6.4							Raspberry	4.2
				366								22
											Percimmon	96.4
												1,740
										Others	115	
											604	

Ref: Statistic Report of Damyang County (2016, 2018)

## Environmental effects of Damyang bamboo fields

The Jeollanam-do Institute of Health and Environment and its Research Institute of Forest Science conducted a comparative analysis of environmental effects for six arboreal species in 150 plantations in Korea over three years, and completed in 2010. Results showed one hectare of the bamboo field absorbed 29.34 metric tons of carbon dioxide, an absorption rate 3.8 times higher than that of pine trees. Amounts of carbon dioxide absorbed per hectare: bamboo, 29.34 tons; tulip trees, 15.4; Mongolian oak, 9.99; Pine trees, 7.68; *Pinus koraiensis*, 7.23. It well demonstrated the considerable effect of bamboo on environment. The amount of oxygen emitted by bamboo was 35% higher than other trees, and the biomass produced annually was 16 tons, 7.68 times that of pine trees. On the other hand, a total of six surveys on the amount of phytoncide that measured the bactericidal substance emitted by plants were conducted for 4 hours each season at Damyang Juk-nok-won Garden, Bulgapsa Temple in Yeonggwang, Seonamsa Temple in Suncheon, Suncheon Bay, and Cypress Forest Woodland in Jangheung region. In this survey, Damyang Juknokwon Garden (871) showed high phytoncide production following Cypress Forest Woodland in Jangheung area (992). However, during the summer, more than twice as many phytoncide were measured in Damyang bamboo field (667) than that in Jangheung area (328). The results of this study are evidence of the environmental impact of Damyang bamboo fields.



Reference: Damyang Bamboo Resources Research Center  
Image 19. Comparison report of 5 regions on the seasonally generated phytoncide

### iii. Traditional Knowledge System& Skills

#### 1) Water resources from bamboo fields for other farming

Bamboo fields are usually formed at the lower mountainous areas with high moist. The moist stays in the bamboo field in normal time but the kept moist in the bamboo field become a pond at the lower part of the field during drought. Water is secured for other crops by managing waterways connecting waterways within bamboo fields, ponds and channels around fields. Some waterways passing through residential areas to farmland may be rerouted through paddies or other fields.

The topographic and geological characteristics along with ecological characteristics of bamboo have been useful for irrigation. Dammed pools or reservoirs are built at the base of bamboo fields for water management.

Water system is one of main elements of Damyang Bamboo-field Agriculture System and the general circular system of agriculture as shown in Samdari village in Image 20.



Image 20. Water resource from bamboo fields used for agriculture in Samdari area



Utilization of water from bamboo fields for lower part of other farming has much to do with locations of rural village. Rural villages are usually located near foot of mountains. Although Yeongsan River flows through lower part of Damyang region, and its tributaries do not reach far enough to rural villages. As shown in <Image 21>, paddies at higher altitude near bamboo depend heavily on good water management. This led people to come up with ways to utilize water from bamboo fields. Rural villages specialized water management and utilization for their success of farming and further provided security of food and livelihoods.

Considering that almost every rural village in Damyang has bamboo fields, efforts have been inevitable towards sustainable agriculture to devise system to manage and utilize water to irrigate farmland by building waterways starting from near bamboo fields.



Image 21. Location characteristics of streams around bamboo fields and rural regions

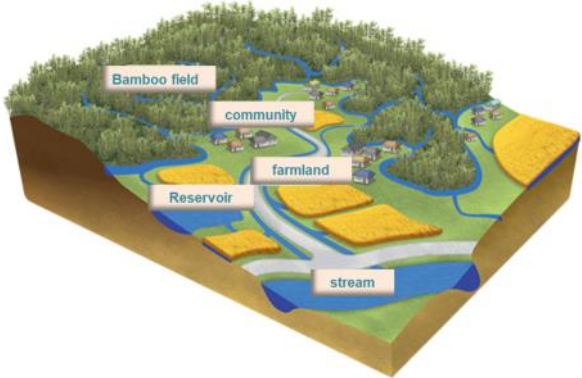


Image 22. Water resource management from bamboo field~village~water path and barrage

**2) Traditional skills in Bamboo field setting-up, management and cultivation**

Damyang region offers an ideal condition for bamboo growing over climate, precipitation, soil condition, and unique bamboo cultivation skills. Bamboo has played a major part of regional food security and livelihood by developing bamboo’s true value which then connect its worthy philosophy to regional culture. It is fair to say bamboo-field farmers enabled bamboo to take an important role in history of region and the peninsula.

The regional knowledge system and farming skills are rather organic and simple yet with the best utilization of what resources farmers were exposed to make their living. The simple and organic management, fertilization, developing and utilization of bamboo are still exercised.

Damyang bamboo-field farmers learned to farm around the distinctive features of bamboo to support family. They started to trim to allow air flow and sun ray for better bamboo timber first. In the large enough ground level after bamboo trimming, they cultivated shade plants, including tea, mushroom and some medicinal plants.

Damyang Bamboo-field Agriculture System represents bamboo-field farmers' wisdom and history of survival by enabling bamboo farming when many people commonly refer bamboo as an 'Invader of environment'. Some indigenous farming skills and knowledge system in bamboo farming are listed below.

### ① Optimal site selection for bamboo fields

Selection and identifying for optimal location for bamboo field setup depends on understanding the area's ecological condition. Traditionally, Damyang people favored areas with annual average temperatures above 10°C and no lower than -10°C, with annual precipitation over 1,000mm. Preferable places are on gentle slopes or flat areas facing north or northeast with no strong winds, soil more than 60cm depth, sandy or with a little gravel for good drainage.

Bamboo-field farmers have added and expanded their bamboo-fields, responding to bigger industrial demand or livelihood security on top of the existing field within their physical capability for his or her farming activity goes on all year around.

Primary bamboo farming activity may include cultivation of bamboo for production of timber or bamboo shoot, and bamboo-field farming has been on object of treasuring, caring and expanding but neglecting or to leave behind for a couple of reason. The first is Damyang bamboo has maintained its prestige status and income. The second reason is each and every farmer knew neighboring field may be in a disaster without his proper management of his field. Bamboo has meant 'tender wood' to most farmers of Damyang.

Bamboo farming cycle may imply for 'a site change' of certain years for soil improvement for many people. But a few years of neglected management of bamboo field means Bamboo INVASION of the area, blocking air and sunlight in the forest. So, bamboo-field farming in rotation may then imply for 'maintaining current activity of trimming and lumbering with alternate ground crop cultivation at alternative sites in SYSTEM.

With a choice of from among several kinds of bamboo, there will be a broader choice of cultivation spots; *Phyllostachys nigra var. henonis* (Mitford) Stapf ex Rendle can grow on rather drier soil than *Phyllostachys bambusoides* Siebold & Zucc, and *Phyllostachys pubescen* Mazel ex Lehaie in areas with soil only 40 centimeters deep and somewhat wet.

This ecological understanding is time-tested knowledge obtaining from trial and error. After identifying places for cultivation depending on the kinds of bamboo trees, skills for managing them accordingly are needed.

### Traditional Cultivation Skills of Damyang Bamboo Field Agriculture System

Site Selection Condition for Bamboo forest(field)	Annual average temperature: 10-c Annual precipitation: 1000mm Ward: Northward or Northeastward Situation: Less windy gentle slope or flatland Soil depth: 60cm)well drained sandy soil or loam with pebbles
Means for Bamboo Forest(field) Settling	Whip, root pillar, bamboo sprout, mother bamboo, etc. Sprinkle rice husks for moisture evaporation control
Bamboo Planting Time	Various but mostly when Whip(later bamboo shoot) starts inflation process. Before end of March prior to bamboo shoot sprouting
Fertilization and Managing Bamboo Field	Fertilizer differs per purpose of bamboo. ex: craft wood, bamboo shoot, etc. No fertilization for raw wood purpose field(forest)
Bamboo Thinning, Trimming, Harvesting	Cycle thinning for bamboo field management or thinning is recommended after bamboo shoot sprouts out  Trimming: differs according to tree characteristics <i>Phyllostachys bambusoides</i> Sieb. et Zucc(Wangdae), <i>P. nigra</i> var. <i>henonis</i> (Somdae) <i>Phyllostachys pubescens</i> (Maengjongjuk) are harvested at between 3 to 4 years old.

Image 23. Summary of traditional cultivation technique in Damyang Bamboo Fields

## ② Establishing a Bamboo Plantation

Bamboo is transplanted after a site selection. The parent trees require delicate handling to avoid undue pressure on rootstocks and keep intact during excavation. Otherwise, bamboo shoots won't be germinated properly. Marginal areas of bamboo field are ideal place to get parent trees. Smaller amount of older culm and rootstocks are found in the marginal areas. The rhizomes with full vitality level are dug afterward.

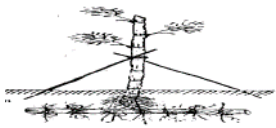

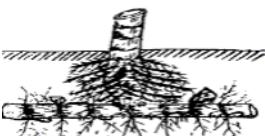

For transplanting bamboo trees, the rootstock (rhizome

with roots), buds, shoots and parent plants used as shown in <Table 30>. In order to raise the possibility of taking root, transplant is done right after digging out parent trees. Usual length of transplanted rootstock is 50cm. Holes for transplant are about 40cm deep and 60cm wide. The holes are watered and tamped after planting for no airspace remain between soil and roots and to cover with more soil. Plants are set in with 5cm of the upper part of parent plant buried.



Picture 15. Formation of bamboo field

Table 30. Formation methods of Damyang Bamboo Field

Type	Characteristics	Method
Mother Bamboo		Harvest by placing underground stems between bamboo poles. Tree age: 1~ 3yrs Diameter: 3~4cm
Whip		Use underground stems only. Length of stem:40~55cm Planting depth: 15cm underground
Root Pillar		Cut bamboo poles at set height 1st, attach the underground stems then plant. Bamboo pole height: 20cm Length of stem:40~55cm
Bamboo Sprout		Cultivate the harvested underground stems for one year artificially. Actual planting is done after the whole process is completed accordingly.

Reference: Damyang-gun Bamboo Resources Research Center

Traditional fertilization was done in a unique way in Damyang. When bamboo field was set near other farming fields, ridges were plowed up first with composted human manure under them. Then the rows were covered with rice straw or husks. The mulch would help bamboo roots to settle in properly and prevent them from drying out. By-products from paddy farming, such as rice straws and husks, along with composted human manure and other compost were used for set up bamboo fields.

### ③ Best time for planting of bamboo, ground crops

Planting period varies depending on species, location and climate condition. Generally, preferred time is mid-June (Jukchwil day: May 13th in lunar calendar) when buds start swelling. If Jukchwil day falls in the rainy season and shoots have already come up and growing, then planting is done a little earlier.

Germination period per species is as follows: *Phyllostachys pubescens* Mazel ex Lehaie between early April to early May, *Phyllostachys nigra* Munro var. *henonis* (Bean) Stapf ex Rendle between late April and late May, and *Phyllostachys bambusoides* Siebold & Zucc between mid-May and mid-June. The timing for germination has much to do with precipitation.

Number of planting tree varies depending on the species, location and soil fertility level. In Damyang, usual number of trees per one hectare is as follows; 500 to 1,000 trees for *Phyllostachys pubescens* Mazel ex Lehaie and 1,000 to 1,500 trees for *Phyllostachys*

*bambusoides* Siebold & Zucc and *Phyllostachys nigra var. henonis* (Mitford) Stapf ex Rendle.

Other usual ground crop of Damyang Bamboo-field Agriculture System includes shade perennial plants of Jukrocha tea, *Liriope muscari* (Decne.) L.H. Bailey, *Lycium chinense* Miller, *Phallus luteus* which does not require periodic plantation.

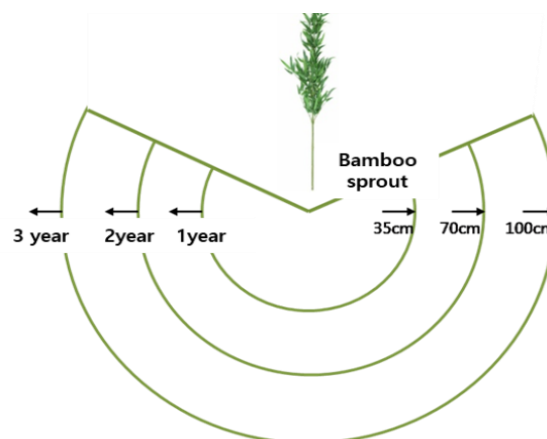
#### ④ Selective fertilization

Damyang's unique fertilization methods for bamboo shoots differ from timber bamboo. No specific fertilization is done to secure good plasticity of timber bamboo. After fertilization, applied rice husk will prevent evaporation and the first white sprouts of bamboo shoots are used for medicinal purpose.

Damyang's selective fertilization system for bamboo-field is divided as follows. First, timber bamboo purpose field may apply rice husk, rice straw, mold and compost mainly. At earlier times, these were only possible items to find around their area. These fertilizers with an idle climate condition of Damyang for bamboo growth have brought the best quality timber till to date.

Second, bamboo farmers applied residues of perilla seeds and sesame seeds following extracting sesame cooking oil and perilla cooking oil for top quality bamboo shoot with shinning texture and better taste.

Different planting time means different ways of fertilization. For older fields, fertilizer is spread across and the surface is mixed with hoes or rakes to improve absorption level. In case of newly-created fields, as shown in <Image 24>, planted areas within a radius of 35 centimeters from juvenile bamboo trees are dug out, fertilized and then re-covered with soil. That radius will expand to 70cm and 100cm within 2 to 3 years of time after planting, then fertilizer is spread across entire field in its 4th year.



Reference: Damyang County report of Bamboo Planting (2004, 2018 reconfirmed)

Image 24. Fertilization point per age of new bamboo field



Picture 16. Fertilization process in Damyang Bamboo-field Agriculture System

### ⑤ Thinning and lumbering

A certain number of canes are thinned when necessary after bamboo shoots' germination to control bamboo density. Space-cutting improves conditions of bamboo growth and development. Culms with damage by blight or insects, poor quality canes and older bamboo are removed first, leaving 2 to 3 years old culms with wider diameters to remain. Usual space for lumbering is 1.5 meters.



Picture 17. Thinning in bamboo field improves the sunlight penetration rate and the regional biological diversity

Bamboo is thinned out in different ways depending on its purpose. First, 3 to 4 years old canes for crafts are separated by thinning from those without value.

Second, bamboo shoots are thinned differently from those for material. Shoots with earlier germination are for crafting, shoots that germinate next are harvested and processed for food. Shoots that germinate last are eliminated for poor maturity.

For the thinning process, ①trees for later harvest from ones to be thinned out are identified; ②trees for lumbering are selected; third, directions and order for cutting trees are decided, considering terrain, location of forest roads; ③after reviewing trees selected and thinning out trees, additional trees to be cut out are selected.

Taking demand into consideration, canes are harvested depending on their age and type. The age of plants to be cut for timber can have huge impact on germination of bamboo shoots and the quality of the field for the following year's harvest. Therefore, proper age is determined according to type. 3 to 4 years old *Phyllostachys bambusoides* Siebold & Zucc and *Phyllostachys nigra var. henonis* (Mitford) Stapf ex Rendle. are cut. 4 to 5 years old *Phyllostachys pubescen* Mazel ex Lehaie are cut. For bamboos with larger diameters like *Phyllostachys pubescen* Mazel ex Lehaie, 1- to 2-year-old culms are not strong enough to be used for product manufacture. Economic purpose is not the only factor in harvesting timber. If trees aged five or more are allowed to stay, there will be significant loss of nutrition and the number of trees in the field will decrease. Harvesting the proper number of canes is very important. Generally, about 10 to 20% of the total canes in a field are chosen to be cut.

Harvested trees must be cut close to the ground and the remaining nodes deeply split. If the bottom nodes are left un-split, they will continue to live and consume nutrients, which stifle new growth.

## ⑥ Management of Bamboo Fields and Harvest

If fields are left unattended after planting, weeds or vines like kudzu will take over and hinder the bamboo. Therefore, 3 to 4 weeding sessions are needed until the bamboo comes to dominate. Dead weeds are laid back upon the ground. Prevention measures against possible damages by blight and insects such as bamboo shoot cutworm should be taken away. Traditionally dry fields were fertilized with human feces or manure, but nowadays organic and inorganic composts are used for fertilization.

Bamboo is harvested between November and January, considering usage and process. Shoots emerge around April and May and usually are harvested early in the morning. Quality bamboo trees can remain standing for future harvesting even when a considerable amount of bamboo shoots is collected. Newly created plantations should allow one good shoot per cane to remain for growth, and the rest be harvested for food.

If soil loses fertility, then soil should be added depending on location and soil fertility. Usually, soil is added every 3 years, 20 years from its first formation. October to March is a good time when bamboos stop growing. 5 to 10cm thick additional soil is spread for the entire sector, then another sector the next year in a turn.

Table 31. Annual management manual of Damyang Bamboo field

		1	2	3	4	5	6	7	8	9	10	11	12
<b>Timber</b>	<b>Planting</b>			█									
	<b>Soil improvement</b>	█									█		
	<b>Thinning</b>						█						
	<b>Fertilization</b>							█					
	<b>Trimming</b>	█									█		
<b>Tea</b>	<b>Establish cultivation area</b>			█							█		
	<b>Seeding</b>					█							█
	<b>Weeding</b>						█						
	<b>Tea leaf pick and roast</b>				█								
	<b>Fertilization</b>			█				█					
<b>Bamboo shoot</b>	<b>Harvest</b>				█								
	<b>Prepare grafting wood</b>	█										█	
	<b>propagate starter cultures</b>	█											
<b>Mushroom</b>	<b>Locate graft wood in bamboo field</b>			█									
	<b>Harvest</b>										█		
	<b>Harvest</b>	█											



### ⑦ Significance of year-long management

Farmers managed their bamboo field all year around for they knew the better quality meant better income for livelihoods. Thinning and fertilization are core elements. Without proper management, the rapid reproduction rate of bamboo can fill up the forest within two short years from plantation. That has been the most common concern for 'bamboo forest', and bamboo is also called as 'invader of forests' at some other regions.

However, that issue never existed in Damyang bamboo farming for each bamboo field is thinned, leaving only healthier bamboo with sufficient space for air flow and sun light. Then fertilization with farming byproduct like rice husk, rice straw, leaf mold and human manure takes place. Recent researches found rice husk, rice straw and leaf mold support bamboo growth by maintaining the optimum Ph level. It is fair to say the traditional management and fertilization measures are confirmed to be 'scientific'.

### ⑧ Bamboo field expansion plan

The county of Damyang has planned to expand the gross size of bamboo field from 2,420ha to 10,000ha to establish 'ECO City Damyang and Sound Environment'. The 30 years long PLAN has launched sine 2015 and will be completed in 2044. The objectives include to restore the historic value of Damyang bamboo and to improve bamboo farmers' income. There would be more opportunity t develop the bio tech new materials but bamboo has been a cradle of Damyang value and so many farmers have made their lives with bamboo value and culture.

The county is determined to help bamboo-field farmers' easier and better life while support the future succession of Bamboo-field Agriculture System. Listed budget has been successfully invested for the mentioned projects, and will be so with the remainder of the 30 years long project.

Table 32. Bamboo field expansion plan of Damyang County

Current size	2,420ha
Target size	10,000ha
Target ratio	36% (bamboo-field against other forests)
Project term	2015 –2044(30 yr)
Objectives	1) Re-establish Damyang Bamboo value 2) Improve bamboo farmers' income 3) Develop bamboo tourism
Strategy	1) Avoid full weeding and cut down target area only 2) Expand "Afforestation Projeet" to current bamboo-field
<b>Four major projects</b>	

1	Project	New bamboo forests
	Objectives	1,500ha(50ha/year)
	Direction	Avoid full clearing to improve bamboo sprouting Group planting is recommended from 5 to 10 roots
2	Project	“Expansion to current nearby bamboo fields”
	Objectives	6,000ha(200ha/year)
	Direction	Natural expansion by providing healthier bamboo-field management
3	Project	“Thinning Improvement”
	Target size	150~300ha/year
	Objectives	1) To maintain healthier bamboo fields and forests 2) Budget: Central government subsidies
4	Project	“Expansion of landscape forest”
	Target area	1) As street trees along National Hwy 24 and 29 2) Vacant land along roads, small parks 3) Embankment along steams

Ref: Damyang County report of KIAHS bamboo agriculture development, 2014

### 3) Complementary cooperation from bamboo farming to dry field farming

#### ① Fertilization with byproducts from rice farming

By-product farming with rice husks and straw is an important component for bamboo fertilization. Periodic fertilization is applied for bamboo fields from the first day of bamboo planting, and all necessary ingredients and resources from bamboo sprouting to growing period are earned from those by-products. Various types of manure from the village and human manure are also utilized. We can say all by-products from farming and rural area are used in bamboo cultivation. Damyang Bamboo Field Agriculture System offers a unique resource circulation system between bamboo fields to agriculture and rural areas.

#### ② Soil improving with byproducts of bamboo fields

Traditionally, humus was applied on bamboo fields for soil conditioning. In this way soil microorganisms were cultivated and spread throughout the field to breed earthworms, mole crickets, spiders, ladybugs, etc. Earthworms consume and excrete more soil than own weight while getting rid of harmful microorganisms and multiplying beneficial ones. Earthworms also raise nitrogen content by fivefold on average. Soil with earthworms holds twice calcium and sevenfold potassium.



Picture 18. Soil improvement with leaf molds in bamboo field

Fore-farmers' wise use of by-products is combined with bio-agriculture new industry. Bamboo vinegar is collected while cooling the smoke from burning bamboo into charcoal. It helps to eliminate harmful insects, sterilization, and facilitation of animal health and hygiene. Eco-friendly bamboo vinegar encourages commercialization of healthy food and is intensively utilized for strawberries, rice, pigs and cattle.

Damyang lead the development of bamboo vinegar for removing foul smells from animal excretions, and it has been patented. Further development will boost competitiveness of bamboo farmers for the innovative eco-friendly product



Picture 19. Bamboo vinegar



Picture 20. Eco-friendly strawberry farming with bamboo vinegar



Picture 21. Soil improve with bamboo charcoal

Bamboo charcoal's efficacy and features are published, and ongoing efforts are active for its commercialization. Bamboo charcoal has more usages than bamboo vinegar for deodorization, elimination of toxic heavy metals, water purification, and anti-bacterial function. Thanks to its outstanding effectiveness, bamboo charcoal is used to improve soil condition and to absorb chemicals from the soil. In addition, agricultural films, using bamboo vinegar and bamboo charcoal has been developed and widely applied in agriculture. Pilot cultivations have proved the vinyl film's excellent function of warmth keeping in agriculture, moving up harvest by 12 to 13 days and increase the crop yield up to 40% more than usual. Damyang Bamboo Biotech, the largest bamboo bio-plant in Korea produces bamboo vinegar and bamboo charcoal along with various products.

### ③ Timber Bamboo

There are variety of farming technique utilizing bamboo. Most rice paddy farmers make hotbed nursery with bamboo yard. Another agricultural technique using bamboo's elasticity is to provide higher temperature, and strawberries is one good example. Bamboo can be easily shaped and connected to form a vinyl greenhouse structure. Also, farmers use timber bamboo to create warm rice seedbeds on the paddies.

To help grow rice in paddies filled with soft mud, bamboo is sometimes buried to improve drainage conditions. If paddy boundaries are damaged due to flooding, then bamboo poles will be used for repair.



Picture 22. Raw bamboo usage in farming

### ④ Ground level cultivation

Ground level cultivation is developed on the environmental features of bamboo fields. Bamboo shoot is most practical and favorite crop for the fast growth speed. The traditional thinning/fertilization manner for bamboo shoot is slightly different from timber-bamboo.

Bamboo roots expand sideway while tea plants' root grow downward, making tea cultivation in bamboo field possible. Mushroom can grow with the adequate level of moist and windbreak function of bamboo field. For that background, more tea cultivation in the ground level of bamboo field is taking place.

### 4) Traditional skill of Damyang bamboo crafts

Damyang has been the cradle of Korean bamboo crafts. Scholars and politicians from the Goryeo and Joseon Dynasty (938 - 1854) expressed their loyalty, fidelity and evergreen pride with the straight and shiny bamboo. The hollow bamboo was believed to be the path of guardian gods to come down from heaven. Bamboo was favorite item for scholars' art, literature and loyal gifts, creating 'DEMAND' of better bamboo and farmers 'SUPPLY'. Damyang bamboo gifts were offered to kings and royal families, and crafting skills and knowledge are easily found thru different masters of distinctive crafting fields as follows.

About 7000 households (30% of region) or 20000 persons were involved in bamboo field management and crafting between 1960s to 70s, the golden age of Damyang bamboo crafting.

Damyang bamboo industry shrunk due to the plastic materials and cheap imported bamboos in 1980s. Damyang County, however, has designated masters of bamboo for continuous management of Damyang bamboo crafts and to foster future leaders. Currently, 1 Important Intangible Cultural Heritage, 5 Intangible Cultural Heritage of Jeonnam Province and 9 Master of Damyang Bamboo are designated and work with County for bamboo progress.

Table 33. Different masters in bamboo crafting

Type	Descriptions
Chaesang-jang	Master of colorful bamboo box by peeling off bamboo skin as thin as a piece of paper, dyeing it with various pigments. Several strands are weaved, creating various patterns or into boxes or baskets with soft and different colors showing from inside
Chambit-jang	Master of fine-dense-tooth combs thru many steps of work
Nakjuk-jang	Master of carving pictures or words into a piece of bamboo by scorching the surface of bamboo with a red-hot iron
Jukryeom-jang	Master of jukryeom (blind or screen). When queen attended government cabinet meeting, jukryeom was rolled down for many social and cultural reasons. Jukryeom is made with finest and thinnest bamboo skin thread.
Jeopseon-jang	Master of jeopseon (folding fan) by gluing paper on slats of a fan, paint and/or write calligraphy on paper, then decorate pivot with seonchu (traditional ornament)
Byeonbi-jang	Master of bamboo jegi(shuttlecock)
Bangrip-jang	Master of satgat hat by weaving strips of bamboo
Jukram-jang	Master of bamboo tea baskets
Akgi-jang	Master of bamboo wind instruments of soguem (small transverse flute) and daegeum (large transverse flute)
Jukgeom-jang	Master of bamboo swords for king to perform a national memorial service or sword dance

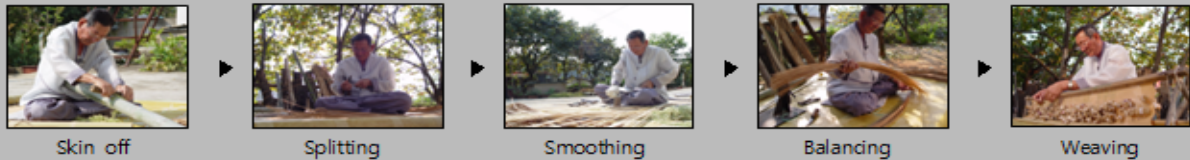


Picture 23. Master Craftsmen of Damyang Bamboo

● An example of bamboo crafts: **jukryeom blind**

Jukryeom is also called daebal, a blind made by weaving thinly split bamboo with thread to hang on the window and block sunlight in the summer or decorate the house. Jukryeom first started to be made in Damyang. Park Seong-chun, a person of a cultural property, continues to work as a craftsman making traditional jukryeom of Damyang for the third generation of his family. He says, "I was able to educate my children through graduate schools thanks to daebal jukryeom, which is a life savior for me.

•Crafting order



• Process

For making jukryeom, strong 3-year-old bamboos with long culms are cut between November and January. A skill called ddeugi is used to eliminate bumps on culms and peel off a skin in 0.1mm thick, and then strands of bamboos are further split apart, a process called joreumjil. These are put together into a container and then woven with silk thread by using 103 spools.

Table 34. Designation status of Damyang Bamboo Masters

No	Type	Artisan	Speciality
1	Important Intangible Cultural Properties of Korea No 53	Sinjeong Seo	Chaesang lady's basket, Sewing basket, Chaejksun fan
2	Intangible Cultural Properties of Jeonnam Province No 15	Haengju Ko	Fine-tooth comb, Advanced fine-tooth comb
3	Intangible Cultural Properties of Jeonnam Province No 44	Hyoungjin Lee	Clothes rack, Jukbi bamboo clapper for meditation, Bamboo ruler, etc.
4	Intangible Cultural Properties of Jeonnam Province No 44	Wunchang Cho	Bamboo Investiture Book, Chimtong needle case, Jukjang cane, etc.
5	Intangible Cultural Properties of Jeonnam Province No 23	Seongchun Park	Bamboo salt, Gwimunryoum bamboo strip weaved space curtain for royal courts, etc.
6	Intangible Cultural Properties of Jeonnam Province No 48-1	Daeseok Kim	Line fan, Hapjukseon double slip bamboo fan
7	Master of Bamboo Crafts No 11	Seongsu Kim	Jukbuin body pillow, Basket, etc.
8	Master of Bamboo Crafts No 11	Sungeol Noh	Bangrip bamboo hat, Seungmobanggot bamboo hat, etc.
9	Master of Bamboo Crafts No 13	Seokgeun Seo	Tea basket, Two-tier basket
10	Master of Bamboo Crafts No 18	Yongtaek Jung	Tea-whipper, Tea tools, etc.
11	Master of Bamboo Crafts No 15	Seongnam Kim	Aerophones of Daegeum, Junggeum, Soguem, etc.
12	Master of Bamboo Crafts No 17	Injin Hwang	Bonyong Bamboo Sword, Sungjuk Bamboo Sword, etc.
13	Master of Bamboo Crafts No 19	Jungja Yang	Bamboo Charcoal Craft
14	Master of Bamboo Crafts No 20	Younsu Kim	Bamboo Charcoal Craft
15	Master of Bamboo Crafts No 21	Sukseon Hap	Bamboo Charcoal Craft

## iv. Cultures, Social Organizations and Value System

### 1) Damyang Bamboo Community

#### ① History

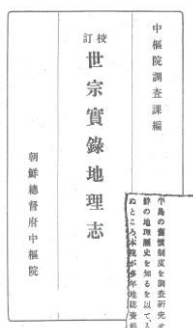
Ancient documents indicate Jukchwi-il day was foundation of Korean bamboo farming in Damyang. As Jukchwi-il (bamboo planting day) started during the Goryeo Dynasty (918-1391), Damyang bamboo fields can be estimated to have about a 1,000-year history.

Bamboo field formation required community-level cooperation and involvement for bamboo field building, harvesting and crafting as a whole year long process. The community production and activities were shared in folk religion and trust system, creating 'Damyang bamboo community' and its significance.

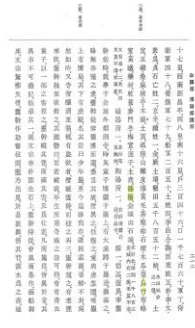
Jukchwi-il explains about the natural prospects of Damyang Bamboo-field Agriculture System. However, the progress of Gasa(lyric) Literature in the Joseon Dynasty (1392-1910) indicate the roles of bamboo in Korean philosophy and literature thru utilization, conservation and management of Damyang Bamboo-field Agriculture System.

Bamboo signified holder's infinity and loyalty from long ago, and the philosophy and idea were expressed thru difficult Chinese letters. Scholars has created Gasa(lyric) Literature in the 1500s, allowing common people to express self idea and thoughts with their practical daily language of Korean. Damyang pagodas were cradle of scholars' exchange and communication, and thousands of poems, essay, letter, painting, craft, calligraphy represent the true value of Korean literature to date.

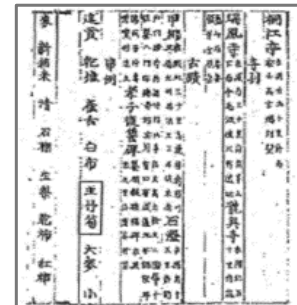
Soswewon garden (built in 1530) represents the social awareness and value of bamboo and bamboo's philosophical value together in Damyang Bamboo-field Agriculture System, leading visitors to cleanse his soul and body by passing thru the bamboo entrance and walking path from its first construction time.



Picture 24. Sejongshillok Annals of Sejong Kingdom



Picture 25. Bamboo record in Annals of King Sejong



Picture 26. Yeojidoseo

Table 35. Literature Record on Damyang Bamboo Fields

Literature	Descriptions	Literature's status
<i>Sejongshillok Annals of Sejong Kingdom</i> (1454)	Offerings of Damyang: Bamboo, <i>Phyllostachys bambusoides</i> Sieb. et Zucc., Black bamboo, Arrow shaft (book 151)	The 3rd Geographic Atlanta of Korean History was made in the early Joseon Dynasty. It is within <i>Sejongshillok Annals of Sejong Kingdom</i> in an independent part.
<i>Yejidoseo</i> (17th century)	Offerings of Damyang: Bamboo shoot	King Youngjo's Regime 33rd yr (1757~65) 313 regional records from the entire kingdom were consolidated.
<i>Changpyoungeupji</i> (Joseon Dynasty)	Offerings of Damyang: Bamboo shoot	Records of Eup Regions in the Joseon Dynasty
<i>Seungjeongwon Journal</i> (1625)	Bamboo product industry was highly advanced in Damyang during Joseon Dynasty. The central government regularly dispatched supervisors for bamboo industry of Damyang, and bamboo fan productions.	The Diaries of the Royal Secretariat in the Joseon Dynasty in 3,243 books. UNESCO World Record (2001) and National Treasure No 303
<i>Sesipungyo</i> (1843)	Jukchwiil day tradition began from the Goryeo Dynasty.	200 poems in 7 letter cycle were written by Yumangong, regarding seasonal changes with Sesipungsok tradition in 1843.
<i>Chuseongji</i> (1756~1759)	Family of Kim from Jeonju moved to Hyanggyori, Damyang hundreds of years ago, and began to make fine-tooth combs during off farming season which became the beginning of Damyang bamboo craft.	Journals of Damyang region was made by the Governor of Damyang Lee Seokheui in King Youngjo's Regime 32nd yr (1756~59) with collected data on Damyang.

The oldest literature about the history of Damyang and bamboo is the “*Sejong-silok-jiriji*” (Annals of King Sejong, 1454). These records contain important data describing tributes paid to the king by each region in detail, which helps us guess what the main industry was in each region. Tributes from Damyang included bamboo timber, *phyllostachys bambusoides* Seibold & Zucc., *Phyllostachys nigra* MUNRO., bamboo arrow shaft, etc., indicating various species of bamboo were cultivated even in the 15th century.

Bamboo shoot was first offered to King Yeongjo in the 17th century. This canal is identified in separate literature of “*Yejidoseo*” and “*Chang-pyeong-eupji*.”

Bamboo fields farming of 1,000-year history were developed, becoming one of 3 main industries of Damyang along with rice and barley.



## ② Birth of bamboo community

Damyang has been home to Koran bamboo and bamboo craft. According to "*Seungjeongwonilgi* (government record, 1625 -13th, 16th yr of King Injo regime), master craftsmen were dispatched to Damyang for joint projects with craftsmen from the region and produced bamboo fans.

"*Chuseongji of Damyang History*" tells how Damyang bamboo craft began. Long ago, the Kim family moved to Hyanggyo-ri in Damyang, and started to make fine-tooth bamboo combs in winter. That was how Damyang bamboo craft started. The reason they chose to move to Damyang was that climate, soil, and precipitation was right for thick-stemmed bamboos and broad-leaf bamboos to grow. As those bamboos were strong but flexible and good enough to split, Damyang became well known as a producer of bamboos from the early Joseon Dynasty and started to produce bamboo spinning wheels, needle boxes, mats and baskets and even exported them to Manchuria and Mongolia in the late Joseon Dynasty and during the Great Korean Empire.



Picture 27. 1910s - Bamboo Masters making blinds at Damyang Jinso Cooperation



Picture 28. 1970s - Damyang bamboo community has formed the unique system of 'Specialized labour per family unit' and 'Village scale team work'.



As shown in Table 36, different village made different bamboo crafts. Hyanggyori was the only producer for 'Nakjuk (carving pictures or words into bamboo), and Bamboo fine-tooth combs was produced only in Hyanggyori and Gigokri. Satgat (bamboo hat) was produced in 7 villages including Dujangri.

The village-wide mono-bamboo production was part of family succession thru generations. Each village needed different species of bamboo, specializing village-wide skill. The system was earlier part of Damyang culture in village-wide cooperation structure of Dure and Hyangyak for bamboo field management. Natural villages of Damyang County and residents were commonly involved in bamboo crafts in 'Bamboo Community and Bamboo culture'.

Table 36. Village level set-bamboo-craft-production tradition in Damyang

Product	Specialized Village
Nakjukjang (Bamboo Pyrography)	Hyanggyori
Chambitjang (Bamboo Fine-tooth Comb)	Hyanggyori, Gigokri
Chambit (Bamboo Fine-tooth Comb)	Hyanggyori, Baekdongri
Buchae (Fan)	Manseongri, Hyanggyori, Hwabangri, Gaeksari, Samdari, Gasanri, Daebangri, Yanggakri
Seokjak (Bamboo Basket with Lid)	Samdari, Hwabangri, Daebangri, Dujangri, Gigokri, Daechuri, Hyanggyori, Daegokri
Satgot (Bamboo Hat with Horse Hair)	Dujangri, Youngcheonri, Hwabangri, Yanggakri, Cheonbyunri, Ohryeri, Gaeksari
Key (Bamboo Wincrowing Basket)	Tongcheonri, Youngcheonri, Wolgyeri, Bongseori, Haengseori, Pungsuri, Hyanggyori, Kangjaengri, Bonghwangri
Jukpi (Bamboo Sheaths)	Guemseongri, Daeseongri, Wonyulri, Daebangri, Ohryeri, Ohgyeri, Banryongri
Gudeok (Bamboo Cradle)	Dujeongri, Jeongjungri, Daebangri, Ohryongri, Geumseongri, Cheonbyunri
Jukseok (Bamboo Mat)	Youngcheonri, Dongsanri, Manseongri, Ohryongri, Jangchanri, Pungsuri, Wolgyeri
Gorijak (Bamboo Multi Purpose Box)	Damjuri, Dongsanri, Dujeongri
Daejari (Bamboo Mattresses)	Gaeksari, Baekdongri, Hyanggyori, Yanggakri, Kangjaengri, Jungwolri, Bongseori, Ohgyeri, Daechuri, Sinhakri, Yugokri, Jungmanri, Dongsanri, Haengseori, Baekdongri, Daeheungri, Chuseongri, Wolpyungri, Ohseongri, Jupyungri, Pungsuri, Byoungpungri, Seongsanri, Daechiri, Cheonbyunri, Damjuri, Namsanri
Hyojason (Bamboo Back Scratcher)	Daebangri, Yanggakri

## 2) Daily lives of Damyang created by bamboo-fields

Damyang people call bamboo forest as daebat (bamboo field), not daesup(forest), because these are very fields where all residents work together to make a living. Areas near bamboo fields usually don't dry up, so it was good for agriculture without having to worry much about a lean year due to drought. Also, different kinds of farming tools could be made out of bamboos and used conveniently. In the past, farming tools were widely used, such as a wicker rack attachment for the A-frame carriers called jige, straw baskets to carry manure or soil, wicker baskets to carry vegetables or flails for threshing grain.

When floods cause damage to the footpaths in rice paddies, water would be released and

the path solidified through twining bamboo, un-rotted by moisture, with poles. In case too much mud turns a rice paddy into marsh, bamboo and pine branches are used, even to this day, to fill a pit dug for the water to drain into.

These examples show that bamboos have been widely used for facilities and tools for farming, which makes them an essential component in the agricultural culture of Damyang. Bamboo has been widely used because it is structurally firm and durable, easy to change and process thanks to its various sizes and thicknesses. And it is readily available.

Bamboo has been closely related to people’s life in Damyang. In a favorable environment, bamboo grows straight and yet flexible at the same time. This is why bamboo items are so widely used daily, ranging from household items to tools for work, farming, musical instruments, toys, and even weapons. Bamboo was used to thatch the roof of a house, and to dry produce and food. Wardrobes and racks to hang clothes were made out of bamboo, and bamboo cushions were used on the flue-heated winter ondol floors to preserve warmth.

Containers for household items were made of bamboos as well. There are so many other examples where bamboos were used in everyday lives; accessories, wooden goods for a memorial ceremony, fruit baskets, back-scratcher (hyojason), bamboo muffs to prevent clothes from sticking to your arms, fans, toys such as water guns, bamboo arrows, etc.



<Bamboo dirt carrying basket>



<Bamboo basket>



<Bamboo spinning-wheel>



<Tool arrangement with bamboo wood>



<Bamboo structure of a thatched house>



<Bamboo structured walls of a thatched house>



<Hanging drier bar for cultivated crops>



<Bamboo fence system>



<Livestock management tools>

Picture 29. Bamboo in residents' daily life cycle

### 3) Diverse culture of bamboo community

#### ① Folk rituals and religion

The culture of bamboo community of Damyang is well passed down through village rituals, folk religion and labor songs such as Hwang-geum-deul-norae (No. 46 of Jeollanamdo Intangible Cultural Asset).

For the First Full Moon Festival on January 15th of the lunar calendar, bamboo poles were set up at the village entrance with wind strings hanging on them to drive away bad luck for the village. At night, fire was set on piles of branches, called daljip-teugi, wishing for the best for a new year. For daljip-teugi, bamboo branches and stacks of rice straws were piled. Other regions used usually pine trees, but in Damyang bamboo and rice straw, which were main local products, were used for the festival since it was a kind of ritual wishing for the best for the year. Children in villages went out with torchlight on bamboo brooms to compete in a game called Jwibulnori striving to be first to set fire to ridges along paddies and fields. This game was our ancestors' wise way to exterminate harmful insects and disease.

As the Jukmul Sijang (bamboo products market) started booming, this place would often see gossaum (a traditional game played by two teams, each of which carries go, a huge braided straw structure to topple the other team's go) and Korean wrestling called ssireum played on January 15 of the lunar calendar and on Chuseok (Korea's Thanksgiving Day on August 15 of the lunar calendar). This also shows how much bamboo products meant to people of Damyang and how they lived always with bamboo products. In particular, gossaum was played by villages in the east and in the west of Jukmul Sijang and very famous across the nation. As soon as around 130 players from two teams showed up in the market, supporters of each team cheered for their team at the top of their lungs.

The reason why this became so fierce a game was that whichever team lost had to do chores for the villages for the rest of the year. Chores usually consisted of maintaining or repairing the shared dammed pools for irrigation or waterways, and it would not be easy to do these chores while farming their own fields. So, they had no other choice but to win at gossaum! This also demonstrates the wisdom of the ancestors to decide who would be responsible for village chores.

Korean wrestling or tug-of-war was played prior to gossaum, and two teams of players also fought fiercely in these games. As such, Jukmul Sijang long played a crucial role in the community culture of Damyang.



Picture 30. Reproduced scene of 'Gossaum' of Damyang



Picture 31. Performance of 'Hwanggeumdeul (in a golden field) Song'



Picture 32. Custom of Wrestling Contest in Jukmul(bamboo) Market

Dangsanje is a kind of folk religions in Damyang. It is also called Chilseongje or Cheonje, a ritual performed by all residents together on January 15th on the lunar calendar to prevent bad luck and wish for a bumper year. The shrines were set up in the east, west, south, north and center of the villages, and enshrined deities such as Dangsan grandmother and Dangsan grandfather were worshiped with this ritual.

After Dangsanje was finished, each household would practice Daetbul-noki fire setting, wishing good luck. The popping sound of burning bamboos would be thought to ward off evils. Around this time of the year, all the villages were filled with this popping sound of daetbul.



Picture 33. Dangsanje (ritual ceremony)



Picture 34. Jwibulnolyi custom of Samok village in Damyang county



Picture 35. Dangshin shrine in 'Daljip burning' custom

There are several folktales or folk beliefs about bamboo canes and shoots. A lean year of bamboo shoots meant a lean year for rice harvest and a bumper year for bamboo shoots meant a bumper year for rice harvest as well. Also, a lot of bamboo shoots were thought to bring a long rain. Lean or rich bamboo shoots were used to predict lean or rich harvest of rice for the year. If new bamboo trees grew less than their parent trees, it was supposed to mean high winds for that year, and if they grew more than their parents, not so much wind. If you saw bamboo shoots in your dream, which is a good sign, you would have many children. This popular belief may come from the fact that bamboo shoots come out in numbers at once and grow very well. So, if you came back with bamboo shoots in your dream, it would be a dream about child birth and your daughter would have a baby boy.



Picture 36. Bamboo in wedding ceremony

Bamboo trees have long held many different meanings for everyday life as well. During the Joseon Dynasty, they were a symbol of scholars with integrity because of their solid structure. Bamboo-like characters also mean fidelity and chastity. In shamanism, bamboo is considered as a sacred tree. This is why shamans have bamboos around his or her worship place and in front of his or her house, welcoming gods. Shamans' shinjangdae bamboo timber with white strips symbolizes for gods' arrival for worship service. It would have same meaning of Bamboo Dangsinsin (guardian spirit) for the first full moon folk culture. Bamboo is a

part of traditional wedding ceremony, wishing for healthy life and good guidance of guardian god of the family.

## ② **Bamboo Food Culture**

Damyang holds rich food culture with bamboo shoot, stem and leaf. Foods from bamboo stem includes Daetongbap rice, bbq, wine, extract, salt, etc. Bamboo leaf menu includes leaf tea, noodle, bean curd, leaf wine, taffy and snack.

Bamboo shoot is harvested for 2 months from late April. Bamboo shoot is known as one of the strongest foods for it can grow around 1 meter a day. People valued bamboo shoot highly as one of food ingredients, and always included in 'King's Gift List'. Bamboo shoots became a key ingredient for a diverse dishes as juksun-hoe (fresh, thinly sliced bamboo shoots parboiled), a fitting representative of Damyang's local cuisine. Also, boiled bamboo shoots are served together with freshwater snails, vinegar, red pepper paste and sugar. The bamboo shoots become an ingredient for juksun gui(grilled bamboo shoots), juksun naeng-chaе (bamboo shoot cold salad), juksun kimchi(bamboo shoot kimchi), juksun jeonggwa (candied bamboo shoot), juksun namul(dried juksun), juksun jang-ajji(pickled bamboo shoot), juksun galchi jorim (braised cutlassfish with bamboo shoots), juksun doenjang(soybean paste with bamboo shoot) and juksun gochujang(red pepper paste with bamboo shoot) as for the main source of protein source.

Bamboo charcoal grilled Short Rib Patties is made with the best ground beef for king's royal cuisine or for sick people and the old to regain strength. The bbq is done slowly not to lose flavor and nutrients while earn flavor of bamboo charcoal.

Daetongju wine is made by most unique local receipt by soaking a big stem of bamboo in a wine jar without any artificial injection of mother liquor. Exact one year of osmosis is its science background. After one year in the wine jar, the stem holds most flavor and delightful wine. After a year, reverse osmosis happens it not taken out. The wine from the stem gets out, leaving the empty stem in its time. With that background, Daetongju wine is served around Jukchwil day or important guest' visit.

Food made with bamboo stem or leaf are undeterred by season, while bamboo shoot dishes are mainly cooked in spring time in the old days. But with development of refrigeration, residents and even tourists enjoy bamboo shoot dishes all year around these days.

Table 37. Bamboo field food culture

Type	Feature	Menu
Bamboo shoot	<ul style="list-style-type: none"> <li>-Over 108 menus exist.</li> <li>-Chewable ingredient as cabbage/radish</li> <li>-Substituted for Kimchi, radish kimchi's</li> <li>-Farmer's meat role with crunch type</li> <li>-Solid ingredient of soup/stew</li> <li>-Scholar, royal, farmer's favorite dish</li> </ul>	<ul style="list-style-type: none"> <li>-Raw bamboo shoot</li> <li>-Raw bamboo shoot with mushroom</li> <li>-Bamboo shoot bean paste soup</li> <li>-Bamboo shoot &amp; kimchi pancake</li> <li>-Bamboo shoot &amp; zucchini stew</li> <li>-Bamboo shoot &amp; burdock fry</li> <li>-Bamboo shoot noodle</li> <li>-Bamboo shoot &amp; mushroom soup</li> </ul>
Tea	<ul style="list-style-type: none"> <li>-Seollokcha tea cultivation</li> <li>-Processed to Jukrocha tea</li> <li>-Scholar, royal's favorite</li> </ul>	
Mushrooms	<ul style="list-style-type: none"> <li>-Phallus luteus</li> <li>-High price medicinal herbs</li> <li>-Scholar, royal's favorite</li> </ul>	
Bamboo leaf	<ul style="list-style-type: none"> <li>-Different from Sasa coreana Nakai tea</li> <li>-Bamboo leaf itself is processed</li> <li>-Roasted young leaf gets flavoring process</li> <li>-Common people's favorite</li> </ul>	
Jukyupju wine	<ul style="list-style-type: none"> <li>-Bamboo leaf and 9 herbs are matured</li> <li>-Can be taken as tea or wine-</li> <li>-Scholar, royal, farmer's favorite dish</li> </ul>	
Daetongju wine	<ul style="list-style-type: none"> <li>-Thick single stem is soaked in wine jar</li> <li>-Osmotic phenomenon completes in 1 yr</li> <li>-Put a hole on top to take out wine</li> <li>-Scholar, royal's favorite</li> </ul>	
Bamboo	<ul style="list-style-type: none"> <li>-Lunck box function</li> <li>-Container for Daetongbap bamboo rice</li> <li>-Best bbq with bamboo charcoal for elderly and visitors</li> <li>-Scholar, royal, farmer's favorite dish</li> </ul>	<ul style="list-style-type: none"> <li>-Bamboo rice</li> <li>-Bamboo charcoal grilled Short Rib Patties</li> <li>-Bamboo salt</li> <li>-Bamboo liquid extract</li> </ul>



Picture 37. Bamboo shoot dishes of Damyang (Raw bamboo shoot, Bamboo rice, Seven delicates with bamboo shoot)



Picture 38. Bamboo drink and food (Bamboo rice, Daetongju wine, Bamboo leaf tea)

### ③ Bamboo in Damyang folk games

Bamboo fields were playground for children. In the bamboo fields children used to grow together with the bamboo trees, playing with bamboo toys.

Folk games include Unsudaetong-nori and Daedorongtae-deonjigi. Unsudaetong-nori is a game where players try to toss a coin into a hole in a bamboo stalk, and if they succeed, they would have a good luck that day. This game later became a folk play that everyone would enjoy on holidays or village festivals when they dug holes in a bunch of bamboo stalks and threw coins into them. This game is reinstated as Unsudaetong or Unsujuktong-i, a pleasant game where you can interpret a divination sign like fortunetelling after tossing your coins.

Daedongtae-deonjigi is a folk game played only in Damyang and daedorongtae (bamboo hoop) was thrown toward a target. Bamboo slats were used for kites so that they could fly kites high in the sky trying to ward off bad luck and bring good luck for the year. Children used to make kites, peeling off the skin of bamboo near their village. Damyang had more snow than other areas because of its inland location, so sleds were also made out of bamboos.



<Bamboo wheel>



<Shield kite>



<Gaego play>

Picture 39. Bamboo tools for folk-plays (loop, kite, stick)

### ④ Bamboo as component of culture and art

Bamboo symbolized 'integrity', 'fidelity', 'sacredness', 'prosperity through unity', which were often depicted in literary works from the Asian region. Bamboo was favorite theme of artists, and has appeared in drawings from Samkuk Sidae (Three Kingdoms of Korea), Mokjukhwa (paintings of bamboo shoots or trees) from the Goryeo Dynasty till it became prevalent until the Joseon Dynasty. In modern times Mokjukhwa (water paint) is still loved by many artists.

Birth of Korean Gasa(lyric-metrical) Literature from the ecological environment of Damyang bamboo fields is a ground breaking success of bamboo field farming history in the Korean Peninsula. Unlike from the old literature with each letter with distinctive meaning, Gasa allowed the writer to express his thought and work in own language and style.

Damyang was a part of national defense system and central government officials were



stationed during the Goryeo Dynasty and scholar self retired and settled in Damyang for political reasons. It was then duty officers' dream to return home of central governing party while retired scholars reminded himself of no-betrayal to his roll model and principals. Both stationed officers and scholars swore their loyalty, integrity and evergreen mind for king and teachers with bamboo's significance in the forms of poem, painting, writing and exchange of bamboo crafts as bamboo was widely acknowledged as one of 'the Four Gracious Plants (plum, orchid, chrysanthemum and bamboo)' representing holder's evergreen integrity.

Jung Cheol (1536 - 1594) was the founder of Gasa(lyric-metrical) Literature, and he talked about landscape and human relationship. Bamboo was one of his favorite topics and here is one of his works from Seongsanbyoulgok (poems and writings of his philosophy with nature as his means).

*Lonely traveler stopped over at Seongsan,  
asking  
dear owner of Sikyoungjung garden,  
why hide yourself in this lonely place from goods of the world.  
Sweep pine cones off the bamboo bed  
to glance at the nearby scene once again  
then,  
only to see the owner resembles the cloud in the sky  
as if it leans on Mt. Mudeungsan as his shelter.*

As the poem talks about, bamboo is the closest friend to human from the surrounding environment. Bamboo, bamboo forest, bamboo cane and names of pagoda frequently exemplified the evergreen spirit of bamboo, and it is fair to say bamboo was tied in with scholars' principals and philosophy for long time.



Picture 40. Mukjukwa (water paint) in a fan



Picture 41. Mukjukwa (water paint)

### ⑤ Bamboo utilized for architecture and landscaping

Bamboo's characteristics in straight stalks and green leaves all year long has been utilized for interior and exterior decorations. Recently bamboo is used for windbreak and fences and see increasing demand for ssamji (left-over spaces) parks in cities and buildings.

Soswaewon garden with bamboo entrance is a specialty of Damyang. This secluded garden was built by Yang San-bo (1503 - 1557) after he gave up on success when his mentor Jo Kwang-ho (1482 - 1519) was banished to Neungju and killed during a season of political strife called the Gimyosahwa.

Trails through the bamboo fields are one of the characteristics of Damyang. Jukrimyeonu Bamboo Trails is a hiking route, linking five trails with the five traditional colors or blue, red, yellow, white and black. Stories combining the nature and culture, and landscape changing according to the seasons can make people feel the wonderful sense of the bamboo of Damyang.



Picture 42. Bamboo trail in Soswoiwon Garden



Picture 43. Jukrimyeonu bamboo trail

### ⑥ Tradition of Jukmul Bamboo Market

Jukmul Bamboo Market, also called Satgatmeori, was formed 300 years ago in Manseong-ri, Damyang. The market was busy with about 30 merchants, selling bamboo products at Damyang 5-day Folk Mart.

Nowadays it is hard to find trace of the old 5-day mart but about 10 stores in part of downtown Damyang close to Korean Bamboo Museum do specialize in bamboo products, continuing spirits of Damyang bamboo crafts. Damyang is the only place with stores that sell only bamboo products in Korea.



Picture 44. Yesterday and today of Bamboo Arcade

## **v. Landscapes**

### **1) Cultural Landscape Born out of Bamboo Fields**

The uniqueness of Damyang landscape is that most villages hold bamboo fields which tells about the bamboo value in environment and economic base of Damyang life, and farmers' today and tomorrow within their cultural landscape. The cultural landscape of Damyang holds the land use structure first. And for the 2nd feature, the significant harmonization over elements is emphasized over its size.

This kind of landscape has been created through the expansion of the bamboo craft culture into villages across Damyang. As bamboo demand expanded, additional bamboo woods were requested. Each and every village formed bamboo field, responding to the expanded bamboo demand, creating current macroscopic landscape. Each village has its own bamboo crafts, and every village was formed after bamboo groves were planted at the foot of the mountain nearby. The fact that most village in Damyang except three has bamboo groves suggests that the cultural landscape has been created by the bamboo craft culture of Damyang. The very landscape embraces the values of economy, society and cultural life of community based on their land use system.

Landscape of Damyang bamboo fields existed in the Goryeo Dynasty according to historic records. Bamboo and bamboo crafts were offered and contributed for kings and it is fair to anticipate the popularity of bamboo crafts and daily gadgets made out of Damyang bamboo must was big enough.

Landscape of Damyang has changed as the popular bamboo craft became an official tribute for kings and royal class. Making bamboo offerings for kings and royal class meant the national scale cultivation of bamboo per government involvement, meaning the moderate scale Damyang bamboo and craft till then leaped and expanded to a much larger scale. The status continued from the Goryeo Dynasty (938-1392) to Joseon (1392-1915), settling bamboo fields in back hills of each village.

#### **(1) Typical Way of Land Use and Cultural Landscape**

Damyang bamboo fields in most natural villages have influenced people's everyday life and their economic activities in rural villages. The cultural landscape of Damyang rural villages starts from the mountain top of mixed forest → bamboo fields → resident area → farmland → then to the stream, representing its ecological flow and distinct social and cultural characteristics. In other words, this gentle flow of landscape is the very axis of the cultural landscape in rural villages of Damyang (Image 25).

The gradual slope of the landscape from the mountain top→ bamboo field→ village → down to the stream is surrounded with bamboo fields and farmland. This landscape contains rural life and culture of Damyang. This also shows the typical way of land use in rural villages of Damyang.

Bamboo fields are usually located at the feet of mountains behind the villages, to grow bamboo and other crops in the ground level. There is settlement area protected by bamboo field, and water that flows in from bamboo field is utilized in lower farmland. The moving path of water resource in bamboo field is the most essential element for land utilization system which separate a residential area from farming area.

In other words, farming area and reservoir are properly settled, maximizing the benefit of moving path around their bamboo field. Many rural villages in Damyang area share the common landscape for that background. The usual land use system from the top mixed forest →bamboo field→residential area→farming area→stream is the core component of cultural landscape from rural villages of Damyang.



Image 25. Landscape of Damyang starting from the mixed forest~bamboo field~village~farm lands~stream in Daesil village at Daegokri, Geumseong-myoun



Image 26. Typical cultural landscape of Damyang Bamboo Fields

Cultural landscape by the traditional land use represents history of bamboo farming and farmers of Damyang region. As shown in the picture, bamboo managing, bamboo produce and ground level cultivation for bamboo shoots and tea are practiced in Damyang bamboo fields. Also, economic activities of bamboo craft and folk rituals in 'Bamboo Community' represent daily lives of residents. Rice paddy farming and dry field farming are practiced in the lower farmland are practiced all year around.





① Rice paddy – paddy field and bamboo water path



② Bamboo pillar in pepper dry field farming



③ Backyard dry field farming



④ Chickens in bamboo field



⑤ Water path in bamboo field



⑥ Puddle near bamboo field



⑦ Ground level cultivation - teas



⑧ Ground level cultivation – bamboo shoot



⑨ Bamboo field in the ridge and other forest on mountain top

Image 27. Serial view of Damyang rural village with bamboo field

In particular, rice farming with the use of water from Damyang bamboo fields is the result of the location of the Yeongsan River and its branch, which is one of the characteristics of the land use in Damyang. The location of streams determines the terrain type of a rural village of Damyang. It could be either the high north and lower south type or the low south and higher north type, as a rural village is located either to the north or to the south of a stream. It is easy to use water resources in flat plains, but it has not been easy to supply water for the farmland at the foot of a mountain (Image 28, 29).

Most rural villages in Damyang have well-managed water resources derived from bamboo fields to the water further for farming. This is how residents have made efforts to overcome the unfavorable conditions and the agricultural system in Damyang bamboo fields has differentiated itself from others.



Image 28. Spatial structure of Samdari(left) and Gasanri(right) in 'High north with lower south formation'



Image 29. Spatial structure of Dongsanri(right) and Baekdongri(left) in 'High south and lower north formation'



Spatial structure of Gogamoi village, Baekdong-ri



Spatial structure of Gogamoi village, Gasanri



Spatial structure of Wandong village Manseongri



Spatial structure of Wolsanmyeon near reservoir

Picture 45. Bamboo fields and reservoir around villages

For the unique cultural landscape of Damyang rural villages shares similar patterns, the view points also share common features. If you would look up a bamboo field from the entrance of village, it is easy to find residential area over the farmland, and it is rather a common cultural landscape feature in its flow. Bamboo fields area settled within its close ties to dwelling area, and it becomes easy to locate the view point around the entrance of a village.



Picture 46. View point at Samdari Bamboo-field Agriculture System



Picture 47. View point at Manseongri Bamboo-field Agriculture System



## (2) Harmonious space of ecological culture from bamboo field →village→ farmland

Another essential feature for landscape of Damyang bamboo fields is its role as a space of ecological culture among various components rather than its size. Each landscape holds moderate size bamboo fields, suiting for community needs rather than same mega size forest setting. The entire village becomes an ecological culture space within the usual land system of Damyang rural villages.

The gradual flow from mountain top~ bamboo field ~ village ~ farmland (Image 25) functions as the pillar of cultural landscape and ecological circulation for rural villages of Damyang. Warm or cool air per season is created from bamboo fields, and by-products from other farmlands are transported to bamboo fields, contributing for sustainable biodiversity of bamboo fields and its ecological culture space.

The distant view of bamboo fields which seem to be embracing both village and farmland is the unique and harmonious landscape that connects Damyang and bamboo. Conservation of Damyang landscape means conservation of sustainable agriculture and rural area, and it is an essential element for conservation of Agricultural Heritage.

There are 3 types of bamboo agriculture; Type 1 of timber and bamboo shoot only, Type 2 of bamboo field with Jukrocha tea cultivation and Type 3 of bamboo field with Jukrocha tea and liriopoe rhizome. *Phyllostachys bambusoides* Sieb. et Zucc is cultivated for industrial value in bamboo craft, and *Phyllostachys nigra* var. *henonis* Stapf is for bamboo shoot of income source in Type 1. Type 2 aims to produce income from Jukrocha tea. Type 3 combines and produce income from other crops in bamboo fields.



Type 1: bamboo produce



Type 2: bamboo field + Jukrocha tea



Type 3: bamboo field + Jukrocha tea + lirioppe rhizome

Picture 48. 3 types of bamboo farming in Damyang

### (3) Bamboo Embracing and Protecting Villages

Bamboo fields set up at the foot of a mountain and mounds near the settlement areas of residents protect rural villages from the heat and cold. The microclimate formed by bamboo field per season protects the village year long. The view of farming villages in Damyang holds more than simple landscape value and offers more of indigenous land use system value built on and by fore-bamboo farmers' wisdom (Picture 49, 50).



Picture 49. Bamboo field as the protecting shield of village (1)



Picture 50. Bamboo field as the protecting shield of village (2)

Bamboo field in backyard confirms the significance. It snows a lot and cold during winter season in Damyang. Bamboo protects the dwelling and village from the cold winter and snow. Bamboo field guards the village and dwelling from the cold winter wind and hot summer heat. Summer is much cooler in Bamboo field, providing shelter for people while winter wind is softened and blocked by bamboo field. (Picture 51)

Tangled rootstocks of bamboo prevent soil loss from heavy rain and flood, fending off disasters. Also, dense fields of bamboos serve as a deterrent to external invasion. (picture 52) Bamboo field also protects the village from invaders.



Picture 51. Wind-breaking bamboo field in the backyard of a house.



Picture 52. Tangled bamboo roots

A clear engraving pattern from farmland to a village with mountain as backdrop really adds the coziness to its scenery. Moving to a different place and looking at the surrounding areas from the village entrance reveals villages and farmland sitting together in a cluster between mountains covered with bamboo.



Picture 53. Gentle slope rural landscape in Daedeok Eco-friendly complex, Yongohreum Village)



Picture 54. Rural village between bamboo field covered mountains

## 2) Cultural landscape among bamboo fields and pagoda

Many magnificent sceneries with bamboo still hold various gardens and pagoda from long ago. They were ground of scholars' communication, networking, exchange and educating. Damyang is home of Korean gardens, and Soswaewon Garden represents its purpose and pride from its first year of 1530. Bamboo was the most favorite theme for scholars as it was one of 4 precious and gracious friends (cherry, orchid, chrysanthemum, bamboo). Bamboo was frequently used in for painting, writing, and bamboo was used to make musical instrument and craft. Bamboo fields with pagoda and garden forms another cultural landscape of Damyang.



Soswaewon Garden(Gasamunhak-myeon)



Myoungok-heon (Goseo-myeon)



Juknokwon Garden (Damyang-eup)



Sangwol-jeong (Changpyoung-myeon)

Picture 55. Cultural landscape formed by bamboo fields with pagoda

### 3) Seasonally Changing Micro-Landscape

Another charm of Damyang bamboo fields is micro-landscape changing according to the seasons. Damyang bamboo surrounding the rural villages is very beautiful from a distance, but taking a closer look offers a different taste of landscape. Emerging bamboo shoots or vines twining around the canes will add to an even more refreshing sense. Changing weather conditions and seasons provide a wide variety of picturesque scenery. The whistling sound of gentle wind whisking through a bamboo grove, tranquility in bamboo fields surrounded with fog, feeling of refreshment in bamboo fields covered with snow; these are representative landscapes of Damyang.



<Bamboo shoot germination>



<Plant sliding up bamboo>



<The waving bamboo field  
in windy day>



<Bamboo surrounded by snow>



<Bamboo reaching out the heaven>



<Foggy bamboo field>



<Hanging bee-box in  
bamboo field>



<A farmer harvesting bamboo-shoots >



<Ecological landscape of Damyang bamboo field  
is a wonderful healing space>

Picture 56. Various micro landscape of Damyang Bamboo Fields in a year cycle

### III. Action Plan

#### i . Summary

'The Comprehensive Conservation/Management/Utilization Plan (PLAN) for Damyang Bamboo-field Agriculture System' has been established among academia, research institute and residents of Damyang County in 2014.

The PLAN has 2 parts, including 'Conservation/Management' and 'Utilization', objecting sustainable Damyang Bamboo-field Agriculture System and eco-tourism based on PLAN. The project with in-depth action plan includes 'Conservation/Management System', 'Awareness Improvement', and 'Utilization Strategy' for Damyang Bamboo-field Agriculture System.

PLAN of 'Short-term' ran from 2014 to 2016, 'Mid-term' from 2017-2020 and 2021-2023 for 'Long-term'. Currently, Mid-term Plan is in its progress accordingly. Short-term Plan is detailed in 'iii. Practical Consideration', and Mid to Long-term Plan in 'iv. Action Plan for Damyang Bamboo-field Agriculture System.

#### ii . Responding Direction for Threats and Challenges

##### 1) Prominent Threats

###### **Farmers' interest loss in bamboo**

Damyang bamboo craft industry has declined since 1990s due to industrialization, increase of plastic, and interest loss of farmers. To make the situation worse, young generation move to big cities for new life. Bamboo plantation shows little increase, but currently the size of Bamboo forest in whole has been staged, responding to developmental needs and extinction of bamboo forest.

Damyang County objects to support bamboo farmers, securing their means of livelihoods from their long bamboo farming, and to solve the threats and challenges effectively.

Table 38. Fluctuation of Damyang Bamboo Fields (unit: ha)

Type	2014	2015	2016	2017	2018
Area	2,420	2,420	2,519	2,536	2,565

Rf: Damyang Bamboo Resource Research Institute

### Decrease of Human Resources in Bamboo Industry

Population of Damyang was 48,448(20,989 household) as of 2010, showing increase of 0.6% against 2009, but small number of decreases is taking place afterward. Population of Damyang was 48,191(21,735 household) as of 2014. As indicated, the household increased a little but population shows decrease. Birthrate and number of seniors over 65 are increasing.

Larger scale of bamboo fields is abandoned or unmanaged due to population decrease and aging factor. In addition, the bamboo professionals have either moved to big cities or passed away without skill successions of management and crafting. With GIAHS designation, more young people will see the importance of GIAHS Damyang Bamboo-field Agriculture System and start building their dream of life to settle in the heritage area with confident income provision from bamboo farming.

Table 39. Senior (65)) population in Damyang (unit: person, %)

Type		2014	2015	2016	2017	2018	Average Rate Change
Total population	Total	46,898	46,712	48,300	48,334	47,952	
Over 65	Number	12,705	12,966	13,329	13,623	13,816	
	Ratio	27.0	27.8	27.6	28.2	29.0	

Census as of 08/31/2019 with 47,221 population (23,521 households, 999 alien)

### Bamboo Field Damages

Located near a mega city, Damyang receives more attention for development. Most Bamboo forests are located near village in gentle slope, where factories and houses are built with less budget. That background has caused negative result in high rate of bamboo field damage. Bamboo cutting by owner doesn't require a permit, and that is why a better bamboo management system to reduce bamboo damage is essential.



Picture 57. Damages in Damyang Bamboo Fields

## **2) Opportunity**

Higher interest in PLAN of Damyang Bamboo-field Agriculture System will advance 'eco-friend value', higher heritage value, 'high-value brand of Damyang in distribution, consumption, demand strategy and tourism development'. The artistic value and landscape can support Damyang Rural Tourism.

Current social trend weighs high for ECO-FRIEND culture, health, environmental value of bamboo; pharmacological industrial value of bamboo as the essential foundation of future industry in architecture design, textile, and bio-industry.

Damyang industry is formed for 47% in primary, 21% secondary, and 32% tertiary, demanding better strategy for future industrial applications of bamboo. Vitalized new bamboo industry of food, textile, and architecture can be integrated with 2nd and 3rd industry. The new 6th industrial development creates new jobs and help new young businesses. The opportunity in 'Value Added Bamboo' comes from innovations in the customary bamboo industry, including bamboo produce, distribution, lower ground cultivation, and bamboo craft cycle.

The farmer oriented Damyang Bamboo-field Agriculture System Cooperatives (Cooperatives) can distribute Damyang Bamboo brand items exclusively and local farming specialties.

Continuous development of new items and bamboo oriented local food will improve the bamboo utilization rate and bamboo related industry. More visitors will visit Damyang to experience mega events of bamboo and Bamboo Festival based on the expanded awareness and significance of Damyang bamboo.

## **1) PLAN Direction**

### **① PLAN Damyang Bamboo-field Agriculture System**

PLAN requires an immediate attention. Bamboo farmers' lower interest in bamboo fields should be rebooted and farmers' participation is main pillar of PLAN. Damyang County has established the Cooperatives with farmers from core area, offering linkage income while they conserve and manage the heritage. The system has been expanded for overall farmers of Damyang County.

Farmer empowerment is a key to PLAN completion along with programs of study tour, networking with GIAHS sites, education for farmer' direct benefit. Integrated system of landscape-ecology-water and periodic monitoring system will be established for continuous improvement of PLAN structure. Intense expansion of bamboo fields built on with effective utilization plan is a MUST, considering current mere increase rate against high demand of bamboo.



Bamboo field expansion requires many elements like optimum location, topography, ecological structure, and surrounding environment, etc. The expansion strategy must ground its direction with full scale understanding of industrial changes.

## ② Expand Awareness for Damyang Bamboo-field Agriculture System Value

Awareness of Damyang Bamboo-field Agriculture System value remains at moderate level compare to its belle epicure glorious memory, and further promotion is most essential for the matter.

Various promotions are due with education programs for residents and visitor side by side. Damyang Bamboo-field Agriculture System promotion thru bamboo tourism and the Genetic Research Center should be developed.

Succession and development of bamboo craft deserve intensification. Brand value of Damyang region was built on bamboo and craft. Bamboo craft gave birth to local communities of social, cultural, traditional art and culture beyond its simple economic value.

Projects of 'Bamboo Craft Training', 'Modern Craft Design', and 'Bamboo Tourism' will be developed. Vigorous bamboo market operation with modern design and automatic gift-wrap system will rebound Damyang bamboo fame. Excellency of Damyang bamboo craft are promoted at Bamboo Festival and other festivals, improving impression of Damyang at the same time.

## ③ Heritage Utilization

Heritage utilization requires precondition of successful PLAN to destine for 'high value bamboo industry'. Expanded industry foundation with farming system built in will be settled in 'Bamboo 6th industry' and 'Bamboo Complex'. Current bamboo tourism is to be connected to eco-tourism and cultural tourism for better dimensionality.

Profitability of value-added bamboo field is about 5 times of its cost in simple wood purpose cultivation. Primary production of bamboo shoot, wood, sap, frond, bamboo sheath and secondary-processed items of charcoal, vinegar, salt earn higher income. In addition, the tertiary value of bamboo field emphasizes its functions as cultural and ecological tourism commodity.

Production of high-quality bamboo shoot, wood, by-products with processed bamboo with new-technique is primary goal of Damyang County for direction of PLAN. The Bamboo 6th industrialization is established with 'Bamboo Field Healing Experience' and 'Bamboo Shoot Dish Tasting', etc. Damyang holds its base in about 50% in agriculture, eco-friend bamboo farming and indigenous farming knowledge applied bamboo shoot cultivation with bamboo vinegar and charcoal.

Damyang County has earned Excellency Award for 'Eco-friend Agriculture' by MAFRA of Korea and Grand prize award from Jeollanamdo Province for 'Continuous and Active Policy Implementation' of eco-friend organic farming and systemized eco-friend measure and expansion of processing facility. Increase of bamboo field ownership by outsider is causing difficulties for PLAN, and a solution is due. Decrease of bamboo business in 3 industrial complexes demands immediate improvement.

Despite being near to Kwangju Metro city, Damyang's vulnerable tourism receptivity with short infrastructure and guide system needs improvement. A sound countermeasure is essential today, responding to the anticipation of lower profit model of local agricultural products following Korea and China FTA and invasion of Chinese farm products. Multi dimension dispersal strategy of tourists from current skewed distributions needs to be established.

### iii. Practical Consideration

#### 1) Designation of KIAHS Damyang Bamboo-field Agriculture System

KIAHS Damyang Bamboo-field Agriculture System has been designated in June, 2014. KIAHS designation indicates national level awareness in importance of bamboo farming and contribution of bamboo in farmers' income and regional economy. The additional elements contributed for designation, including 'continuous planting' and 'projects of PLAN accompanied by diverse utilizations'. The systematic Short-Term PLAN was completed by 2015. Further farmer orient projects for utilization will continue to bring further income boost for farmers and community development.

#### 2) Resident Oriented Bamboo Field Conservation Activities

##### ① Activities by Bamboo Organizations

##### The Damyang Bamboo Craft Cooperatives

The first organization supporting bamboo shoot farmers and craft personals called Jinsogye was established in 1916 then developed into the Fine-Tooth Comb Cooperatives in 1919. The industrial cooperatives were formed in 1926 which then soon became a managing structure of bamboo fields and bamboo craft.

In 1963, the Bamboo Craft Center was built and local government supported the bamboo industry under 'the Local Specialty Industrialization Project', and "the Cooperatives of Bamboo Craft" was found. The Cooperatives has led the development of bamboo industry and persuaded the Central Trade Committee to research on industrial damage due to unlimited bamboo import since 1989. In addition, the Cooperatives led establishment of village labor sharing for competitiveness of Damyang bamboo.



Picture 58. Activity by Damyang Bamboo Craft Cooperatives

Picture 59. The earlier view of Damyang Bamboo Craft Center

Since 1990, bamboo craft has declined and bamboo market became weak. To overcome situation, The Cooperatives and the Damyang Bamboo Association introduced 'Direct Market for Damyang Bamboo Product' on weekends. A special bamboo market is in the exhibition corner of Korea Bamboo Museum.



Picture 60. Bamboo craft in exhibition of Damyang Jukmul(bamboo) Street

### The Korea Bamboo Development Association

The Korea Bamboo Development Association was found in 2013 for exchange and networking among stake holders of bamboo. The members consist of patent holders of bamboo painting, bamboo intangible cultural heritages, bamboo experts, businesses, and artists. The association empowers its capacity thru bamboo forum, researches, promotion and the Korea Bamboo General Assembly while leading national networking and exchanges for bamboo industrial developments. The Association has progressed various researches and published magazines. The Association has collaborated with bamboo industry, academia and municipality scale bamboo projects. The Association has promoted Damyang Bamboo at home and abroad and carried out an actual condition report of bamboo industry. And the association has hosted 2015 Damyang International Bamboo Exposition and the 10th World Bamboo Congress (WBC) attended by 300 international guests form 40 countries.

The Association objects to protect those small local bamboo crafters by advancing technique and improving the sale volume thru operation of 'Bamboo Local Market'.



Picture 61. Inaugural assembly of 'Korea Bamboo Development Association



Picture 62. The 10th World Bamboo Assembly (2015)

### The Damyang Bamboo Work Alliance

The 'Damyang Bamboo Work Alliance' continues bamboo craft, promoting Damyang Bamboo value and train future leaders. The Alliance exhibits bamboo crafts during Bamboo Festival in May. Products like Jukbuin (bamboo cooler), basket, lunch box, etc are sold, and visitor's crafting experience program is delivered, promoting 'Home of Bamboo Craft Damyang'.

## The Cooperatives of KIAHS Damyang Bamboo Field Agricultural Heritage

Damyang County has established various projects of PLAN to improve farmers' income. The Cooperatives was established as handling agency for 'PLAN Phase 1', working with residents of core area, handling production, trade, promotion, and marketing Damyang brand. The Cooperatives targets for new kernel power of local economy and further development of primary industry.

Additional bamboo organizations partake in leading Damyang bamboo culture and industry, and they are 'the Damyang Jukro Tea Alliance', 'the Damyang Bamboo Shoot Farmers' Association', 'the Bamboo Culture Study' and 'the Damyang Crafter's Alliance'.



Picture 63. Public hearing to establish 'Damyang Bamboo Cooperatives'

### ② The Local Leading Activities

Damyang County has cooperated with residents for conservation of Damyang Bamboo-field Agriculture System. \$2,6 million was allocated for conservation/management/produce activities and promotion of local industrial resource Bamboo from 2012 to 2014. The project involved fertilization, management of Damyang Bamboo-field Agriculture System and operation of bamboo shoot management team.

Promotion workshop for local resource Damyang bamboo-shoot for leaders of towns, civic groups and Bamboo farmers were held in 2013. Additional activities like revival of Jukchwuil (Planting day) and studies on conservation/development strategy with Bamboo Culture Study Association were established.



Picture 64. Resident education for 'Bamboo Managing'



Picture 65. Media coverage on 'Jukjuk Dream Day'



Picture 66. Public hearing to establish the Farmers' Cooperatives

### ③ Civic Organizations and Experts

Projects like Damyang Bamboo Shoot Development, Jukchwiil-day event, Jukro-tea master training, origin patent of Damyang bamboo shoot and Damyang Jukro-tea are in progress by The Damyang Bamboo-shoot Farmer's Association, The Bamboo Culture Study Association and The Jukro Tea Producers' Association.

Bamboo vinegar and further practical applications of bamboo vinegar on farming are in progress among research institutes. Bamboo experts, scholars, producers, farmers, merchants and artists have established 'Korean Bamboo Development Association' to advance bamboo industry for information exchange/share/cooperate. The association supports management/conservation of Damyang Bamboo-field Agriculture System with forum, research, education, industry-academia-government linked projects and training of field experts.

### ④ The Resident Empowerment

The Damyang Bamboo-field Agriculture System Cooperatives has been the headquarter of Resident Empowerment programs, including 'bonsai horticulture program' and 'bamboo field management'. 'The 108 Damyang Bamboo Shoot Recipe book' has been distributed to local restaurants.



(Publications from left: Bamboo Cultivation Technique, Bamboo Culture and the New Bamboo Industry, 108 Damyang Bamboo Shoot Recipe Book, The Korea Bamboo Museum, Bamboo-shoot Farming)

Picture 67. Publication of Resident Empowerment program

The Bamboo Shoot Cosmetic Corporation offers quarterly forum on 'Damyang bamboo shoot commercialization' for various rural area, exchanging ideas of bamboo field management for richer bamboo shoot harvest. Residents share their ideas while participate for new training.

### ⑤ Continuous increase for Jukrocha tea planting

Plantation of Jukrocha tea has been increased to maximize the ecological significance. 12 counties have devoted efforts in Jukro-tea plantation. Currently 180ha of Jukro-tea is planted, and it started from 11.5ha in 2005, 63.5ha in 2006, 67ha in 2007 and 28.8 ha in 2008 distinctively. 179 farm-household cultivate Jukrocha-tea now, and tea farmers' income is increasing due to active promotions of Damyang Bamboo-field Agriculture System.



Picture 68. Jukrocha-tea growing in the ground level of Damyang Bamboo-field Agriculture System

## 3) Implementation of Bamboo Industry Development Strategy

### (1) Development of Bamboo Tourism Content

#### ① Festival/Exhibition

The Damyang Bamboo Culture Festival promotes utility and significance of Damyang Bamboo-field Agriculture System together with 'Eco-city Damyang' value. The festival began in 1999 and the 19th festival was another success in 2017. Festival promotes people's participation in successful inheritance of traditional culture, bamboo art, offering direct enjoyments at the same time. The Festival has been designated as 'The Outstanding Cultural Tourism Festival of 2016' by the Ministry of Culture, Sports and Tourism of Korea.

The Damyang International Bamboo Exposition 2015 was held for 45 days from September 17, attracting 1.04 million visitors in total. The 340,000m<sup>2</sup> exposition venue included 3 exhibition halls and 6 sub-galleries around the Juknokwon Garden, 30 experience program, 500 performances and events. The outdoor healing gallery of Juknokwon Gardem exhibited the past, present and the future of Damyang bamboo and the infinite significance of bamboo from bamboo craft to up-to-date bio-industry.

The 10th WBC (World Bamboo Convention) Forum hosted by Damyang county and World Bamboo Convention was participated by 320 global field experts from China, Japan, Vietnam, France, Belgium, US and a good networking was formed within the forum.

The Exposition took 5 years in preparation, and the success of Exposition for Damyang county includes the engrossment of bamboo's economic and ecological value, promoting the idea of 'Damyang = Bamboo' and the branding power of eco friendly city Damyang.



Picture 69. Damyang Bamboo Festival (Left: Venue, Reproduced Bamboo Market)



Picture 70. Juknokwon Garden

## ② The Juknokwon Garden

The Juknokwon Garden, the most favored tourist attraction for Korean travelers, is 22.5ha in its size. The garden is located in Hyanggyori, and the eco-tourism Damyang Bamboo-field Agriculture System was developed as a standard model of bamboo-system management/cultivation and advance bamboo significance. The main facility includes observation tower, trail, eco-exhibition hall, Korean style cafe and houses for visitors. The total visitor count has continuously increased from its birth year of 2003, and currently, over 1.2 million annual visitors visit the Juknokwon Garden from 2011. The induced economic effect is anticipated at around ₩150 billion per year. The garden has been selected as one of '50 Must Visit Attractions in Korea' by CNN, and has become a popular advertising filming spot.

## ③ The Korea Bamboo Museum

Korea Bamboo Museum (founded 1981) is the only bamboo museum of Korea. The relocation of museum took 6 years, costing ₩6.1 billion. The museum is built on the lot size of 46,650 m<sup>2</sup>, including 3,625 m<sup>2</sup> of facilities of 8 exhibition halls, international exhibition hall, 3 shopping buildings and a bamboo botanic garden.

The museum has been popular for teenagers' bamboo crafting experience and various programs. About 1800 bamboo articles are exhibited, and the museum has been marked as the significant icon of Damyang.



Picture 71. View of Korea Bamboo Museum and Exhibition Hall



## **(2) Establishment of Foundation for New Bamboo Industry**

### **① The Bamboo Research Institute**

The Damyang Bamboo Research Institute has been established for effective management and propulsion of bamboo industry. Currently, multi studies to establish hi-tech bio-industry, and thinning project of bamboo-field (since 2010) are in progress, responding for aging farmers and vacant bamboo fields. 26 studies for effective industrial utilization of bamboo and new bamboo dish development have been progressed since 2000. The institute offers the National Bamboo Craft Design Contest to promote bamboo craft.



Picture 72. Facilities in Damyang Bamboo Resources Research Center (top: Breeding Lab, Bamboo cycling area)

### **② The Master Plan to Conserve/Manage/Support Damyang Bamboo Value**

The Master Plan of Conserve/manage/support of Bamboo has been established in 2015, promoting high-value-added bamboo of 21st century and to expand the cultivation size. A promotion brochure 'Manual for Bamboo Breeding and Planting' helps to meet the growing demand of landscaping bamboo in the nearer future.

'The Ordinance to Support Damyang Bamboo Organization' has been implemented for systematic supports for bamboo field management agencies. The local ordinance of 'Standards to Designate Bamboo Crafter and Management' can boost the bamboo industrial development and spirit of bamboo craft artists.

### **③ Bamboo Industry Promotions**

Damyang County has launched 'Tea-Brewing Master' program in 2011 for Jukro-tea farmers to develop a global premium tea. The program teaches details in Jukrocha-tea brewing, fermented tea, rice cake tea, etc. The collective geographical patent of Damyang Jukrocha-tea was earned in 2012, certifying the royalty of Jukrocha-tea of Damyang Bamboo-field Agriculture System.

Continuous trainings have supported the tradition of Damyang bamboo craft. The Korea Bamboo Museum has established a successful 'Saturday Auctions of Masters' Bamboo Work' program in 2013, allowing general consumers to acquire masters' work at reasonable price.

Mentioned above activities are connected with 'Bamboo Culture Industrial Exhibition', and audiences can experience from A to Z of bamboo.

Commercialization of 'Bamboo Beer' and 'Bamboo Shoot Sausage' promotes bamboo food industry. The project was established in 2012 by MOU with 'Damju Farming Association Corporation' based on a research finding in 2010.



Picture 73. Bamboo Industry Promotion Activities

**4) 'Rural Area's Multi Resource Project' to Conserve/Manage Agricultural Heritage**  
**(1) Guide/Bamboo Craft Masters of Damyang Bamboo-field Agriculture System**

'Rural Area's Multi Resource Project' to conserve/manage heritage has been launched in 2016. Training for guides and Bamboo Craft masters' objects to promote for villagers of core area with 'Damyang Bamboo-field Agriculture System, RURAL TOURISM', 'Community activity', 'Exchanges of farmers and government', 'Commercializing rural resources' and 'Mapping community resource'.

Resident workshop and Study tours were implemented. Workshop agenda was 'Social economics and utilization', 'Image-making and Service-mind program', 'Power leadership'. The study tours destined for communities of excellent activity and culture, successful local food restaurants and shops.

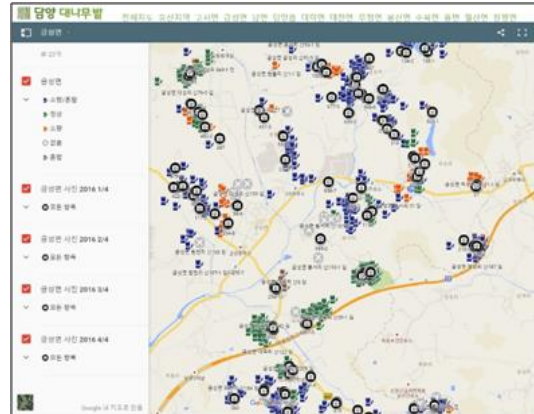


Picture 74. Resident Workshop/Study Tour for Succession of Damyang Bamboo-field Agriculture System

## (2) Online DB for Heritage

A complete survey in Damyang bamboo fields was taken, establishing DB per species from each bamboo field and to collect overview information. 'DB Integrated Management System' objects to set a sound bamboo field management, positioning new bamboo industry with attractions and evaluate productivity of bamboo per site.

12 regions including 138(ri) district in Damyang county were investigated and data of site locations, distribution/topography, availability research per each species and management status was collected. Each bamboo field was reviewed based on its accessibility, utilization, manageability and current management condition. Damyang County has applied the DB information in the systematic management and utilization of bamboo fields. (Appendix) (<http://db.damyangbamboo.org> → password: damyang2016)



Picture 75. DB Integrated management system of Damyang Bamboo-field Agriculture System

## (3) Promotion and Exchange

### ① Launch of Web page and online promotion

Damyang Bamboo web page is established, and current issues of Damyang Bamboo, interviews and articles are promoted. "I Like Damyang Bamboo!" corner was introduced thru SNS with pictures and video clips simultaneously.

### ② Program of exchange and Promotion

The program promotes Damyang Bamboo value and sisterhood with continuous exchanges. A special program called 'Bamboo village tour with my family!' was launched with online club members. Diverse programs like food carving, bamboo craft, tea ceremony, Jukro tea culture and bamboo field walking tour were progressed with MOU agreement.



Picture 76. Promotion & Exchanges

## **iv. Action Plan for Damyang Bamboo-field Agriculture System**

### **1) Vision and Objectives**

The objectives of the comprehensive conservation, management and utilization (here in after PLAN) of Damyang Bamboo-field Agriculture System (here in after SYSTEM) is to protect the future resource system, vitalize local economy and identity thru multilateral utilization of the SYSTEM and branding. The PLAN of SYSTEM should be tied within the vision of 'Ecological and Cultural Destination Damyang'.

PLAN strategy includes  $\Delta$ Vitalize rural area with updated traditional knowledge and skills,  $\Delta$ Eco-Damyang with richer agro-biodiversity,  $\Delta$ Vitalize local economy with bamboo tourism and bamboo new-industrialization and  $\Delta$ New local identity enhanced by cultural development.

Vision of PLAN will improve eco-Damyang value, vitalize regional economy, re-establish impression of bamboo-oriented Damyang thru sound conservation and management.

The implementation of Action Plan includes projects to boost farmers' interest in bamboo farming and solve the challenges for successful bamboo farming. The success of Action Plan also means natural improvement of the SYSTEM and bring more bamboo farmers.

Damyang county level supports for each village and district to maintain their bamboo farming with more information exchange, financial support and empower resident passion in bamboo farming, bamboo farmers' contribution for global expansion of bamboo farming are being organized within the Regional Ordinance for Supporting Bamboo Farmers will be in effect by end of 2019. Damyang County is setting another 30 years of expansion and management practice for bamboo field up to 10,000 ha and its according maintenance to prepare for sound SYSTEM for future generation.

Projects in the Action Plan are oriented and will reduce the current burden while bringing more motivated residents into bamboo farming. With GIAHS designation more and further suggestions will be gathered from farmers for sound SYSTEM and better global communication in Damyang's eco value on top of current PLANs, and there is no time frame for our efforts to realize all goals of Action Plan.

### **2) Core Strategy and Action Plan**

The core strategy to achieve PLAN goals of the SYSTEM includes; ①Establish the systematic structure of PLAN ②Promote SYSTEM value ③Propel strategic implementation of PLAN. The action plan structure for sustainable SYSTEM is formed in 2 phases of 3 core targets; Short Term Action Plan (2014-16) for \$1.3 million and Mid-Long Term Action Plan

(2017-23) with its budget of \$217 million.

The action plan to “establish the systematic structure of PLAN” includes (1) Maintenance greater SYSTEM and its Landscape (2) Select managing agency (3) Systemize management structure of landscape, agro-biodiversity, water (4) Additional designation (5) Expand bamboo fields.

The action plan to “Promote SYSTEM value” holds 5 terms; (1) Develop promotion tools of integrated BI, (2) Bamboo School operation, (3) Program of ‘Rediscover Bamboo’ program, (4) Bamboo tourism, (5) Establish the Bamboo Genetics Research Center.

The action plan to “Propel strategic implementation of PLAN” includes 4 basic tasks: (1) Establish bamboo craft workshop and the promotion hall, (2) Bamboo Trail, (3) Establish bamboo-eco-friendly farming (4) Industrialization of new bamboo material. Diverse hazards will be eased upon success of tasks which provides high value for the SYSTEM.

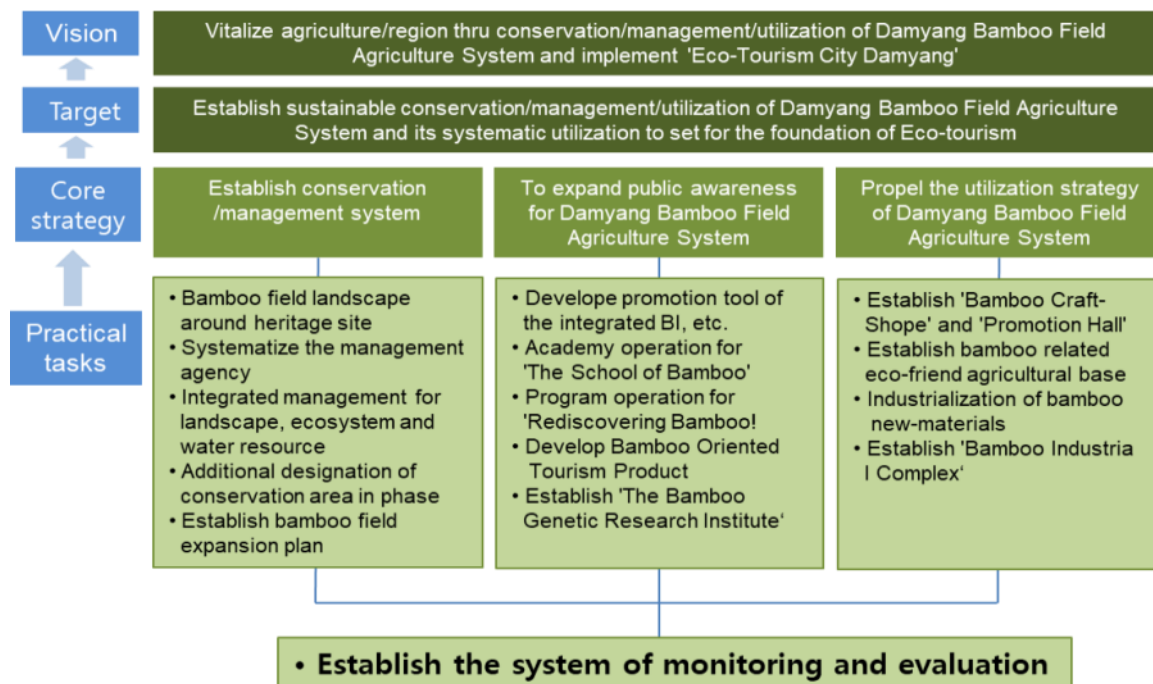


Image 30. Action plan summary for Damyang Bamboo-field Agriculture System

### 3) Conservation System of Damyang Bamboo Field Agriculture System

#### (1) Establish plan of conservation and management

Table 40. Plan of Conservation and Management System for SYSTEM

Project	Target	Action	Department	Time
To develop maintenance & landscape Development	1) Efficiency increase for SYSTEM management 2) Develop differentiated landscape per village and SYSTEM	1) Maintenance bamboo fields 2) Maintenance for unpleasant facilities in core area village	• ※Division of Bamboo •Core villages	2016 ~2020
Systematize management structure for SYSTEM	1) Farmer organizations 2) Establish administrative organization of PLAN	1) Expand the Cooperatives throughout county 2) Establish management dept for SYSTEM and locate experts	• ※Division of Bamboo •The Damyang Bamboo Cooperatives	2015 ~2020
Systematize landscape management, ecosystem, water	Establish- integrated management system	1) Integrated management plan 2) Monitoring system	• ※Division of Bamboo	2017 ~2018
Additional designation of conservation area in Phase	Improve resource value per systematic management	1) Establish designation detail 2) Specialize per area to area	• ※Division of Bamboo	2018 ~2023
Establish and Implement the Bamboo field expansion project	Improve bamboo resource value & vitalize bamboo industry per expansion	1) Establish demand orient bamboo field expansion project 2) Site selection and expansion per phase	• ※Division of Bamboo	2018 ~2023

※ Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County

#### ① Maintenance SYSTEM and Landscape

Period	2016-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Periodic thinning and trail improvement will promote effectiveness and efficiency of SYSTEM while establishing specialized scenery of rural villages.
Direction	Prioritize theme park tour course with extra space for effective simultaneous implementation with the 'Rural Village Service Project'.
Plan in detail	
Bamboo field service	36.2ha in 2 districts
Landscape restoration	Tradition and historicity of core zone in Samdari and Manseongri to be restored. Hazardous obstacles to be removed.
Thinning	Timely implementation accordingly to 'Thinning Procedure & Standard of Damyang County'
Trail building	To clarify target forests prior
Further maintenance & conservation area	Observance of GIAHS Damyang Bamboo-field Agriculture System designation and additional designations of bamboo fields

## ② Establish managing agency for SYSTEM

Period	2015-2020	
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County	
Objectives	Establish farmer-leading conservation/management/utilization structure for effectiveness and income increase. Local economy will vitalize as its result.	
Direction	1)The Cooperatives serves greater region. 2)Establish a comprehensive administrative system	
Plan in detail		
High value Damyang farming	Include membership of farmers and stake holders	
Membership	To include farmers and bamboo businesses	
Objectives for joint projects	△Economic scale △Prioritize common tasks △Ease individual investment burden △Improve synergy effect of various projects.	
Empower Administrative Structure	More manpower and structure expansion PLAN for of GIAHS Damyang Bamboo-field Agriculture System	

## ③ Systemize management structure of landscape/biodiversity/water

Period	2017-2023	
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County	
Objectives	Establish 'Comprehensive Management Structure' for effective conservation of multi core values of GIAHS Damyang Bamboo-field Agriculture System	
Direction	Comprehensive Management Structure will secure effectiveness in landscape, biodiversity and water. Periodic monitoring will improve the manage system continuously.	
Plan in detail		
Reinforcing management system	Expand conservation area following GIAHS designation of SYSTEM	
Build comprehensive management system	To tie plan of further designation area to system's landscape, biodiversity and water	
Improvement	To utilize ecological resource investigation and Integrated DB of SYSTEM To survey greater region and utilize water from bamboo field for other farming	
Periodic monitoring	To implement suggestion for further improvement To tie monitoring system post GIAHS designation	
Disaster prevention system	Establish 'Standard Responding Manual' following ordinance and systematic support system	

**④ Additional designation of conservation area in phase**

Period	2018-2023	
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County	
Objectives	Additional 'Conservation area` in phase for greater value and multilateral utilization of Damyang Bamboo-field Agriculture System	
Direction	Detail in criteria to be evaluated for environment, landscape, economy, culture, resource size, and its expansion possibility, state of preservation/management, principal agent and accessibility. Areas specialized as 'Core area', 'Industrial area' and 'Special management area'.	
Plan in detail		
Features per area	Core area: Samdari/Manseongri with prior PLAN implementation Industrial area: optimum zone for tourism with outstanding landscape, economy, cultural value. Special managing area: area with outstanding resource condition but poorer conservation/management status, demanding an immediate attention.	
Conservation/Management	In-phase expansion will be progressed from applicant districts of full qualification to intensify the value and needs of agricultural heritage.	
Integrated Operation Structure	Establish thru networking with other heritage sites and share know- how's of management and utilization.	
'Clean Shelter Bamboo Field'	Each district to build Bamboo Park near passing highway for visitors' convenience. Brand value of 'Bamboo World Damyang' will improve farmers' income.	

**⑤ Expansion of bamboo fields**

Period	2018-2023	
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County	
Objectives	Resource scaling from expansion will boost resource value and vitalize bamboo industry and tourism	
Direction	Review current expansion project of Damyang (for 30yr, 10000 ha) to calculate optimum size : Addition to existing bamboo fields is more practical than new setup. Each district's plan is included in their application. : Bamboo planting site selection prioritizes for hills and fields with less usability and area in need of disaster prevention forest. The unselected small to medium size bamboo fields can establish their expansion plan, tying to nearby areas. : Roads for site management will be pre-organized before establishing management plan. : Select destination site for eco-tourism development in phase.	
Plan in detail		
Demand strategic expansion Plan	Expansion will respond to the needs of social, environment, tourism, economic, industry.	
Integrated plan	Tie with ecotourism Damyang Bamboo	
Elements of expansion	: Social/environment: If bamboo planting is possible from areas in need of disaster prevention forest : Conservation management to expand for nearby area : Tourism, economy, industry: New plantation in vacant land with good landscape value	



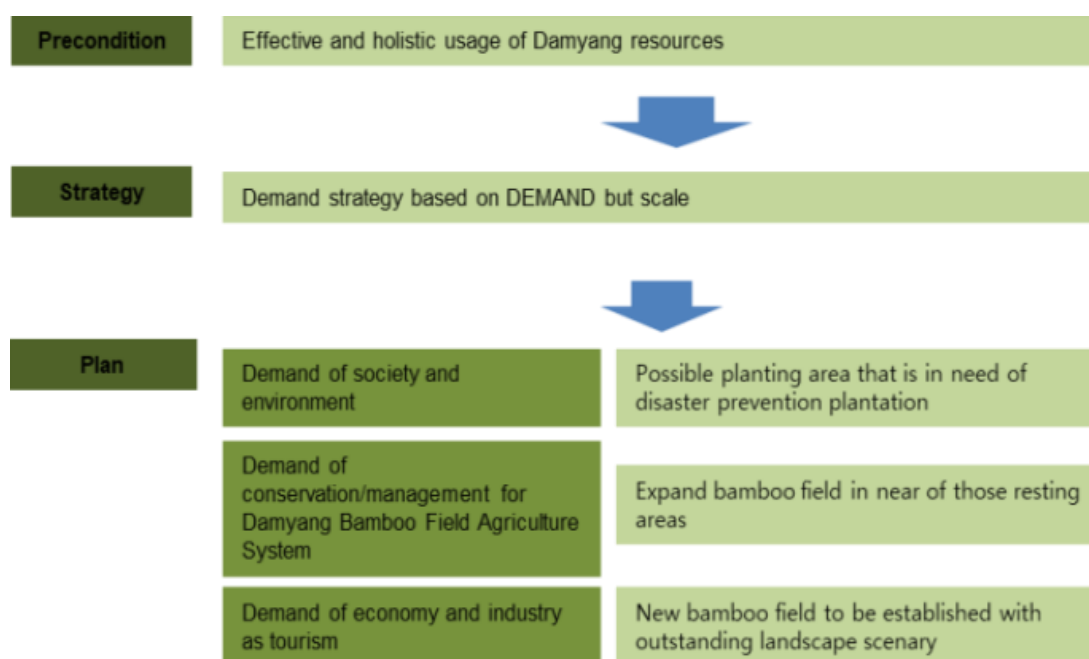


Image 31. Expansion plan and direction of bamboo fields based on the basic need strategy

## (2) Value Expansion for Damyang Bamboo-field Agriculture System

Table 41. Promotion Strategy and Value Improvement for SYSTEM

Project	Target	Action	Department	Time
Develop PR tool for integrated BI	SYSTEM promotion	1) Develop web site, Integrated BI 2) Develop promotion tools	•※Division of Bamboo	2015 ~20
The Bamboo School	1) Resident empowerment for SYSTEM PLAN 2) Guide program	1) Program of culture of bamboo and county 2) Establish Agricultural Heritage Guide curriculum	•※Division of Bamboo •Damyang Bamboo Cooperatives •Civic organizations	2018 ~23
'Rediscover Bamboo & Its Importance' program	Develop advanced value of SYSTEM and expand the resource value.	1) Introduce FORUM 2) Promote success cases	•※Division of Bamboo •civic groups/experts	2018 ~23
Develop bamboo tourism	1) Souvenir 2) Tourism income	1) Develop and market unique tourism items	•※Division of Bamboo	2018 ~23
Establish 'Bamboo Genetics Research Institute'	1) Increase bamboo resources 2) Expand bamboo industry	1) Genetic researches 2) Sufficient supply for farmers and ideal production control	•※Division of Bamboo •Bamboo Genetics Research Institute	2018 ~20

※ Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County

### ① Develop promotion tools of integrated BI, etc

Period	2015-2020
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Develop promoting tools for Damyang Bamboo-field Agriculture System and its significance.
Direction	Develop promoting strategy thru web site, integrated BI, story books, etc.
Plan in detail	
-Improve existing promotion tools for effective utilization	
-Advance heritage stories, story books and promotion materials	
-Expand human resources thru Fam-tours, exchange programs with other districts and farmers.	
-Establish periodic bamboo R & D workshops and forum.	

### ② Operation of Bamboo School

Period	2018-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	1) Effective utilization of heritage 2) Empower residents' devotion in conservation/management 3) Promote bamboo field's value and indigenous Damyang culture. : Concurrent heritage guide training and trail operation
Direction	Establish 'Rediscover Damyang Bamboo-field Agriculture System value and Direct Experience' with communicative academy among instructors/field experts and people's suggestions.
Plan in detail	
-Bamboo School: Diverse topics on SYSTEM for residents' bamboo knowledge/interest who later could be guide for SYSTEM	
- Participants by 6 months interval and certificate grant after completion. Mutual sense of solidarity and interest in school and bamboo will be improved thru Alumni activities. The school will run with textbooks per curriculum and guide standards.	

### ③ Operate 'Rediscover the Significance of Bamboo' program

Period	2018-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Government-Industry-Academia collaborated program of 'Rediscover Bamboo Value' is essential to promote and increase resource value for young generation.
Direction	Forum-type program with multilateral exchanges to conduct and share the SYSTEM value and sustainable development
Plan in detail	
Forum title: 'Bamboo Story Forum'	
Networking entity will be established for significance resources.	
Systemize history/value of Damyang bamboo for industrialization and advance art/culture of bamboo.	
Forum committee consists of Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County, civic organizations, experts and residents. Membership: Bamboo processor/distributor, academia and public agencies	
Secretariats' duty: Spread the fruitful outcomes with expert's consultations. Forum will carry out activities for future generation programs.	

### ④ Develop bamboo tourism products

Period	2018-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Develop/distribute symbolic items of Damyang for tourists, improving tourism income strategically.
Direction	Build popularization and tourism merchandising with reasonable price bamboo craft
Plan in detail	
-National contest for △Bamboo sculpture, toys, musical instrument, daily gadgets, etc. △Bamboo of Damyang spirit, △Reasonable/merchandising item, △Bamboo for distinctive age group from children to adult	
-Judging category: quality, commercialization possibility, easy to manage, symbolic value, interest, price range, etc.	
-Tourism commodity will be developed by tying residents and bamboo craft shops to support rural area income and to create specialized industry.	

### ⑤ Establish 'Bamboo Genetics Research Center'

Period	2018-2020
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	R&D for bamboo functions and advancement, tying with tourism for high-value bamboo income for farmers and business.
Direction	Landscaping shorter bamboo is popular, and new species is due, boosting farmers' income and local economy.
Plan in detail	
-Foundation plan, location, operation plan, construction plan, human resources and research plan will be completed in phase.	
-Research system includes 'Bamboo Bio-analysis Center' to research in medicine, health food, eco-friend farming tool, environmental upgrading items. Research lab(1,200m <sup>2</sup> ) includes a component analysis lab, gene analysis lab, seminar room, bamboo tissue culture lab, bamboo data bank, etc.	
-Research on agro-biodiversity conservation and bamboo farming will be progressed side by side.	

### (3) Utilization strategy for Damyang Bamboo-field Agriculture System

Table 42. Strategy for Damyang Bamboo-field Agriculture System

Project	Target	Action	Department	Time
Bamboo Craft Workshop & Exhibition Hall	1) SYSTEM promotion 2) Craft shop in core area as new growth power	1) Samdari: 'Creative Workshop & Theme Park' with Exhibition 2) Manseongri: 'Healing & Mentor House' -School + Book Cafe + History Hall	•※Division of Bamboo •Damyang Bamboo Cooperatives, • Civic Organization /Experts	2017~23
Bamboo Trail	Build Bamboo Trail, connecting attractions of SYSTEM	1) 2 walking/bicycle trail from Samdari to Manseongri 2) Path, connecting main course and Juknokwon Garden	•Dept of Bamboo New Industries •Damyang Bamboo Cooperatives,	2017~20
Bamboo eco-friend farming	Expand eco-friend farming with traditional and modern techniques	1) Empirical study, applying with traditional farming technology 2) Success of eco-friend farming	•Dept of Bamboo New Industries •Damyang county Agro-tech Center	2015~23
Industrialize new bamboo materials	Create new industry to PR for future resource bamboo	1) Strategy building and decide roles in phase for new material. 2) Study into merchandising strategy and complex development	•Dept of Bamboo New Industries •Bamboo Genetics Research Institute	2019~23
Bamboo Industrial Complex	1) Promote bamboo as new power 2) Synergy effect of bamboo industry	1) Invite new business with incentives 2) Build strategy for long term development	•Dept of Bamboo New Industries • Bamboo businesses	2019~23
Bamboo expansion plan	1) Damyang Bamboo value 2) Improve farmers' income 3) Bamboo tourism	1) New bamboo forests set up 2) Expansion to current nearby bamboo fields 3) Thinning Improvement 4) Expansion of landscape forest	•Division of Bamboo •Damyang Bamboo Cooperatives, • Civic Organization /Experts	2015~44

※Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County

## ① Establish bamboo craft workshop and promotion hall

Period	2017-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Establish ideal conservation/management/utilization model. System success will contribute for expansion of bamboo farming for better world. -Damyang will be center of heritage promotion and networking following GIAHS designation
Direction	Establish resident oriented bamboo craft and mentor zone to create Damyang's growth power and promote 'Bamboo Repository Area' Projects: △Create growth power of art/technology, △Introduce local identity and cultural strategy, △Resident empowerment △Low-carbon environment practices & eco forest
Activities and Plan in detail	
'Damyang Bamboo Story Theater' concept with 3 distinctive regional specialty will be implemented.	
-Samdari: 'Art and Technology' as base with projects of 'Resident leading bamboo production & processing', 'Bamboo governance for art/technology/harmonization'. △Measure: business within network, craft lab, promotion hall, exhibition	
Manseongri's theme is 'Regeneration + Farmers' dignity and pride', establishing an agency of welfare, consultative operations and management among resident and government, specialized services. △Measure: Bamboo Book-Cafe, Social networks, Create value/experience	
Juknokwon Garden: Represents Damyang's significance in 'Eco-forest & Low Carbon City' and promote regional identity, Ecological Repository value, of Damyang's growth power	
Project direction	
-Samdari Craft Workroom & Promotion Hall is separated from the 'House of Healing & Mentor' in Manseongri but connected in operations, meaning the bamboo experience in crafting/trail are inter-locked as a course to 'Healing program in Manseongri' for higher synergy effect.	
-Damyang County's core objectives in establishment of 'Wellbeing Tourism City and Global Eco-city' base will be achieved and contribute for 'Sustainable green growth policy' → 'Self supporting eco-city building (objectives)' → 'Better economy, happier welfare'(vision).	

## ② Bamboo Trail

Period	2017-2020
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Support tourism development of the SYSTEM, connecting core areas to nearby attractions.
Direction	Course from Samdari ~ Manseongri ~ Juknokwon Garden. Trail is built in harmonization with its surrounding environment, local culture and agro-tourism resources.
Target activities and Plan in detail	
- Facilities of amenities, interpretation, and safety to be installed in streams. - Bamboo bicycle trek is built near distribution areas of agricultural products, supporting farmers' income.	

### ③ Bamboo eco-friend farming system

Period	2015-2025
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Increase farmers' income and reinforce environment by expanding eco-friend farming by combining traditional technology and modern skills.
Direction	Study findings in traditional farming of SYSTEM to be collected for empirical studies and farm family supply. Eco-friend farming training and per-crop-application will be offered. Integrated BI utilization with cooperative operation and joint trading system to be built for system support and eco-friend farming expansion.
Plan in detail	
- Soil conditioning & pest control for livestock farming will be supported with bamboo vinegar. The foundation of bamboo charcoal eco-friend farming includes multi effects in deodorization, heavy metal remove, water purification, agricultural adsorbent, soil improve and antibiosis.	
- Establish collectivized eco-friend farming district for safe farm production and distribution system.	
- Eco friend farming base: Establish Agricultural Association Corporation. Distribute eco-friend products under contract cultivation. RPC distributes contract farmed rice, and APC for garden products. - The Damyang Bamboo Cooperatives will support the whole progress.	

### ④ Industrialization of bamboo new material

Period	2019-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Sound utilization of SYSTEM will vitalize local economy based on the future resource bamboo and the new bamboo industry.
Direction	Managing committee among Dept of Bamboo New Industries, Bamboo Genetics Research Institute, KIAHS Cooperatives, experts from local universities and research institutes.
Plan in detail	
-Project connection: Intense cooperation among 3 parties of production, processing technique and R & D among producer-processor-academia	
-Establish New Material Committee among Damyang Bamboo Cooperatives (producer), bamboo businesses (processing), Bamboo Genetic Research Center/Damyang Agricultural Technique Center/universities/Dept of Bamboo New Industries (R & D).	
-R & D: Damyang Bamboo Resources Research Center will lead projects of $\Delta$ Automatic bamboo component analysis system, $\Delta$ Bamboo seedling facility and research laboratory building	

### ⑤ Bamboo complex

Period	2019-2023
Entity	Division of Bamboo New Industry & Bamboo Resource Research of Damyang County
Objectives	Create Damyang growth power with bamboo industry and its synergy effect will be increased by direct operation and scaling. Operation of 'Damyang County Agricultural Industrial Complex' can vitalize the complex. Farmers' awareness in the SYSTEM value will increase farmers' income.
Direction	Bamboo Business Association establishes an extended development strategy. Incentives will be offered for incoming businesses. Industrialization of new-bamboo-material thru collaborations among businesses will be supported.
<b>Plan in detail</b>	
<p>-Establish Complex of multi-function, knowledge industrialization, rich networking and professionalism. : Trend of industrial complex weighs more for R&amp;D, training and education, start up functions, joint exhibition, and sale system. Damyang can offer qualitative improvement by tying industry, academia, researches, and advance for successful outcomes. : Vitalize networking among associations, stake holders, businesses, etc.</p> <p>- Vitalize the operation of the complex: widen type of incoming business, upgraded infrastructure and residential area will advance the complex as the Base of Industrial Complex</p>	

### ⑥ Bamboo Expansion Plan and budget

Current size	2,420ha	
Target size	10,000ha	
Target ratio	36% (bamboo against forests/fields)	
Project term	2015 –2044(30 yr)	
Objectives	1) Re-establish Damyang Bamboo value 2) Improve bamboo farmers' income 3) Develop bamboo tourism	
Strategy	1) Avoid full weeding and cut down target area only 2) Expand "Afforestation Project" to current bamboo area	
<b>Four major projects</b>		
1	Project	New bamboo forests
	Objectives	1,500ha(50ha/year)
	Direction	Avoid full clearing to improve bamboo sprouting Group planting is recommended from 5 to 10 roots
2	Project	"Expansion to current nearby bamboo fields"

3	Objectives	6,000ha(200ha/year)
	Direction	Natural expansion by providing healthier bamboo management
	Project	“Thinning Improvement”
	Target size	150~300ha/year
	Objectives	1) To maintain healthier bamboo fields and forests 2) Budget: Central government subsidies
4	Project	“Expansion of landscape forest”
	Target area	1) As street trees along National Hwy 24 and 29 2) Vacant land along roads, small parks 3) Embankment along steams

Table 43. Budget for New Bamboo Forest near Baekjin River area 2017 – 2019

Year	Budget (\$1:1150)	Planted	Area	Major species
2017	\$295,562	4,200roots	27ha	1) <i>Phyllostachys pubescens</i> 2) <i>Sinoarundinaria nigra var. henonis HONDA</i>
2018				
2019	\$295,562	68 roots	8ha	

Table 44. Budget for New Bamboo Forest

Year	Budget (\$1:1150)	Planted	Planted species
2015	\$662,608	12,693roots	1) <i>Phyllostachys pubescens</i> 2) <i>Sinoarundinaria nigra var. henonis HONDA</i>
2016	\$23,478	5,520roots	
2017	\$149,565	2,450roots	
2018	\$451,304	7,701roots	
2019	\$200,000	3,000roots	



#### 4) Investment plan for Conservation/Management of Damyang Bamboo-field Agriculture System

##### (1) Investment, following KIAHS designation

\$1.3 million was invested in 3 yrs (2014-16) as follows: ₩200 million (\$174,000) for Trail Course, \$383,000 for Heritage Maintenance/Landscaping. These projects are included in Mid-Long Term Plan. \$9.74 million for Theme Park, \$1.13 million) for Trail Course, \$817,000 was invested for Heritage Area Landscaping.

##### (2) Further Investment Plan

7 year plan, including Phase 1(2017~20) and Phase 2(2021~2023) includes △Theme Park △Trail building △Landscaping and management △Bamboo rediscovery program △Bamboo new-resource industrialization △Bamboo eco-friend farming foundation △Bamboo industrial complex △Bamboo Genetic Research Institute △Designation of additional bamboo area for conservation △Expand bamboo fields.

The comprehensive plan takes \$20 million in total. Theme Park takes \$9.7 million, Bamboo Genetic Research Institute takes \$3.7 million and \$2. million will be utilized for bamboo new-resource industrialization, additional designations for conservation and Ssamji Park building.

Table 45. Investment Plan per the Action Plan

Project	Investment		
	Total	2017~2020	2021~2023
Total	\$19.94 mil	\$10.07 mil	\$9.87 mil
Bamboo handicraft work shop & exhibition center	\$9.7 mil	\$4.70 mil	\$5.00 mil
Walking trail	\$1.00 mil	\$1.00 mil	-
Maintenance of site and landscaping	\$.50 mil	\$.50 mil	-
Bamboo tourism development	\$1.20 mil	\$1.20 mil	-
Bamboo new material industrialization	\$2.61 mil	\$2.2 mil	\$.41 mil
Additional designation for conservation	\$1.67 mil	\$.43 mil	\$1.24 mil
Bamboo Genetic Resource Research Institute	\$3.7 mil	\$1.20 mil	\$2.50 mil
Expansion of bamboo fields	\$.17 mil	\$43,000	\$130,000

\* No budget allocated project is prosecuted under 'Associated Project'

## **5) Expected Outcome by Action Plan**

### **(1) Threat solution**

3 threats for Bamboo-field Agriculture System are 'Loss of farmers' interest', 'Manpower reduce' and 'Damages caused by development'. 3 core strategy of Action Plan, including 'Conservation/management system built', 'System value increase' and 'System utilization' will ease threats from multiple directions.

Establishment of Conservation/management structure will improve farmers' awareness for Bamboo-field Agriculture System and reduce damages due to development and stagnation of bamboo-fields. More designations for conservation and further projects will expand bamboo fields size, preventing damages. Establishment of managing agency will also prevent damages.

'Bamboo School' and 'Rediscovering Bamboo Value' for 'Value Expansion of Damyang Bamboo-field Agriculture System' project will establish base ground to reduce field damages and human resources. Supply of new-variety and economic species by Bamboo Genetic Research Center will contribute in expansion of bamboo field.

Detailed utilization plan will support resolving threats. Bamboo Craft Work Shop in Theme Park will create more bamboo human resources. Promotion of bamboo-eco-friend farming will increase residents' awareness in necessity of conservation/management and bamboo field damage prevention.

Vitalized bamboo industry will boost local economy and further contribute for easing threats of Damyang Bamboo-field Agriculture System in many ways.

### **(2) Opportunity**

Conservation/management plan of Damyang Bamboo-field Agriculture System can provide various opportunities. System promotions will intensify the brand power and further successes. Projects of high-value bamboo industry, integration of agriculture and tourism, bamboo future industry promotion can improve farmers' income and local economy.

### **(3) Implementation of challenged projects**

Challenges for SYSTEM are △Establishment of Conservation/management system, △Expand awareness of SYSTEM value, △SYSTEM utilization. The challenge projects are described in the Action Plan.

Bamboo field expansion per demand and eco-friend farming built on traditional bamboo farming technique has been planned. Succession and development of bamboo craft, appointing procedure of bamboo craft masters and future bamboo craftsman foster program

are ongoing. Additional plans for 'Bamboo craft workshop and the bamboo school' and 'Rediscover Bamboo Value' will advance bamboo crafting.

Bamboo new-industrialization projects include 'Bamboo Genetics Research Institute', 'Bamboo Industrial Complex' and 'Bamboo New-Material Industrialization'. Projects cover wide angle of bamboo industry from producing-processing-distribution, and bamboo will remain as the main industry of Damyang region together with bamboo tourism.

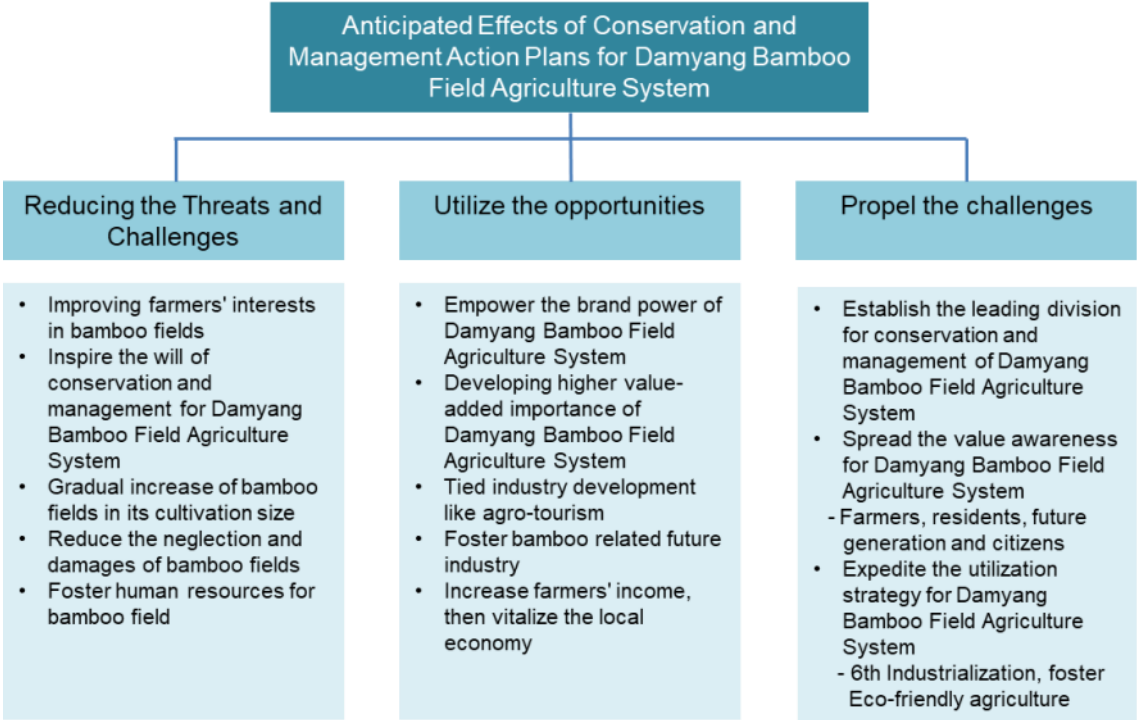


Image 32. Expected outcome by 'Action Plan of Conservation and Management of Damyang Bamboo Fields'

## v . Role of stake holders, county, central government, international channel

### 1) Participation of stake holders

#### (1) Role assigned per 'Operation/Management of Action Plan'

Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County has been appointed for further 'Total Management of Damyang Bamboo-field Agriculture System' following GIAHS designation. The Damyang Bamboo-field Agriculture System Cooperatives was launched among farmers of heritage area who possess traditional knowledge/skill of bamboo farming, craft, and community culture. The Cooperatives represents the civic organization of the SYSTEM.

Civic organizations of Damyang Bamboo Crafter's Cooperatives, Korea Bamboo Development Association, and Damyang Bamboo Craft Association have been involved in various projects and researches as main stream stake holders. Damyang bamboo businesses are considered as stake holder for projects.

#### ① Operation/management system

Damyang County supervises whole project with Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County as the main pillar and participation of the Cooperatives and stake holders.

Details and management measures of PLAN will be worked out from the 'Round Table Meeting'. Experts can be hired for clear success of implication.

Evaluation per general project and phase will be delivered at Round Table Meeting with experts. Reviewing standards are pre-decided at planning phase.

#### ② Roll Assignment

Damyang County supervises for budget, evaluation, follow-up actions and management, and roles of each division is as follows. Division of Bamboo Resource for Research, Museum & Bamboo New Industry of Damyang County involves in overall projects, attending Round Table Meeting of planning/evaluations and find experts.

The Cooperatives participates in Round Table Meeting for planning/evaluations and carry out community projects. Civic organizations participate in Round Table Meeting for planning/evaluations and carry out experts' projects. Experts will consult for policy, technique and evaluation.

Youth of Damyang will be trained and participate for exchange and share the necessity of conservation/management of SYSTEM.

## **2) Support of county, central government and international channel**

### **(1) Support of county**

Damyang County has set 'Ordinances for Damyang Bamboo-field Agriculture System Management'. County administration, civic level and stake-holders' rolls and strategies are supported by the Ordinances.

County allocates and balance for operation budget for SYSTEM management. County supports the managing agency of Division of Bamboo Resource for Research, Museum & Bamboo New Industry. Expertise of institute structure and human resources have been improved for future management of GIAHS Damyang Bamboo-field Agriculture System.

Various promotions and resident empowerment projects are managed by county for region of Damyang. Exchanges with home and abroad will be fully supported by Damyang County concurrently.

### **(2) National Support**

New phrase of 'Conservation and utilization of KIAHS' has been added to the article 30 Term 2 of Special Law of 'To prove life quality of farmers and rural development', allowing needed support for Agricultural Heritage. Damyang County was supported with \$1.3 million for conservation/management projects for first 3 years post designation. MAFRA will continue the needed support based on periodic monitoring.

### **(3) International Support**

Network with other GIAHS sites will be established to share, exchange and develop joint projects. The objectives are promotion of rice farming in Damyang Bamboo-field Agriculture System and its cycling farming structure together with setting a unique agricultural model of Damyang Bamboo-field for global bamboo farmers.

Participation in GIAHS meetings and annual ERAHS conference will offer opportunities to learn role model policy and trend of GIAHS sites.

Damyang County will develop sisterhoods with global bamboo farming areas, for periodic exchanges and to learn from outstanding GIAHS sites and apply for Damyang Bamboo-field Agriculture System.

GIAHS Damyang Bamboo-field Agriculture System will establish a communication channel with other GIAHS sites and social network system for exchange and share of FAO value and the core background of bamboo farming and farmers' life, culture and philosophy as reflected in the criteria of GIAHS designation. The Division of Bamboo Resource for Research, Museum & Bamboo New Industry will supervise the communication system with expert's consultation.

## **vi. Funding Strategy for Conservation/Management**

The Mid-to-Long Term Project began in 2017. Finance allocation as been planned in joint project format with central ministries. Damyang County will allocate necessary fund in delivering Mid-to-Long term project which will secure an easier support of central government. Various strategies in expanding individual investments will be implemented to improve project performances.

50% of finance is supported by the central government while 20% by Damyang County and 30% from private sector. The annual project target will be established, and the objectives for the coming year will be decided upon reviewing the present year's project performances.

## **vii. Monitoring and Evaluation**

Damyang County has established 'Comprehensive Plan of Conservation/ Management for Damyang Bamboo-field Agriculture System'. The Plan includes 'County ordinance of conservation and management for Damyang Bamboo-field Agriculture System' in conjunction with detail measure of periodic monitoring.

Conservation criteria for Damyang Bamboo-field Agriculture System is included in PLAN. The criteria includes 1) Environmental component(biodiversity), 2) Landscape value(harmony within surroundings), 3) Economic feasibility(possibility in industrialization), 4) Cultural component(linkage to cultural resources), 5) Site size, 6) Expandability, 7) Status of conservation/management, 8) Managing agency and 9) Accessibility for evaluation process. The data will be applied for monitoring scale on Damyang Bamboo-field Agriculture System. Further details of the proceeding agency selection for monitoring evaluation and terms will be decided and post-management-measure will assist the result. Once the central monitoring structure is completed, the monitoring system on Damyang Bamboo-field Agriculture System will be improved, responding to central structure.

### **Primary Direction for Monitoring**

Self Annual Monitoring of Damyang County will be implemented with by-year periodic Integrated Monitoring by MAFRA. Technical Monitoring will be performed for the expert review, and Damyang County will include experts to examine 'Agro-biodiversity', 'Bamboo field condition research' and 'Landscape changes in the heritage site'.

If needed, maintenance project will undertake in conjunction with central division, and both parties will do their best allocating budget. The maintenance project will be exercised post consensus of resident organization.

Monitoring objects include all elements of heritage site's ecological system, various facility and landscape together with those nearby areas and projections included in the action plan.

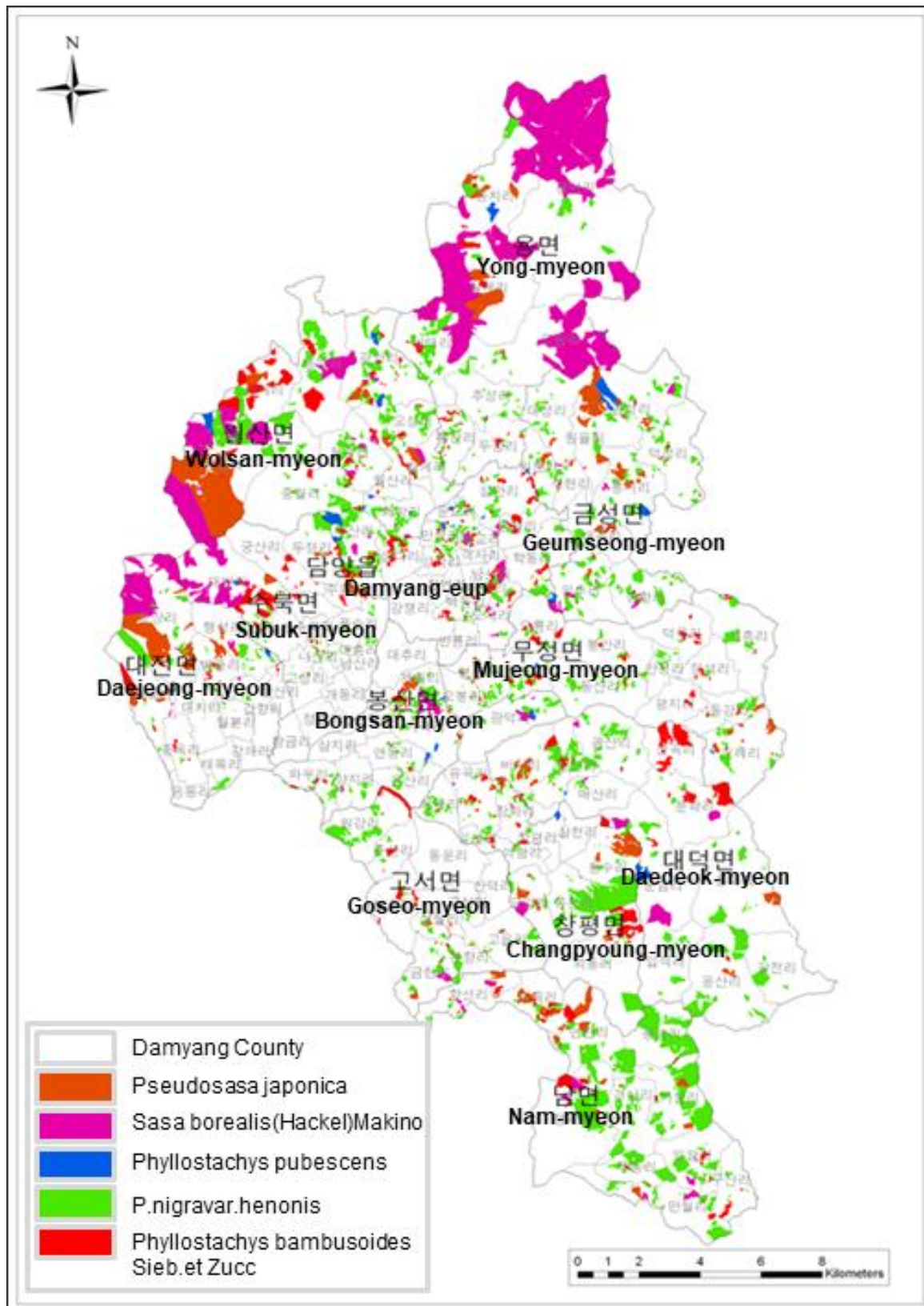
The quantitative analysis and systematic study on heritage change in progress will be monitored for future resource and be applied as a base resource.

<APPENDIX>

1. Location of Damyang Bamboo Field Agricultural System



## 2. Distributions of Damyang Bamboo Fields in Damyang county





### 3. On-line DB Information of Damyang Bamboo Field Management and Locations

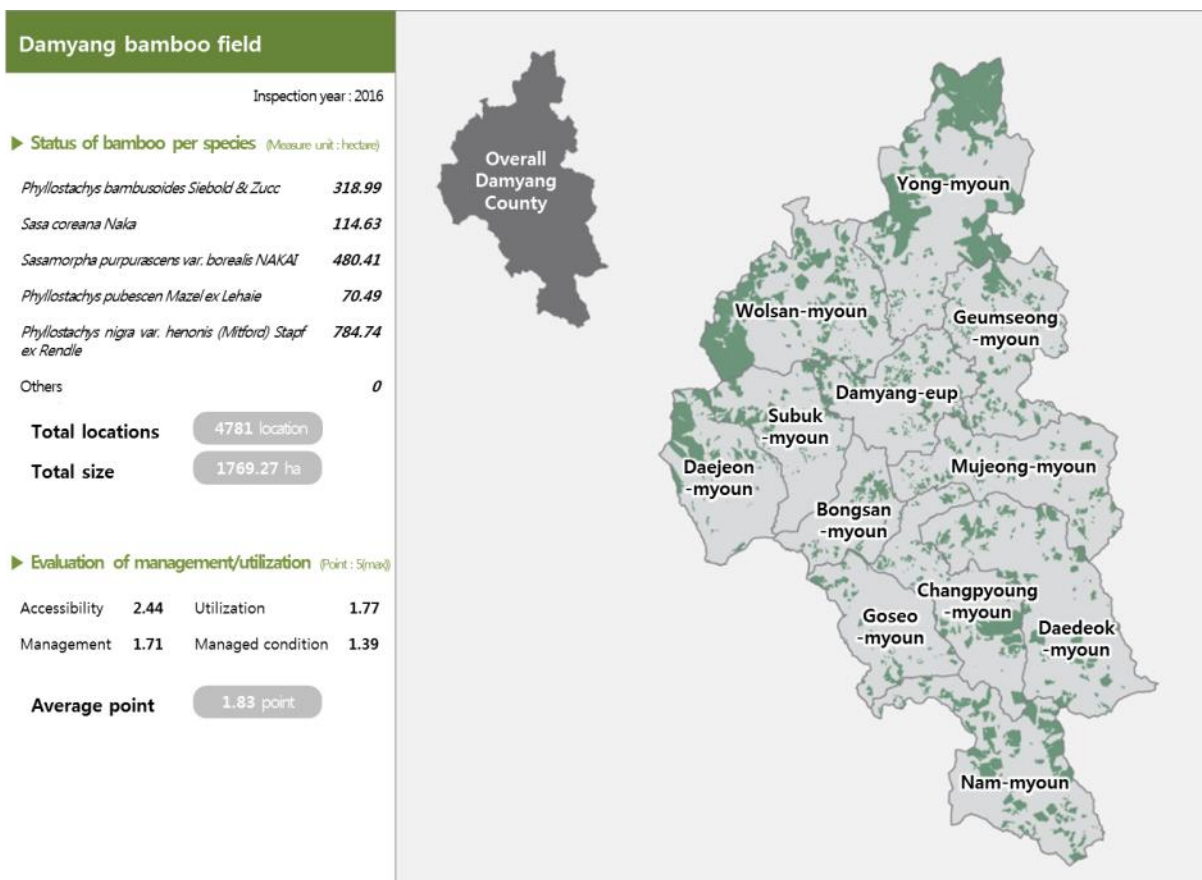
· <http://db.damyangbamboo.org>

- Password: damyang2016 → click 'Accessing Data'

#### ○ Overall Damyang County

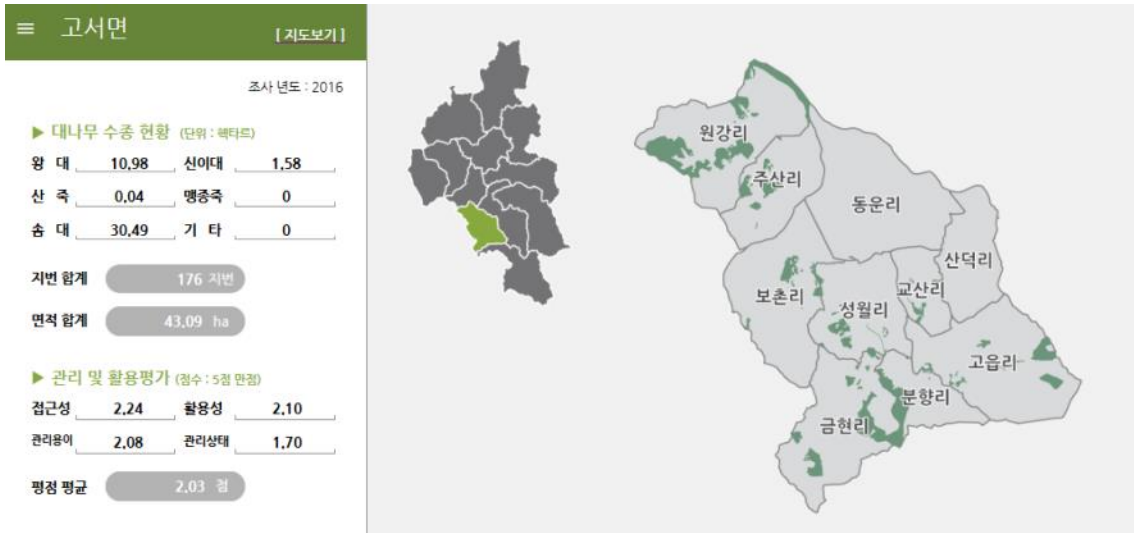
- Latitude 35 19' 30"N / Longitude 127 0' 31"E

<sample>



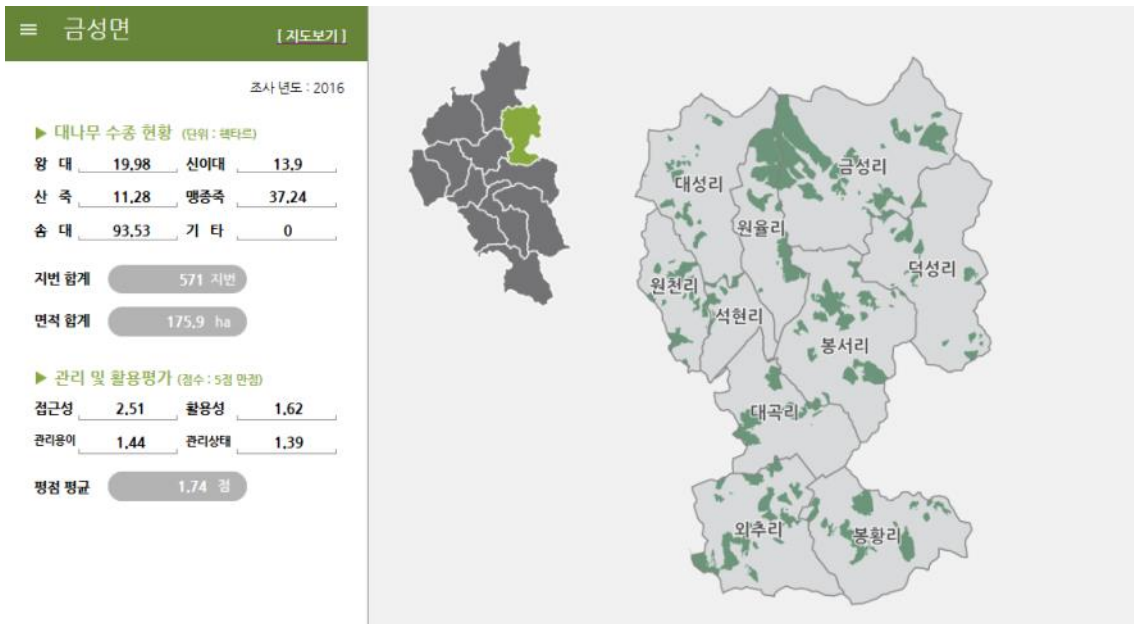
○ Goseo-myoun

- Latitude 35.2074650~ / Longitude 127.00337510~



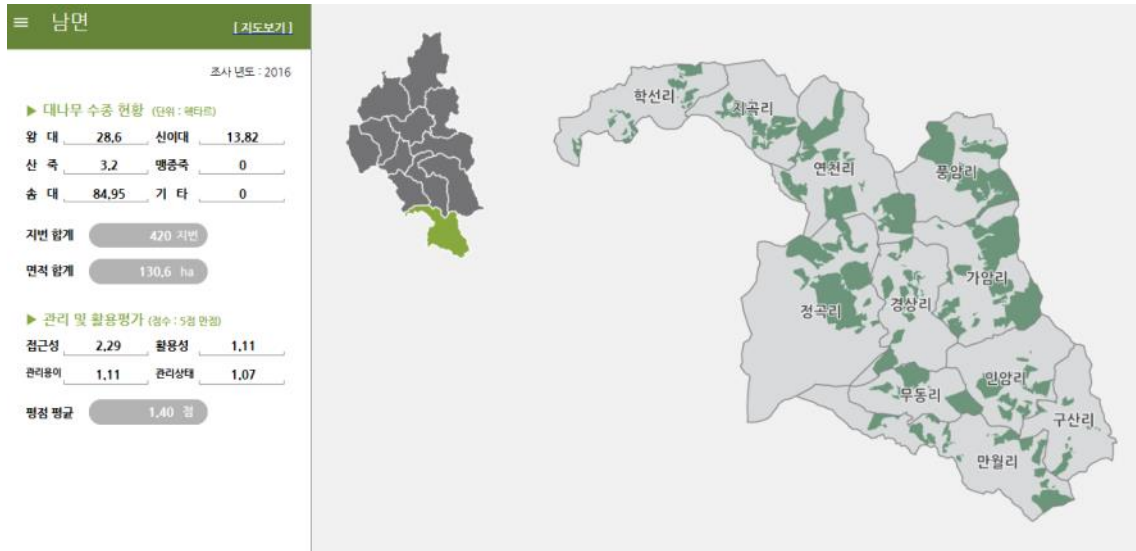
○ Geumseong-myoun

- Latitude 35.3718480~ / Longitude 127.0533760



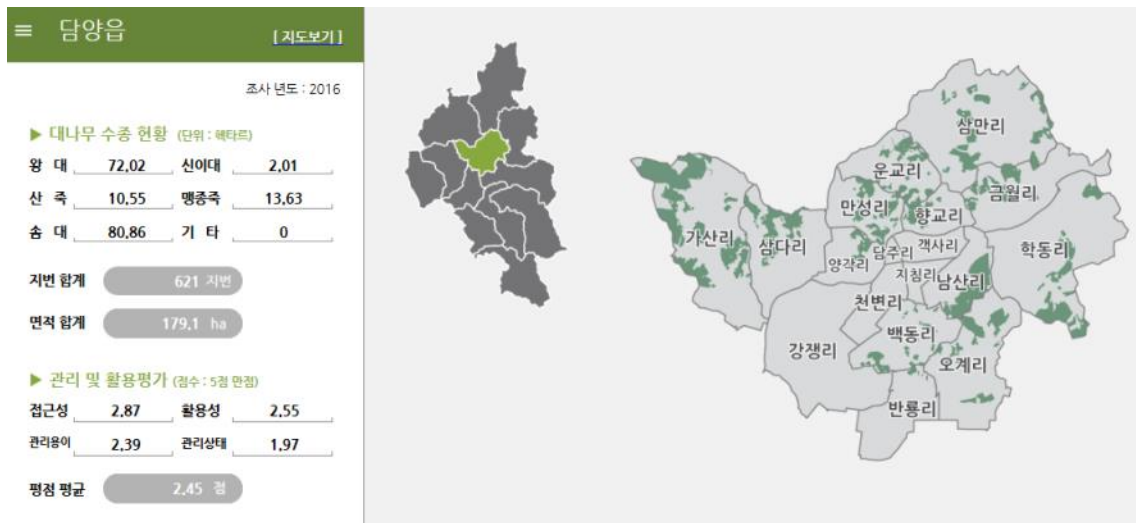
○ Nam-myoun

- Latitude 35.1567830~ / Longitude 127.0625750~



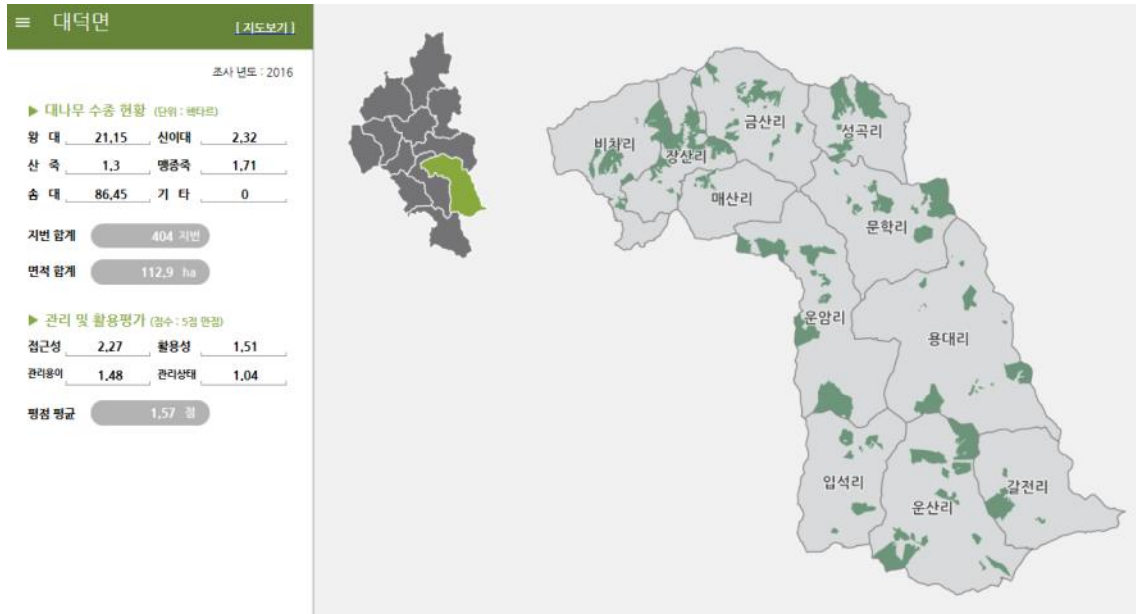
○ Damyang-eup

- Latitude 35.3225340~ / Longitude 126.9528130~



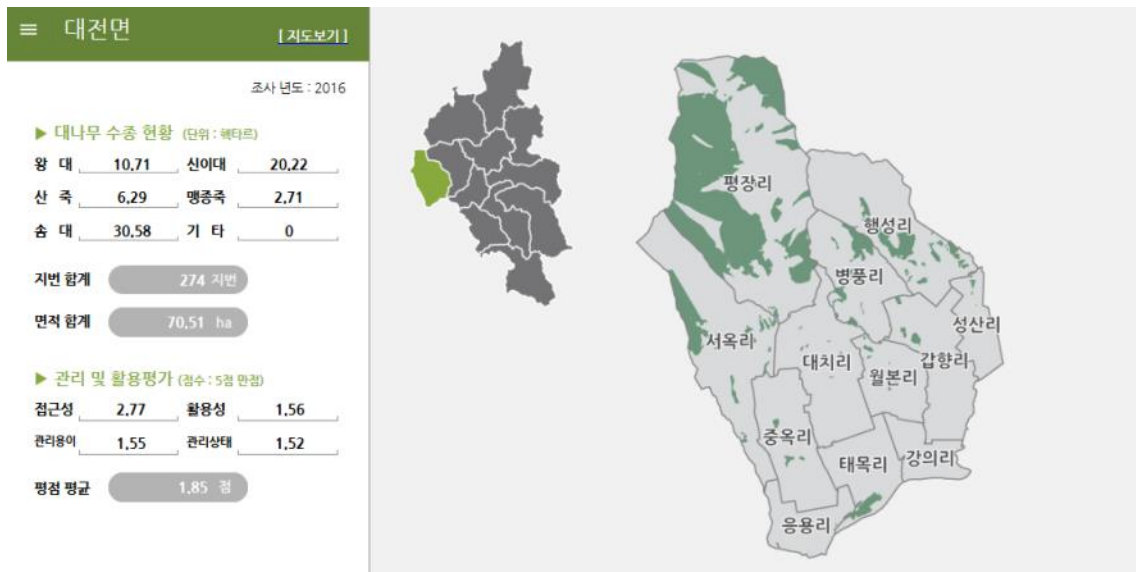
○ Daedeok-myeon

- Latitude 35.1934720~ / Longitude 127.0984630~



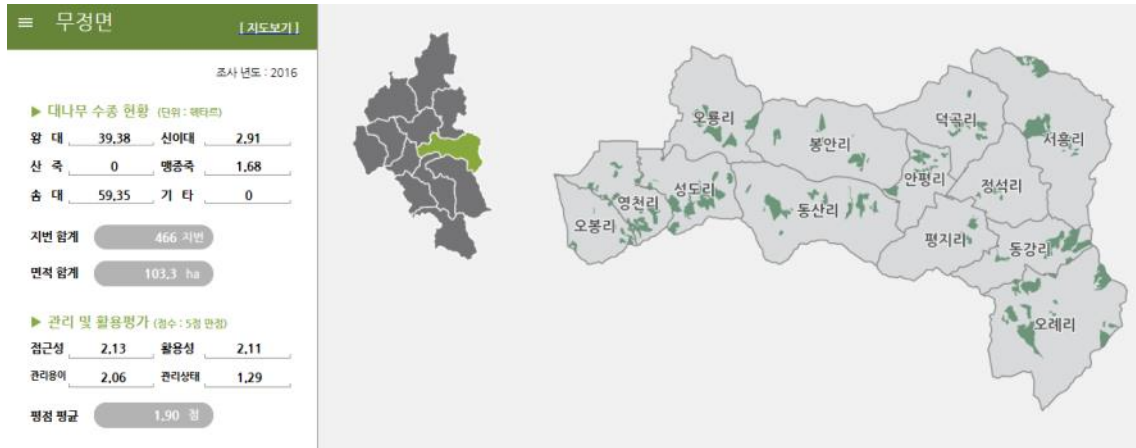
○ Daejeon-myeon

- Latitude 35.2788060~ / Longitude 126.9071310~



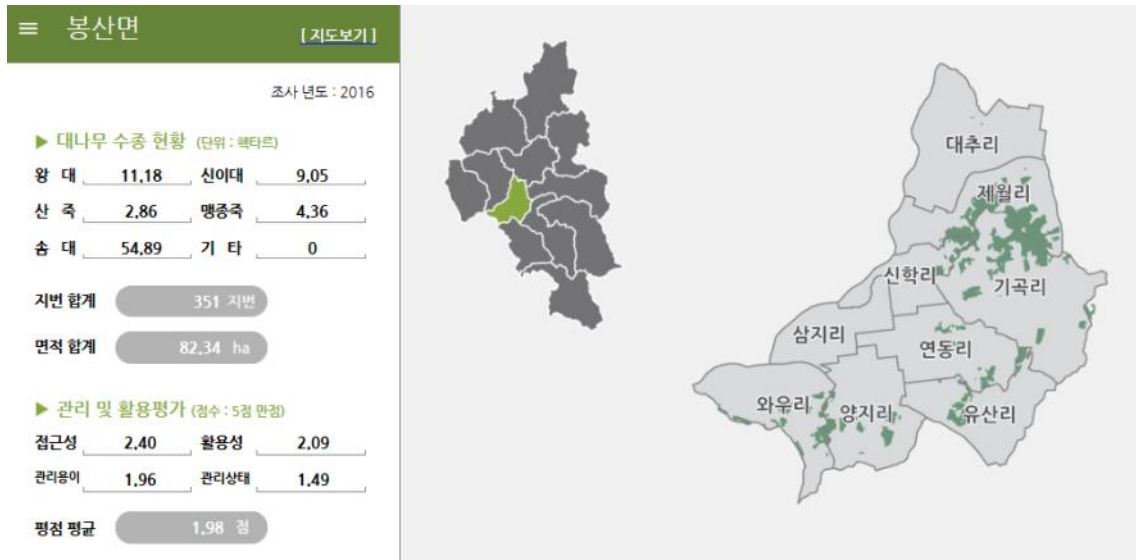
○ Mujeong-myoun

- Latitude 35.2978500~ / Longitude 127.0686120~



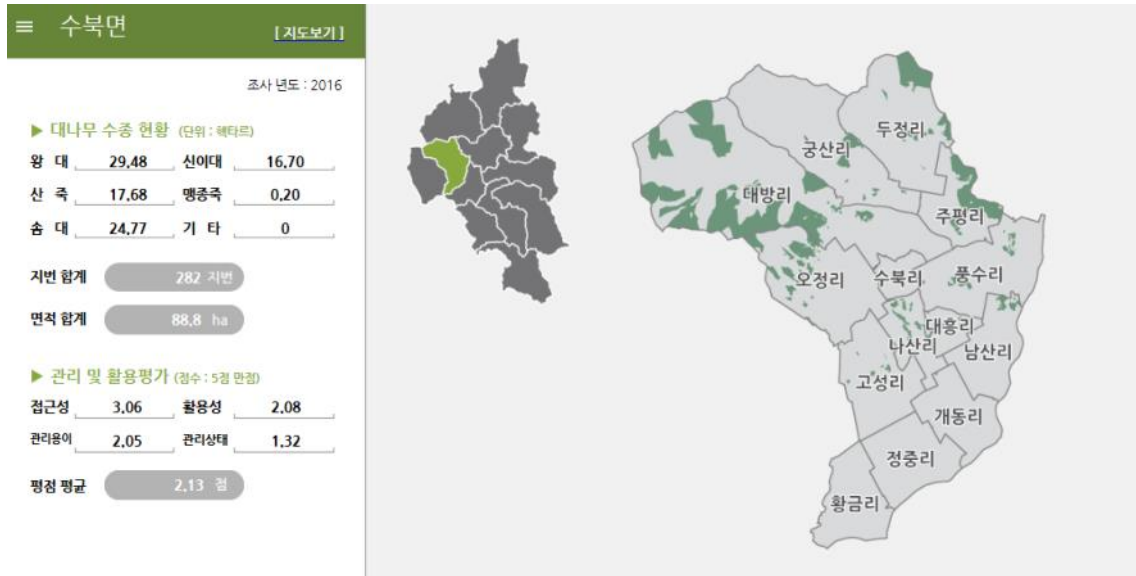
○ Bongsan-myoun

- Latitude 35.2706090~ / Longitude 126.9630740~



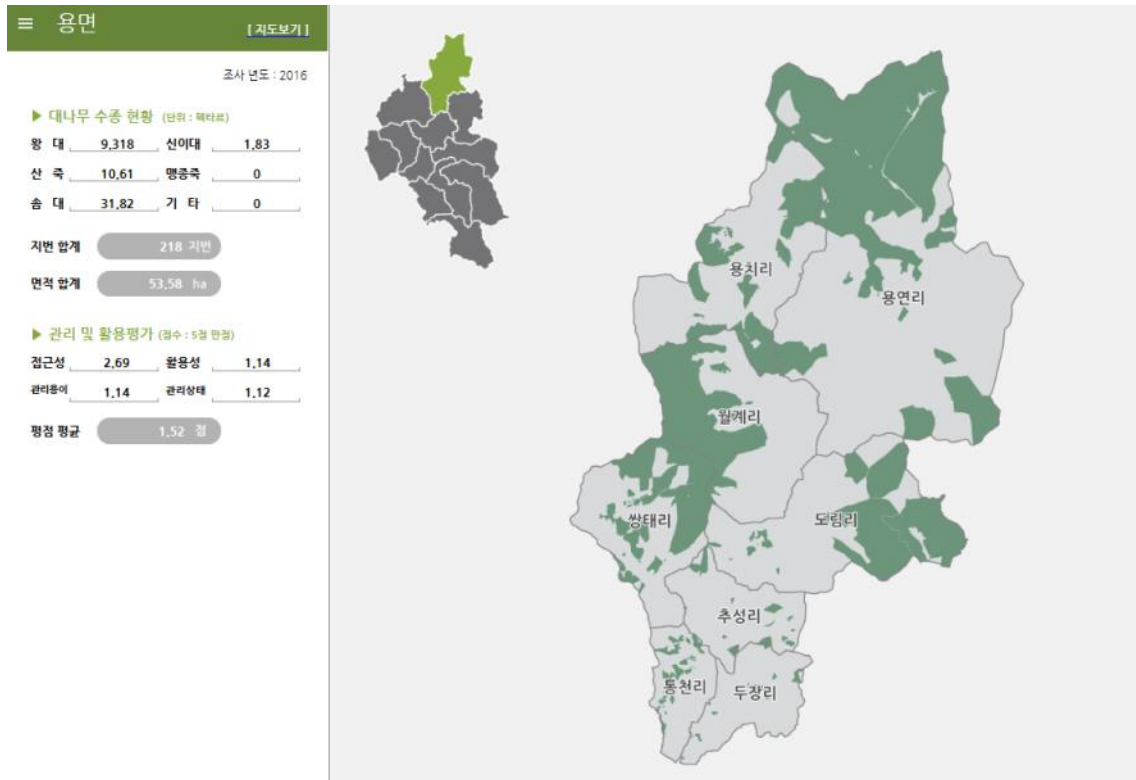
○ Subuk-myoun

- Latitude 35.2869570~ / Longitude 126.9276390~



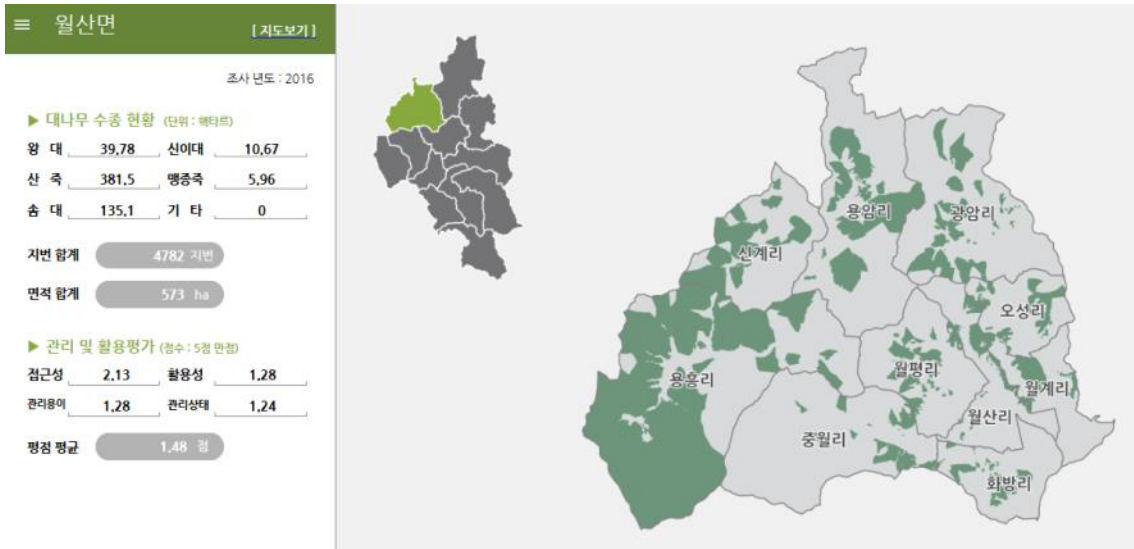
○ Yong-myoun

- Latitude 35.3823970~ / Longitude 126.9950100~



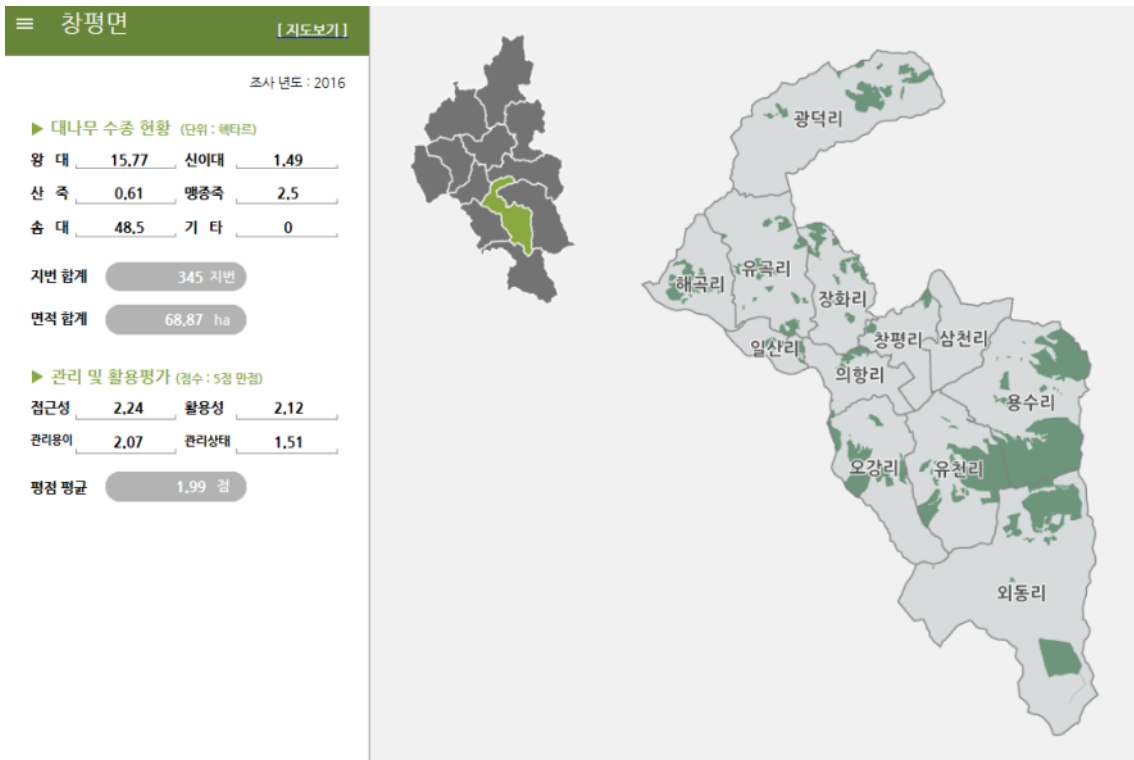
○ Wolsan-myoun

- Latitude 35.3796450~ / Longitude 126.9645090~

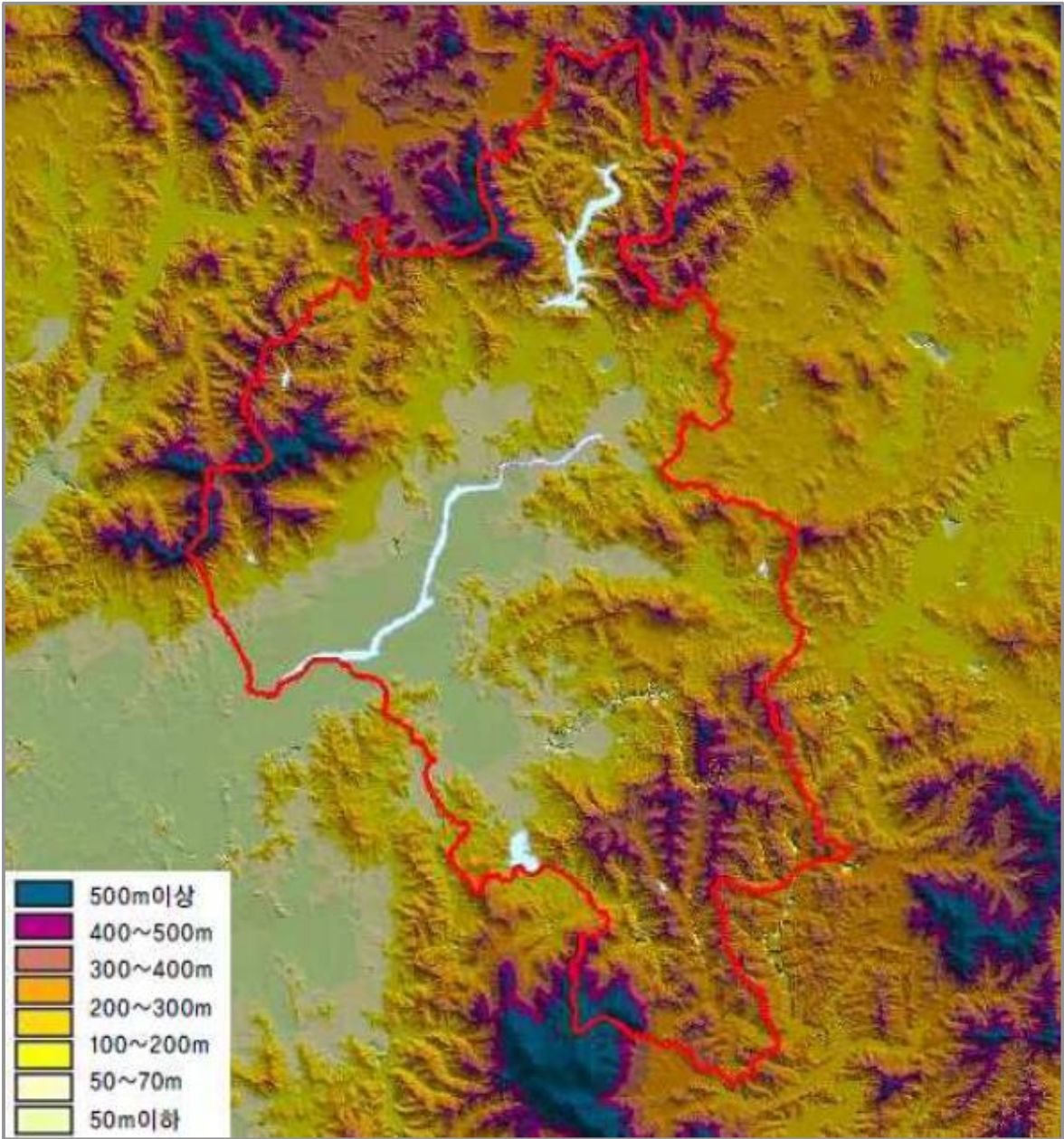


○ Changpyoung-myoun

- Latitude 35.2770860~ / Longitude 127.0068050~



#### 4. Altitude Analysis for Damyang Region





## 5. Flora and fauna in Damyang bamboo-field Agriculture System

### □ Fauna

#### 1) Mammal

학 명 (Scientific name)	국 명 (Korean name)	비 고
<b>Order Insectivora</b>	식충목	
<b>Family Talpidae</b>	두더지과	
<i>Mogera wogura</i>	두더지	
<b>Order Lagomorpha</b>	토끼목	
<b>Family Leporidae</b>	토끼과	
<i>Lepus coreanus</i>	멧토끼	
<b>Order Rodentia</b>	설치목	
<b>Family Sciuridae</b>	청설모과	
<i>Sciurus vulgaris</i>	청설모	
<i>Tamias sibiricus</i>	다람쥐	
<b>Family Muridae</b>	쥐과	
<i>Rattus norvegicus</i>	집쥐	
<i>Micromys minutus</i>	멧밭쥐	
<i>Apodemus agrarius</i>	등줄쥐	
<b>Order Carnivora</b>	식육목	
<b>Family Canidae</b>	개과	
<i>Nyctereutes procyonoides</i>	너구리	
<b>Family Felidae</b>	고양이과	
<i>Felis bengalensis</i>	살	멸 II *
<i>Felis catus</i>	고양이	
<b>Family Mustelidae</b>	족제비과	
<i>Mustela sibirica</i>	족제비	
<i>Lutra lutra</i>	수달	멸 I, 천
<b>Order Artiodactyla</b>	우제목	
<b>Family Suidae</b>	멧돼지과	
<i>Sus scrofa</i>	멧돼지	
<b>Family Cervidae</b>	사슴과	
<i>Hydropotes inermis</i>	고라니	
<b>Family Bovidae</b>	소과	
<i>Capra hircus</i>	염소	

(\*En I : Endanger species I , En II : Endanger II , Chun: Natural Treasure)

## 2) Birds

학 명 (Scientific name)	국 명 (Korean name)	비고
<b>Order Podicipediformes</b>	논병아리목	
<b>Family Podicipedidae</b>	논병아리과	
<i>Tachybaptus ruficollis</i>	논병아리	
<b>Order Ciconiformes</b>	황새목	
<b>Family Ardeidae</b>	백로과	
<i>Ardea cinerea</i>	왜가리	
<i>Egretta alba</i>	중대백로	
<i>Egretta garzetta</i>	쇠백로	
<i>Bubulcus ibis</i>	황로	
<i>Butorides striatus</i>	검은댕기해오라기	
<b>Order Anseriformes</b>	기러기목	
<b>Family Anatidae</b>	오리과	
<i>Aix galericulata</i>	원앙	천
<i>Anas penelope</i>	흥머리오리	
<i>Anas strepera</i>	알락오리	
<i>Anas crecca</i>	쇠오리	
<i>Anas platyrhynchos</i>	청둥오리	
<i>Anas poecilorhyncha</i>	흰뺨검둥오리	
<i>Aythya fuligula</i>	댕기흰죽지	
<i>Mergus merganser</i>	비오리	
<b>Order Falconiformes</b>	매목	
<b>Family Accipitridae</b>	수리과	
<i>Buteo buteo</i>	말뚝가리	
<b>Family Falconidae</b>	매과	
<i>Falco tinnunculus</i>	황조롱이	천
<b>Order Galliformes</b>	닭목	
<b>Family Phasianidae</b>	꿩과	
<i>Phasianus colchicus</i>	꿩	
<b>Order Gruiformes</b>	두루미목	
<b>Family Rallidae</b>	뜸부기과	
<i>Gallinula chloropus</i>	쇠물닭	
<i>Fulica atra</i>	물닭	

학 명 (Scientific name)	국 명 (Korean name)	비고
<b>Order Charadriiformes</b>	<b>도요목</b>	
<b>Family Recurvirostridae</b>	<b>장다리물떼새과</b>	
<i>Himantopus himantopus</i>	장다리물떼새	
<b>Family Charadriidae</b>	<b>물떼새과</b>	
<i>Charadrius placidus</i>	흰목물떼새	멸
<i>Charadrius dubius</i>	꼬마물떼새	
<b>Family Scolopacidae</b>	<b>도요과</b>	
<i>Tringa ochropus</i>	뺨뺨도요	
<i>Xenus cinereus</i>	윗부리도요	
<i>Actitis hypoleucos</i>	갯작도요	
<b>Order Columbiformes</b>	<b>비둘기목</b>	
<b>Family Columbidae</b>	<b>비둘기과</b>	
<i>Columba livia var. domestica</i>	집비둘기	
<i>Streptopelia orientalis</i>	멧비둘기	
<b>Order Cuculiformes</b>	<b>두견이목</b>	
<b>Family Cuculidae</b>	<b>두견이과</b>	
<i>Cuculus canorus</i>	빠꾸기	
<b>Order Strigiformes</b>	<b>올빼미목</b>	
<b>Family Strigidae</b>	<b>올빼미과</b>	
<i>Otus scops</i>	소쩍새	천
<b>Order Coraciiformes</b>	<b>파랑새목</b>	
<b>Family Alcedinidae</b>	<b>물총새과</b>	
<i>Alcedo atthis</i>	물총새	
<b>Family Coraciidae</b>	<b>파랑새과</b>	
<i>Eurystomus orientalis</i>	파랑새	
<b>Order Piciformes</b>	<b>딱다구리목</b>	
<b>Family Picidae</b>	<b>딱다구리과</b>	
<i>Picus canus</i>	청딱다구리	
<b>Order Passeriformes</b>	<b>참새목</b>	
<b>Family Hirundinidae</b>	<b>제비과</b>	
<i>Hirundo rustica</i>	제비	

학 명 (Scientific name)	국 명 (Korean name)	비고
<b>Family Motacillidae</b>	<b>할미새과</b>	
<i>Motacilla cinerea</i>	노랑할미새	
<i>Motacilla alba</i>	알락할미새	
<i>Motacilla lugens</i>	백할미새	
<i>Motacilla grandis</i>	검은등할미새	
<i>Anthus rubescens</i>	밭종다리	
<b>Family Pycnonotidae</b>	<b>직박구리과</b>	
<i>Hypsipetes amaurotis</i>	직박구리	
<b>Family Laniidae</b>	<b>때까치과</b>	
<i>Lanius bucephalus</i>	때까치	
<b>Family Turdidae</b>	<b>지빠귀과</b>	
<i>Zoothera dauma</i>	호랑지빠귀	
<i>Turdus pallidus</i>	흰배지빠귀	
<b>Family Panuridae</b>	<b>붉은머리오목눈이과</b>	
<i>Paradoxornis webbiana</i>	붉은머리오목눈이	
<b>Family Sylviidae</b>	<b>휘파람새과</b>	
<i>Cettia diphone</i>	휘파람새	
<i>Acrocephalus orientalis</i>	개개비	
<b>Family Paridae</b>	<b>박새과</b>	
<i>Parus ater</i>	진박새	
<i>Parus major</i>	박새	
<i>Parus varius</i>	곤줄박이	
<b>Family Ploceidae</b>	<b>참새과</b>	
<i>Passer montanus</i>	참새	
<b>Family Sturnidae</b>	<b>찌르레기과</b>	
<i>Sturnus cineraceus</i>	찌르레기	
<b>Family Corvidae</b>	<b>까마귀과</b>	
<i>Garrulus glandarius</i>	어치	
<i>Cyanopica cyana</i>	물까치	
<i>Pica pica</i>	까치	
<i>Corvus corone</i>	까마귀	

### 3) Amphibians

학 명 (Scientific name)	국 명 (Korean name)	비 고
<b>Order Caudata</b>	유미목	
<b>Family Hynobiidae</b>	도롱뇽과	
<i>Hynobius leechii</i>	도롱뇽	
<b>Order Salientia</b>	무미목	
<b>Family Bufonidae</b>	두꺼비과	
<i>Bufo gargarizans</i>	두꺼비	
<b>Family Bombinatoridae</b>	무당개구리과	
<i>Bombina orientalis</i>	무당개구리	
<b>Family Hylidae</b>	청개구리과	
<i>Hyla japonica</i>	청개구리	
<b>Family Ranidae</b>	개구리과	
<i>Rana dybowskii</i>	북방산개구리	
<i>Rana nigromaculata</i>	참개구리	
<i>Rana rugosa</i>	움개구리	
<i>Rana coreana</i>	한국산개구리	고**
<i>Rana catesbeiana</i>	황소개구리	교

(\*\*Go: Indigenous, Gyo: Disturbing species)

### 4) Reptiles

학 명 (Scientific name)	국 명 (Korean name)	비 고
<b>Order Squamata</b>	유린목	
<b>Family Colubridae</b>	뱀과	
<i>Elaphe dione</i>	누룩뱀	
<i>Elaphe rufodorsata</i>	무자치	
<i>Rhabdophis tigrinus tigrinus</i>	유혈목이	
<i>Zamenis spinalis</i>	실뱀	
<b>Family Viperidae</b>	살모사과	
<i>Agkistrodon ussuriensis</i>	쇠살모사	

## 5) Insecta

학 명 (Scientific name)	국 명 (Korean name)	비 고
<b>Order Odonata</b>	<b>잠자리목</b>	
<b>Family Coenagrionidae</b>	<b>실잠자리과</b>	
<i>Ceriagrion melanurum</i>	노란실잠자리	
<i>Ischnur asiatica</i>	아시아실잠자리	
<i>Cercion hieroglyphicum</i>	등줄실잠자리	
<i>Lyriothemis pachygastra</i>	배치레잠자리	
<b>Family Platycnemididae</b>	<b>방울실잠자리과</b>	
<i>Platycnemis philopoda</i>	방울실잠자리	
<b>Family Lestidae</b>	<b>청실잠자리과</b>	
<i>Sympecm apaedisca</i>	묵은실잠자리	
<b>Family Calopterygidae</b>	<b>물잠자리과</b>	
<i>Calopteryx atrata</i>	검은물잠자리	
<i>Calopteryx japonica</i>	물잠자리	
<b>Family Libellulidae</b>	<b>잠자리과</b>	
<i>Orthetrum albistylum</i>	밀잠자리	
<i>Crocothemis servilia</i>	고추잠자리	
<i>Sympetrum unfuscatum</i>	깃동잠자리	
<i>Sympetrum risi</i>	들깃동잠자리	
<i>Sympetrum eroticum</i>	두점박이좁잠자리	
<b>Order Mantodea</b>	<b>사마귀목</b>	
<b>Family Mantidae</b>	<b>사마귀과</b>	
<i>Tenodera aridibolia</i>	왕사마귀	
<b>Order Orthoptera</b>	<b>메뚜기목</b>	
<b>Family Tettigoniidae</b>	<b>여치과</b>	
<i>Ducetia japonica</i>	줄베짱이	
<i>Phaneroptera falcata</i>	실베짱이	
<i>Conocephalus chinensis</i>	썩새기	
<b>Family Gryllotalpidae</b>	<b>땅강아지과</b>	
<i>Gryllotalpa orientalis</i>	땅강아지	
<b>Family Tetrigidae</b>	<b>모메뚜기과</b>	
<i>Tetrix japonica</i>	모메뚜기	

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<b>Family Pyrgomorphidae</b>	<b>섬서구메뚜기과</b>	
<i>Atractomorpha lata</i>	섬서구메뚜기	
<b>Family Acrididae</b>	<b>메뚜기과</b>	
<i>Oxya japonica japonica</i>	벼메뚜기	
<i>Shirakiacris shirakii</i>	등검은메뚜기	
<i>Acrida cinerea cinerea</i>	방아깨비	
<i>Mongolotettix japonicus</i>	삼사리	
<i>Locusta migratorius</i>	풀무치	
<i>Oedaleus infernalis</i>	팔중이	
<b>Order Hemiptera</b>	<b>노린재목</b>	
<b>Family Nabidae</b>	<b>썩기노린재과</b>	
<i>Stenon abisyasumatsui</i>	미니날개썩기노린재	
<b>Family Miridae</b>	<b>장님노린재과</b>	
<i>Orthocephalus funestus</i>	암수다른장님노린재	
<i>Charagochilusangusticollis</i>	흰숨털검정장님노린재	
<i>Lygocoris nigrifulus</i>	검은빛장님노린재	
<i>Lygocoris spinolae</i>	애무늬고리장님노린재	
<i>ProboscidocoriSvaricornis</i>	큰흰숨털검정장님노린재	
<b>Family Reduviidae</b>	<b>침노린재과</b>	
<i>Sphedanolestes impressicollis</i>	다리무늬침노린재	
<b>Family Lygaeidae</b>	<b>긴노린재과</b>	
<i>Nysius plebejus</i>	애긴노린재	
<i>Pachygrontha antennata</i>	더듬이긴노린재	
<b>Family Coreidae</b>	<b>허리노린재과</b>	
<i>Acanthocorissordidus</i>	파리허리노린재	
<i>Homoeocerusunipunctatus</i>	두점배허리노린재	
<i>Hygialativentris</i>	떼허리노린재	
<i>Cletus punctiger</i>	시골가시허리노린재	
<i>Cletusschmidtii</i>	우리가시허리노린재	
<i>Molipteryx fuliginosa</i>	큰허리노린재	
<b>Family Rhopalidae</b>	<b>잡초노린재과</b>	
<i>Rhopalus sapporensis</i>	삿포로잡초노린재	
<i>Liorhyssus hyalinus</i>	투명잡초노린재	

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<b>Family Plataspidae</b>	<b>알노린재과</b>	
<i>Coptosoma parvictum</i>	희미무늬알노린재	
<b>Family Acanthosomatidae</b>	<b>뿔노린재과</b>	
<i>Acanthosoma forficula</i>	녹색가위뿔노린재	
<i>Sastragala esakii</i>	에사키뿔노린재	
<b>Family Dinidoridae</b>	<b>톱날노린재과</b>	
<i>Megymenum gracilicorne</i>	톱날노린재	
<b>Family Pentatomidae</b>	<b>노린재과</b>	
<i>Carbula putoni</i>	가시노린재	
<i>Halyomorpha halys</i>	썩덩나무노린재	
<i>Plautia stali</i>	갈색날개노린재	
<b>Order Homoptera</b>	<b>매미목</b>	
<b>Family Membracidae</b>	<b>뿔매미과</b>	
<i>Machaerotypus sibiricus</i>	외뿔매미	
<b>Family Cicadellidae</b>	<b>매미충과</b>	
<i>Bothrogonia japonica</i>	끝검은말매미충	
<b>Family Cixiidae</b>	<b>장삼벌레과</b>	
<i>Kuvera flaviceps</i>	작은깨장삼벌레	
<b>Family Cicadidae</b>	<b>매미과</b>	
<i>Cryptotympana dubia</i>	말매미	
<b>Order Neuroptera</b>	<b>폴잡자리목</b>	
<b>Family Inocelliidae</b>	<b>약대벌레과</b>	
<i>Inocellia japonica</i>	약대벌레	
<b>Order Coleoptera</b>	<b>딱정벌레목</b>	
<b>Family Carabidae</b>	<b>딱정벌레과</b>	
<i>Nebria chinensis chinensis</i>	중국먼지벌레	
<b>Family Staphylinidae</b>	<b>반날개과</b>	
<i>Aleochara curtula</i>	홍딱지바수염반날개	
<b>Family Cetoniidae</b>	<b>꽃무지과</b>	
<i>Gametis jucunda</i>	풀색꽃무지	
<b>Family Coccinellidae</b>	<b>무당벌레과</b>	



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<i>Cryptogonus orbiculus</i>	쌍무늬검은무당벌레	
<i>Harmonia axyridis</i>	무당벌레	
<i>Coccinella septempunctata</i>	칠성무당벌레	
<i>Propylea japonica</i>	꼬마남생이무당벌레	
<b>Family Oedemeridae</b>	<b>하늘소붙이과</b>	
<i>Oedemeronia lucidicollis</i>	알통다리하늘소붙이	
<b>Family Cerambycidae</b>	<b>하늘소과</b>	
<i>Leptura arcuata</i>	긴알락꽃하늘소	
<i>Anastrangalia sequensi</i>	옆검은산꽃하늘소	
<i>Agapanthia pilicornis</i>	남색초원하늘소	
<b>Family Chrydomelidae</b>	<b>잎벌레과</b>	
<i>Galerucella grisescens</i>	딸기잎벌레	
<i>Gallerucida bifasciata</i>	상아잎벌레	
<i>Aulacophora indica</i>	오이잎벌레	
<i>Crepidodera pluta</i>	알통다리잎벌레	
<i>Phygasia fulvipennis</i>	황갈색잎벌레	
<i>Thlaspida cribrata</i>	큰남생이잎벌레	
<b>Family Attelabidae</b>	<b>거위벌레과</b>	
<i>Adoderus erythropterus</i>	북방거위벌레	
<i>Cycnotrachelus coloratus</i>	노랑배거위벌레	
<i>Paracycnotrachelus longiceps</i>	왕거위벌레	
<b>Family Curculionidae</b>	<b>바구미과</b>	
<i>Mesalcidodes trifidus</i>	배자바구미	
<i>Lixus imperessiventris</i>	길쭉바구미	
<b>Order Hymenoptera</b>	<b>벌목</b>	
<b>Family Argidae</b>	<b>등에잎벌과</b>	
<i>Arge pagana pagana</i>	장미등에잎벌	
<i>Arge captiva</i>	홍가슴루리등에잎벌	
<b>Family Tenthredinidae</b>	<b>잎벌과</b>	
<i>Athalia rosae ruficornis</i>	무잎벌	
<i>Tenthredo mortivaga</i>	황호리병잎벌	

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<i>Rhogogaster nigriventris</i>	시베리아상제잎벌	
<b>Family Ichneumonidae</b>	<b>맷시벌과</b>	
<i>Chlorocryptus coreanus</i>	청뽕족맷시벌	
<i>Metopius dissectorius dissectorius</i>	줄몽톡맷시벌	
<i>Amblyjoppa cognatoria</i>	검정맷시벌	
<i>Platylabus nigricornis</i>	검정뿔맷시벌	
<b>Family Formicidae</b>	<b>개미과</b>	
<i>Crematogaster brunnea teranishii</i>	검정꼬리치레개미	
<i>Pristomyrmex pungens</i>	그물등개미	
<i>Camponotus japonicus</i>	일본왕개미	
<i>Formica japonica</i>	곰개미	
<i>Lasius hayashi</i>	하야시털개미	
<i>Paratrechina flavipes</i>	스미스개미	
<b>Family Eumenidae</b>	<b>호리병벌과</b>	
<i>Discoelius japonicus</i>	띠호리병벌	
<i>Orancistrocerus drewseni</i>	줄무늬감탕벌	
<b>Family Vespidae</b>	<b>말벌과</b>	
<i>Vespa crabro flavofasciata</i>	말벌	
<i>Polistessnelleni</i>	벌쌍살벌	
<i>Parapolybiavaria</i>	뱀허물쌍살벌	
<i>Parapolybia indica</i>	큰뱀허물쌍살벌	
<b>Family Sphecoidae</b>	<b>구멍벌과</b>	
<i>Ammophila sabulosa infesta</i>	나나니	
<i>Sceliphron madraspatanum</i>	애황나나니	
<b>Family Apidae</b>	<b>꿀벌과</b>	
<i>Eucera sociabilis</i>	긴수염줄벌	
<i>Bombus ignitus</i>	호박벌	
<i>Apis cerana</i>	재래꿀벌	
<i>Apis mellifera</i>	양봉꿀벌	
<b>Order Diptera</b>	<b>파리목</b>	
<b>Family Tipulidae</b>	<b>각다귀과</b>	

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<i>Ctenophora pictipennis fasciata</i>	대모각다귀	
<i>Nephrotoma virgata</i>	황각다귀	
<b>Family Bibionidae</b>	<b>털파리과</b>	
<i>Bibio tenebrosus</i>	검털파리	
<b>Family Stratiomyidae</b>	<b>동애등애과</b>	
<i>Ptecticus tenebrifer</i>	동애등애	
<i>Odontomyia hirayamae</i>	히라야마동애등애	
<i>Craspedometopon frontale</i>	방울동애등애	
<b>Family Asilidae</b>	<b>파리매과</b>	
<i>Laphria mitsukurii</i>	뒤영벌파리매	
<i>Promachus yesonicus</i>	파리매	
<i>Trichomachimus scutellaris</i>	검정파리매	
<b>Family Dolichopodidae</b>	<b>장다리파리과</b>	
<i>Mesorhaga nebulosa</i>	얼룩장다리파리	
<b>Family Syrphidae</b>	<b>꽃등애과</b>	
<i>Sphaerophoria menthastri</i>	꼬마꽃등애	
<i>Allograpta balteata</i>	호리꽃등애	
<i>Metasyrphus corollae</i>	별넓적꽃등애	
<i>Melanostoma mellinum</i>	광불이꽃등애	
<i>Chrysotoxum shirakii</i>	일본수염치레꽃등애	
<i>Eumerus strigatus</i>	알뿌리꽃등애	
<i>Xylota frontalis</i>	알락허리꽃등애	
<i>Syritta pipiens</i>	알통다리꽃등애	
<i>Eristalis tenax</i>	꽃등애	
<i>Eristalis arbustorum</i>	덩굴꽃등애	
<i>Eristalis cerealis</i>	배짧은꽃등애	
<i>Eristalis kyokoae</i>	큰무늬배짧은꽃등애	
<i>Helophilus virgatus</i>	수중다리꽃등애	
<b>Family Tephritidae</b>	<b>과실파리과</b>	
<i>Dacus depressus</i>	호박과실파리	
<i>Trupanea convergens</i>	고들빼기과실파리	

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<b>Family Sepsidae</b>	꼭지파리과	
<i>Sepsis monostigma</i>	꼭지파리	
<b>Family Lauxaniidae</b>	큰날개파리과	
<i>Minettia longipennis</i>	검정큰날개파리	
<b>Family Scathophagidae</b>	똥파리과	
<i>Scathophaga stercoraria</i>	똥파리	
<b>Family Calliphoridae</b>	검정파리과	
<i>Aldrichina grahami</i>	털검정파리	
<i>Lucilia illustris</i>	연두금파리	
<b>Family Sarcophagidae</b>	쉬파리과	
<i>Helicophagella melanura</i>	검정불기쉬파리	
<b>Family Tachinidae</b>	기생파리과	
<i>Gymnosoma rotundatum</i>	똥보기생파리	
<b>Order Trichoptera</b>	날도래목	
<b>Family Hydropsychidae</b>	줄날도래과	
<i>Macronema radiatum</i>	큰줄날도래	
<b>Order Lepidoptera</b>	나비목	
<b>Family Tortricidae</b>	잎말이나방과	
<i>Grapholita delineana</i>	네줄애기잎말이나방	
<b>Family Yponomeutidae</b>	집나방과	
<i>Plutella xylostella</i>	배추좀나방	
<b>Family Stathmopodidae</b>	감꼭지나방과	
<i>Oedematopoda ignipicta</i>	붉은꼬마꼭지나방	
<b>Family Pyralidae</b>	명나방과	
<i>Calamotropha paludella purella</i>	흰포충나방	
<i>Pseudocatharylla simplex</i>	은빛포충나방	
<i>Bradina geminalis</i>	외줄들명나방	
<i>Glyphodes duplicalia</i>	띠무늬들명나방	
<i>Diasemia accalis</i>	점애기들명나방	
<i>Nomophila noctuella</i>	등심무늬들명나방	
<i>Cnaphalocrocis medinalis</i>	흑명나방	

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<i>Maruca testulalis</i>	콩명나방	
<i>Hymenia recurvalis</i>	흰띠명나방	
<i>Lamoria glaucalis</i>	앞붉은부채명나방	
<i>Orthopygia glaucinalis</i>	곧은띠비단명나방	
<i>Endotricha olivacealis</i>	검은점뽕족명나방	
<b>Family Thtrididae</b>	<b>창나방과</b>	
<i>Thyris fenestrella seoulensis</i>	깜둥이창나방	
<b>Family Zygaenidae</b>	<b>알락나방과</b>	
<i>Illiberis pruni</i>	사과알락나방	
<b>Family Geometridae</b>	<b>자나방과</b>	
<i>Scopula confusa</i>	네접애기자나방	
<i>Scopula superior</i>	줄노랑흰애기자나방	
<i>Hypomecis punctinalis</i>	네눈가지나방	
<b>Family Uraniidae</b>	<b>제비나방과</b>	
<i>Acropteris iphiata</i>	제비나방	
<b>Family Sphingidae</b>	<b>박각시과</b>	
<i>Macroglossum bombylans</i>	작은검은꼬리박각시	
<b>Family Noctuidae</b>	<b>밤나방과</b>	
<i>Athetis albisignata</i>	흰점국화밤나방	
<i>Niphonyx segregata</i>	엉겅퀴밤나방	
<i>Spirama retorta</i>	태극나방	
<b>Family Hesperidae</b>	<b>팔랑나비과</b>	
<i>Lobocla bifasciata</i>	왕팔랑나비	
<i>Daimio tethys</i>	왕자팔랑나비	
<i>Parnara guttata</i>	줄점팔랑나비	
<i>Ochlodes subhyalina</i>	유리창떠들썩팔랑나비	
<b>Family Papilionidae</b>	<b>호랑나비과</b>	
<i>Papilio xuthus</i>	호랑나비	
<i>Papilio machaon</i>	산호랑나비	
<i>Papilio bianor</i>	제비나비	
<i>Papilio maackii</i>	산제비나비	

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<i>Papilio protenor</i>	남방제비나비	
<i>Eurema laeta</i>	극남노랑나비	
<b>Family Lycaenidae</b>	<b>부전나비과</b>	
<i>Everes argiades</i>	암먹부전나비	
<i>Pseudozizeeria maha</i>	남방부전나비	
<i>Celastrina argiolus</i>	푸른부전나비	
<i>Favonius orientalis</i>	큰녹색부전나비	
<i>Lycaena phlaeas</i>	작은주홍부전나비	
<b>Family Libytheidae</b>	<b>뿔나비과</b>	
<i>Libythea celtis</i>	뿔나비	
<b>Family Nymphalidae</b>	<b>네발나비과</b>	
<i>Limenitis camilla</i>	줄나비	
<i>Limenitis doerriesi</i>	제이줄나비	
<i>Polygonia c-aureum</i>	네발나비	
<i>Neptis sappho</i>	애기세줄나비	
<i>Dichorragia nesimachus</i>	먹그림나비	
<i>Argynnis paphia</i>	은줄표범나비	
<i>Argyronome laodice</i>	흰줄표범나비	
<i>Damora sagana</i>	암검은표범나비	
<i>Argyreus hyperbius</i>	암끝검은표범나비	
<i>Hestina assimilis</i>	홍점알락나비	
<i>Vanessa indica</i>	큰멋쟁이나비	
<i>Cyntia cardui</i>	작은멋쟁이나비	
<b>Family Satyridae</b>	<b>뱀눈나비과</b>	
<i>Mycalesis gotama</i>	부처나비	
<i>Mycalesis francisca</i>	부처사촌나비	
<i>Minois dryas</i>	굴뚝나비	
<i>Ypthima motschulskyi</i>	물결나비	
<i>Ypthima argus</i>	애물결나비	
<i>Lethe diana</i>	먹그늘나비	

□ Flora

학 명 (Scientific name)	국 명 (Korean name)	비 고
<b>Class Sphenopsida</b>	속새강	
<b>Order Equisetales</b>	속새목	
<b>Family Equisetaceae</b>	속새과	
<i>Equisetum arvense</i> L.	쇠뜨기	
<b>Class Filicineae</b>	고사리강	
<b>Order Filicales</b>	고사리목	
<b>Family Osmundaceae</b>	고비과	
<i>Osmunda japonica</i> Thunb.	고비	
<b>Family Schizaeaceae</b>	실고사리과	
<i>Lygodium japonicum</i> (Thunb.) Sw.	실고사리	
<b>Family Pteridaceae</b>	고사리과	
<i>Pteridium aquilinum</i> var. <i>latiusculum</i> Underw.	고사리	
<b>Family Aspidiaceae</b>	면마과	
<i>Athyrium yokoscense</i> (Fr. et Sav.) H. Christ	뱀고사리	
<i>Cyrtomium fortunei</i> J. Smith	쇠고비	
<i>Dryopteris bissetiana</i> (Bak.) C.Christ.	산족제비고사리	
<i>Dryopteris chinensis</i> (Bak.) Koidz	가는잎족제비고사리	
<i>Athyrium japonicum</i> var. <i>dimorphophyllum</i> (Koidz.) Ohwi	큰진고사리	
<b>Family Pteridaceae</b>	꼬리고사리과	
<i>Asplenium incisum</i> Thunb.	꼬리고사리	
<b>Class Gymnospermae</b>	나자식물강	
<b>Subclass Coniferophytæ</b>	구과식물아강	
<b>Order Ginkgoales</b>	은행목	
<b>Family Ginkgoaceae</b>	은행나무과	
<i>Ginkgo biloba</i> L.	은행나무	식*
<b>Order Coniferales</b>	구과목	
<b>Family Pinaceae</b>	소나무과	
<i>Pinus densiflora</i> S. et Z.	소나무	
<i>Pinus rigida</i> Miller	리기다소나무	식
<i>Pinus thunbergii</i> Parl.	곰솔	
<b>Family Taxodiaceae</b>	낙우송과	
<i>Cryptomeria japonica</i> D. Don	삼나무	식

학 명 (Scientific name)	국 명 (Korean name)	비 고
<i>Metasequoia glyptostroboides</i> Hu et Cheng	메타세쿼이아	식
<b>Family Cupressaceae</b>	<b>측백나무과</b>	
<i>Chamaecyparis obtusa</i> (S. et Z.) Endl.	편백	식
<i>Juniperus chinensis</i> var. <i>kaizuka</i> Hort.	카이즈카향나무	식
<i>Juniperus rigida</i> S. et Z.	노간주나무	식
<b>Class Angiospermae</b>	<b>피자식물강</b>	
<b>Subclass Dicotyledoneae</b>	<b>쌍자엽식물아강</b>	
<b>Order Piperales</b>	<b>후추목</b>	
<b>Family Saururaceae</b>	<b>후추과</b>	
<i>Houttuynia cordata</i> Thunb.	약모밀	귀
<b>Order Salicales</b>	<b>버드나무목</b>	
<b>Family Salicaceae</b>	<b>버드나무과</b>	
<i>Populus tomentiglandulosa</i> T. Lee	은사시나무	특
<i>Salix gracilistyla</i> Miquel	갯버들	
<i>Salix koreensis</i> Anderss.	버드나무	
<b>Order Juglandales</b>	<b>가래나무목</b>	
<b>Family Juglandaceae</b>	<b>가래나무과</b>	
<i>Platycarya strobilacea</i> S. et Z.	굴피나무	
<b>Order Fagales</b>	<b>참나무목</b>	
<b>Family Betulaceae</b>	<b>자작나무과</b>	
<i>Alnus firma</i> S. et Z.	사방오리	식
<i>Corylus heterophylla</i> var. <i>thunbergii</i> Bl.	개암나무	
<b>Family Fagaceae</b>	<b>참나무과</b>	
<i>Castanea crenata</i> S. et Z.	밤나무	식
<i>Quercus acutissima</i> Carruth.	상수리나무	
<i>Quercus aliena</i> Bl.	갈참나무	
<i>Quercus dentata</i> Thunb.	떡갈나무	
<i>Quercus mongolica</i> Fisch.	신갈나무	
<i>Quercus serrata</i> Thunb.	졸참나무	
<i>Quercus variabilis</i> Blume	굴참나무	
<b>Order Urticales</b>	<b>쐐기풀목</b>	
<b>Family Ulmaceae</b>	<b>느릅나무과</b>	
<i>Zelkova serrata</i> Makino	느티나무	식



학 명 (Scientific name)	국 명 (Korean name)	비 고
<i>Celtis sinensis</i> Pers.	팽나무	식
<b>Family Moraceae</b>	<b>뽕나무과</b>	
<i>Morus bombycis</i> Koidz.	산뽕나무	
<i>Cudrania tricuspidata</i> Bureau	꾸지뽕나무	
<b>Family Cannabinaceae</b>	<b>삼과</b>	
<i>Humulus japonicus</i> S. et Z.	환삼덩굴	
<b>Family Urticaceae</b>	<b>쐐기풀과</b>	
<i>Boehmeria platanifolia</i> Fr. et Sav.	개모시풀	
<i>Boehmeria nivea</i> (L.) Gaudich.	모시풀	
<i>Boehmeria tricuspis</i> Makino	거북꼬리	
<i>Boehmeria spicaria</i> Thunb.	좀깨잎나무	
<i>Boehmeria longispica</i> Steud.	왜모시풀	
<b>Order Polygonales</b>	<b>마디풀목</b>	
<b>Family Polygonaceae</b>	<b>마디풀과</b>	
<i>Persicaria hydropiper</i> (L.) Spach.	여뀌	
<i>Persicaria perfoliata</i> H. Gross	머느리배꼽	
<i>Persicaria senticosa</i> Gross	머느리밀씻개	
<i>Persicaria thunbergii</i> H. Gross	고마리	
<i>Polygonum aviculare</i> L.	마디풀	
<i>Rumex acetosa</i> L.	수영	
<i>Rumex crispus</i> L.	소리쟁이	귀
<i>Rumex obtusifolius</i> L.	돌소리쟁이	귀
<i>Persicaria filiforme</i> Nakai	이삭여뀌	
<i>Persicaria vulgaris</i> Webb et Moq.	봄여뀌	
<i>Rumex acetocella</i> L.	애기수영	귀, 교
<i>Persicaria longiseta</i> (Debruyn) Kitag.	개여뀌	
<i>Persicaria nodosa</i> Opiz	큰개여뀌	
<i>Persicaria yokusaiana</i> for. <i>laxiflora</i> (Meisn.) Hiyama	장대여뀌	
<b>Order Aristolochiales</b>	<b>취방울덩굴목</b>	
<b>Family Aristolochiaceae</b>	<b>취방울덩굴과</b>	
<i>Asarum sieboldii</i> Miq.	족도리풀	
<b>Order Centrospermales</b>	<b>중심자목</b>	
<b>Family Chenopodiaceae</b>	<b>명아주과</b>	

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<i>Chenopodium album</i> var. <i>centrorubrum</i> Makino	명아주	
<i>Chenopodium serotinum</i> L.	좀명아주	귀
<b>Family Amaranthaceae</b>	<b>비름과</b>	
<i>Achyranthes japonica</i> (Miq.) Nakai	쇠무릎	
<i>Amaranthus deflexus</i> L.	눈비름	
<b>Family Phytolaccaceae</b>	<b>자리공과</b>	
<i>Phytolacca americana</i> L.	미국자리공	귀
<b>Family Portulacaceae</b>	<b>쇠비름과</b>	
<i>Portulaca oleracea</i> L.	쇠비름	
<b>Family Caryophyllaceae</b>	<b>석죽과</b>	
<i>Arenaria serpyllifolia</i> L.	벼룩이자리	
<i>Cerastium holosteoides</i> var. <i>hallaisanense</i> Mizushima	점나도나물	
<i>Stellaria alsine</i> var. <i>undulata</i> Ohwi	벼룩나물	
<i>Stellaria aquatica</i> Scop.	쇠별꽃	
<i>Stellaria media</i> Villars	별꽃	
<b>Order Ranales</b>	<b>미나리아재비목</b>	
<b>Family Ranunculaceae</b>	<b>미나리아재비과</b>	
<i>Clematis apiifolia</i> DC.	사위질빵	
<i>Clematis mandshurica</i> Rupr.	으아리	
<i>Ranunculus cantoniensis</i> Dc.	털개구리미나리	
<i>Ranunculus chinensis</i> Bunge	젓가락나물	
<i>Ranunculus sceleratus</i> L.	개구리자리	
<i>Semiaquilegia adoxoides</i> (DC.) Makino	개구리발톱	
<i>Clematis trichotoma</i> Nakai	할미밀망	특
<b>Family Lardizabalaceae</b>	<b>매자나무과</b>	
<i>Nandina domestica</i> Thunb.	남천	
<b>Family Berberidaceae</b>	<b>으름덩굴과</b>	
<i>Akebia quinata</i> Decne.	으름	
<b>Family Menispermaceae</b>	<b>방기과</b>	
<i>Cocculus trilobus</i> Dc.	댕댕이덩굴	
<b>Order Magnoliales</b>	<b>목련목</b>	
<b>Family Magnoliceae</b>	<b>목련과</b>	
<i>Magnolia kobus</i> A.P. DC.	목련	식

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<b>Family Lauraceae</b>	<b>녹나무과</b>	
<i>Lindera glauca</i> Bl.	감태나무	
<i>Lindera obtusiloba</i> Bl.	생강나무	
<b>Order Papaverales</b>	<b>양귀비목</b>	
<b>Family Papaveraceae</b>	<b>양귀비과</b>	
<i>Chelidonium majus</i> var. <i>asiaticum</i> (Hara) Ohwi	애기똥풀	
<b>Family Fumariaceae</b>	<b>현호색과</b>	
<i>Corydalis incisa</i> Pers.	자주괴불주머니	
<b>Family Fumariaceae</b>	<b>현호색과</b>	
<i>Corydalis incisa</i> Pers.	자주괴불주머니	
<i>Corydalis speciosa</i> Maxim.	산괴불주머니	
<i>Corydalis turtschaninovii</i> Bess.	현호색	
<i>Corydalis turtschaninovii</i> var. <i>linearis</i> (Regel) Nakai.	땃잎현호색	
<b>Family Cruciferae</b>	<b>십자화과</b>	
<i>Brassica campestris</i> subsp. <i>napus</i> var. <i>nippo-oleifera</i> Makino	유채	
<i>Brassica juncea</i> var. <i>integrifolia</i> Sinsk.	갓	귀
<i>Capsella bursa-pastoris</i> (L.) Medicus	냉이	
<i>Cardamine flexuosa</i> With.	황새냉이	
<i>Cardamine lyrata</i> Bunge	논냉이	
<i>Lepidium apetalum</i> Willd.	다닥냉이	귀
<i>Rorippa cantoniensis</i> Ohwi	좁개갓냉이	
<i>Rorippa islandica</i> (Ode.) Borb.	속속이풀	
<i>Thlaspi arvense</i> L.	말냉이	귀
<b>Order Rosales</b>	<b>장미목</b>	
<b>Family Crassulaceae</b>	<b>돌나물과</b>	
<i>Sedum sarmentosum</i> Bunge	돌나물	
<b>Family Rosaceae</b>	<b>장미과</b>	
<i>Duchesnea chrysantha</i> (Zoll. et Morr.) Miquel	뱀딸기	
<i>Potentilla fragarioides</i> var. <i>major</i> Max.	양지꽃	
<i>Potentilla freyniana</i> Bornm.	세잎양지꽃	
<i>Prunus mume</i> S. et Z.	매실나무	식
<i>Prunus sargentii</i> Rehder	산벚나무	
<i>Prunus serrulata</i> var. <i>spontanea</i> (Maxim.) Wils.	벚나무	식

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Rubus crataegifolius</i> Bunge	산딸기	
<i>Rubus parvifolius</i> L.	명석딸기	
<i>Sanguisorba officinalis</i> L.	오이풀	
<i>Spiraea prunifolia</i> for. <i>simpliciflora</i> Nakai	조팝나무	식
<i>Stephanandra incisa</i> Zabel	국수나무	
<i>Pyracantha angustifolia</i> Schneid.	피라칸다	식
<i>Geum japonicum</i> Thunb.	뱀무	
<b>Family Leguminosae</b>	<b>콩과</b>	
<i>Aeschynomene indica</i> L.	자귀풀	
<i>Albizia julibrissin</i> Durazz.	자귀나무	
<i>Amorpha fruticosa</i> L.	족제비싸리	귀
<i>Astragalus sinicus</i> L.	자운영	귀
<i>Glycine soja</i> S. et Z.	돌콩	
<i>Sophora flavescens</i> Aiton	고삼	
<i>Indigofera kirilowii</i> Maxim.	땅비싸리	
<i>Lespedeza bicolor</i> Turcz.	싸리	
<i>Lespedeza maximowiczii</i> C.K. Schn.	조록싸리	
<i>Pueraria thunbergiana</i> Benth.	취	
<i>Rhynchosia volubilis</i> Lour.	여우콩	
<i>Dunbaria villosa</i> (Thunb.) Makino	여우팔	
<i>Robinia pseudo-acacia</i> L.	아까시나무	귀
<i>Robinia pseudo-acacia</i> L.	아까시나무	귀
<i>Trifolium repens</i> L.	토끼풀	귀
<i>Vicia angustifolia</i> var. <i>segetilis</i> K. Koch.	살갈퀴	
<i>Vicia amoena</i> Fisch.	갈퀴나물	
<i>Vicia cracca</i> L.	등갈퀴나물	
<i>Vicia hirsuta</i> S.F. Gray	새완두	
<i>Vicia tetrasperma</i> Schreb.	얼치기완두	
<i>Lespedeza pilosa</i> (Thunb.) S. et Z.	괭이싸리	
<i>Trifolium pratense</i> L.	붉은토끼풀	
<i>Kummerowia stipulacea</i> (Maxim.) Makino	등근매듭풀	
<i>Desmodium oxyphyllum</i> DC.	도독놈의갈고리	
<i>Vicia japonica</i> A. Gray	넓은잎갈퀴	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Medicago lupulina</i> L.	잔개자리	귀
<b>Order Geraniales</b>	<b>쥐손이풀목</b>	
<b>Family Geraniaceae</b>	<b>쥐손이풀과</b>	
<i>Geranium sibiricum</i> L.	쥐손이풀	
<b>Family Oxalidaceae</b>	<b>괭이밥과</b>	
<i>Oxalis corniculata</i> L.	괭이밥	
<i>Oxalis stricta</i> Linnaeus, Sp.	선괭이밥	
<i>Oxalis corymbosa</i> DC.	자주괭이밥	귀,식
<b>Family Rutaceae</b>	<b>윤향과</b>	
<i>Poncirus trifoliata</i> Rafin.	탱자나무	III,식
<i>Zanthoxylum piperitum</i> A.P. DC.	초피나무	
<i>Zanthoxylum piperitum</i> A.P. DC.	초피나무	
<i>Zanthoxylum schinifolium</i> S. et Z.	산초나무	
<b>Family Meliaceae</b>	<b>멀구슬나무과</b>	
<i>Melia azedarach</i> var. <i>japonica</i> Makino	멀구슬나무	
<b>Family Polygalaceae</b>	<b>원지과</b>	
<i>Polygala japonica</i> Houtt	애기풀	
<b>Family Euphorbiaceae</b>	<b>대극과</b>	
<i>Euphorbia humifusa</i> Willd.	땅빈대	귀
<i>Mallotus japonicus</i> Muell. Arg.	예덕나무	
<i>Daphniphyllum macropodum</i> Miq.	굴거리나무	식
<i>Acalypha australis</i> L.	깨풀	
<i>Phyllanthus ussuriensis</i> Rupr. et Maxim	여우주머니	
<b>Order Sapindales</b>	<b>무환자나무목</b>	
<b>Family Anacardiaceae</b>	<b>옻나무과</b>	
<i>Rhus chinensis</i> Mill.	붉나무	
<i>Rhus trichocarpa</i> Miq.	개옻나무	
<b>Family Aquifoliaceae</b>	<b>감탕나무과</b>	
<i>Ilex crenata</i> Thunb.	광광나무	식
<i>Ilex cornuta</i> Lindl.	호랑가시나무	식
<b>Family Celastraceae</b>	<b>노박덩굴과</b>	
<i>Celastrus orbiculatus</i> Thunb.	노박덩굴	
<i>Euonymus japonica</i> Thunb.	사철나무	식

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<b>Family Staphyleaceae</b>	<b>고추나무과</b>	
<i>Euscaphis japonica</i> (Thunb.) Kanitz.	말오줌때	
<b>Family Aceraceae</b>	<b>단풍나무과</b>	
<i>Acer buergerianum</i> Miq.	중국단풍	식
<i>Acer ginnala</i> Maxim.	신나무	
<i>Acer palmatum</i> Thunb.	단풍나무	식
<i>Acer pseudo-sieboldianum</i> (Pax.) Kom.	당단풍	식
<b>Order Rhamnales</b>	<b>갈매나무목</b>	
<b>Family Vitaceae</b>	<b>포도과</b>	
<i>Parthenocissus tricuspidata</i> (S. et Z.) Planch.	담쟁이덩굴	
<i>Ampelopsis brevipedunculata</i> var. <i>heterophylla</i> (Thunb.) Hara	개머루	
<i>Vitis thunbergii</i> var. <i>sinuata</i> (Regel) Rehder	까마귀머루	
<b>Order Parietales</b>	<b>축막태좌목</b>	
<b>Family Theaceae</b>	<b>차나무과</b>	
<i>Camellia japonica</i> L.	동백나무	식
<i>Eurya japonica</i> Thunb.	사스레피나무	식
<i>Thea sinensis</i> L.	차나무	식
<i>Stewartia koreana</i> Maxim.	노각나무	식
<b>Family Violaceae</b>	<b>제비꽃과</b>	
<i>Viola acuminata</i> Ledebour	줄방제비꽃	
<i>Viola dissecta</i> var. <i>chaerophylloides</i> (Regel) Makino	남산제비꽃	
<i>Viola mandshurica</i> W. Becker	제비꽃	
<i>Viola rossii</i> Hemsl	고갈제비꽃	
<i>Viola japonica</i> Langsd.	왜제비꽃	
<i>Viola lactiflora</i> Nakai	흰젓제비꽃	
<i>Viola selkirkii</i> Pursh	외제비꽃	
<i>Viola yedoensis</i> Makino	호제비꽃	
<b>Order Myrtales</b>	<b>도금양목</b>	
<b>Family Elaeagnaceae</b>	<b>보리수나무과</b>	
<i>Elaeagnus umbellata</i> Thunb.	보리수나무	
<b>Family Lythraceae</b>	<b>부처꽃과</b>	
<i>Lagerstromia indica</i> L.	배롱나무	식
<b>Family Onagraceae</b>	<b>바늘꽃과</b>	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Oenothera odorata</i> Jacq.	달맞이꽃	귀
<b>Family Punicaceae</b>	<b>석류과</b>	
<i>Punica granatum</i> L.	석류	식
<b>Order Umbellales</b>	<b>산형화목</b>	
<b>Family Araliaceae</b>	<b>두릅나무과</b>	
<i>Aralia elata</i> Seem.	두릅나무	식
<i>Hedera rhombea</i> Bean	송악	
<b>Family Umbelliferae</b>	<b>산형과</b>	
<i>Hydrocotyle sibthorpioides</i> Lamarck	피막이풀	
<i>Hydrocotyle maritima</i> Honda	선피막이	
<i>Oenanthe javanica</i> (Bl.) DC.	미나리	
<i>Torilis japonica</i> (Houtt.) DC.	사상자	
<b>Order Ericales</b>	<b>진달래목</b>	
<b>Family Cornaceae</b>	<b>층층나무과</b>	
<i>Cornus controversa</i> Hemsley	층층나무	
<b>Family Pyrolaceae</b>	<b>노루발과</b>	
<i>Pyrola japonica</i> Klenze	노루발	
<b>Family Ericaceae</b>	<b>진달래과</b>	
<i>Rhododendron lateritium</i> Planch	영산홍	식
<i>Rhododendron mucronulatum</i> Turcz.	진달래	
<i>Rhododendron schlippenbachii</i> Max.	철쭉꽃	식
<i>Rhododendron yedoense</i> var. <i>poukhanense</i> (Lev) Nakai	산철쭉	
<i>Vaccinium oldhami</i> Miq.	정금나무	
<b>Order Primulales</b>	<b>앵초목</b>	
<b>Family Primulaceae</b>	<b>앵초과</b>	
<i>Androsace umbellata</i> (Lour.) Merr.	봄맞이	
<i>Lysimachia clethroides</i> Duby	큰까치수영	
<b>Order Ebenales</b>	<b>감나무목</b>	
<b>Family Ebenaceae</b>	<b>감나무과</b>	
<i>Diospyros kaki</i> Thunb.	감나무	식
<b>Family Symplocaceae</b>	<b>노린재나무과</b>	
<i>Symplocos chinensis</i> for. <i>pilosa</i> (Nak.) Ohwi	노린재나무	
<i>Symplocos paniculata</i> Miq.	검노린재	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<b>Family Styracaceae</b>	<b>때죽나무과</b>	
<i>Styrax japonica</i> S. et Z.	때죽나무	
<b>Order Gentianales</b>	<b>용담목</b>	
<b>Family Oleaceae</b>	<b>물푸레나무과</b>	
<i>Forsythia koreana</i> Nakai	개나리	특,식
<i>Fraxinus rhynchophylla</i> Hance	물푸레나무	
<i>Ligustrum japonicum</i> Thunb.	광나무	식
<i>Ligustrum obtusifolium</i> S. et Z.	쥐똥나무	
<i>Syringa dilatata</i> Nakai	수수꽃다리	식
<i>Fraxinus sieboldiana</i> Blume	쇠물푸레	
<b>Family Gentianaceae</b>	<b>용담과</b>	
<i>Gentiana zollingeri</i> Fawc.	큰구슬봉이	
<b>Family Apocynaceae</b>	<b>헝죽도과</b>	
<i>Trachelospermum asiaticum</i> var. <i>intermedium</i> Nakai	마삭줄	
<b>Family Asclepiadaceae</b>	<b>박주가리과</b>	
<i>Metaplexis japonica</i> (Thunb.) Makino	박주가리	
<b>Order Tubiflorales</b>	<b>통꽃식물목</b>	
<b>Family Borraginaceae</b>	<b>메꽃과</b>	
<i>Quamoclit angulata</i> Bojer	등근잎유홍초	귀
<i>Calystegia japonica</i> (Thunb.) Choisy	메꽃	
<i>Cuscuta australis</i> R. Br.	실새삼	
<i>Cuscuta japonica</i> Choisy.	새삼	
<b>Family Borraginaceae</b>	<b>지치과</b>	
<i>Trigonotis peduncularis</i> Benth	꽃마리	
<b>Family Verbenaceae</b>	<b>마편초과</b>	
<i>Callicarpa dichotoma</i> Raeuschel	좁작살나무	
<i>Callicarpa japonica</i> Thunb.	작살나무	
<b>Family Labiatae</b>	<b>꿀풀과</b>	
<i>Ajuga decumbens</i> Thunb.	금창초	
<i>Lamium amplexicaule</i> L.	광대나물	
<i>Lamium purpureum</i> L.	자주광대나물	귀
<i>Leonurus sibiricus</i> L.	익모초	
<i>Mosla punctulata</i> (Gmel.) Nakai	들깨풀	



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<i>Stachys riederi</i> var. <i>japonica</i> Miq.	석잠풀	
<i>Prunella vulgaris</i> var. <i>lilacina</i> Nakai	꿀풀	
<i>Salvia plebeia</i> R. Br.	배암차즈기	
<i>Clinopodium gracile</i> (Benth.) O. Kuntze	애기탑꽃	
<i>Isodon inflexus</i> (Thunb.) Kudo	산박하	
<i>Clinopodium chinense</i> var. <i>parviflorum</i> (Kudo) Hara	층층이꽃	
<i>Elsholtzia ciliata</i> Hylander	향유	
<b>Family Solanaceae</b>	<b>가지과</b>	
<i>Solanum nigrum</i> L.	까마중	
<i>Solanum lyratum</i> Thunb.	배풍등	
<b>Family Scrophulariaceae</b>	<b>현삼과</b>	
<i>Mazus japonicus</i> (Thunb.) Kuntze	주름잎	
<i>Paulownia tomentosa</i> (Thunb.) Steud.	참오동	
<i>Vandellia angustifolia</i> Benth.	논뚝외풀	
<i>Veronica didyma</i> var. <i>lilacina</i> (Hara) Yamazaki	개불알풀	
<i>Veronica persica</i> Poir.	큰개불알풀	귀
<i>Mazus miquelii</i> Makino	주운주름잎	
<i>Vandellia crustacea</i> (L.) Benth	외풀	
<b>Family Acanthaceae</b>	<b>쥐꼬리망초과</b>	
<i>Justicia procumbens</i> L.	쥐꼬리망초	
<b>Order Plantaginales</b>	<b>질경이목</b>	
<b>Family Plantaginaceae</b>	<b>질경이과</b>	
<i>Plantago asiatica</i> L.	질경이	
<b>Order Rubiales</b>	<b>꼭두서니목</b>	
<b>Family Rubiaceae</b>	<b>꼭두서니과</b>	
<i>Galium spurium</i> L.	갈퀴덩굴	
<i>Rubia akane</i> Nakai	꼭두서니	
<i>Paederia scandens</i> (Lour.) Merr.	계요등	
<i>Serissa japonica</i> Thunb.	백정화	식
<b>Family Caprifoliaceae</b>	<b>인동과</b>	
<i>Lonicera japonica</i> Thunb.	인동	
<i>Viburnum dilatatum</i> Thunb.	가막살나무	
<i>Viburnum erosum</i> Thunb.	덜꿩나무	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<b>Order Cucurbitales</b>	<b>박목</b>	
<b>Family Cucurbitaceae</b>	<b>박과</b>	
<i>Trichosanthes kirilowii</i> Maxim.	하늘타리	
<i>Melothria japonica</i> Maxim.	새박	
<b>Order Campanulales</b>	<b>초롱꽃목</b>	
<b>Family Campanulaceae</b>	<b>초롱꽃과</b>	
<i>Codonopsis lanceolata</i> (S. et Z.) Trautv.	더덕	
<i>Platycodon grandiflorum</i> (Jacq) A.DC.	도라지	
<b>Family Compositae</b>	<b>국화과</b>	
<i>Artemisia keiskeana</i> Miq.	맑은대쑥	
<i>Artemisia montana</i> Pamp.	산쑥	
<i>Artemisia princeps</i> Pampan.	쑥	
<i>Artemisia stolonifera</i> (Max.) Kom.	넓은잎외잎쑥	
<i>Bidens bipinnata</i> L.	도깨비바늘	
<i>Bidens frondosa</i> L.	미국가막사리	귀
<i>Cirsium japonicum</i> var. <i>ussuriense</i> Kitamura	엉겅퀴	
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore.	주홍서나물	귀
<i>Eclipta prostrata</i> L.	한련초	
<i>Erigeron annuus</i> (L.) Pers.	개망초	귀
<i>Erigeron canadensis</i> L.	망초	귀
<i>Gnaphalium affine</i> D. Don	떡쑥	
<i>Galinsoga ciliata</i> (Raf.) Blake	털별꽃아재비	귀
<i>Hemistepta lyrata</i> Bunge	지칭개	
<i>Lactuca indica</i> var. <i>laciniata</i> Hara	왕고들빼기	
<i>Petasites japonicus</i> (S. et Z.) Max.	머위	
<i>Helianthus tuberosus</i> L.	뚱딴지	귀
<i>Senecio vulgaris</i> L.	개쑥갓	귀
<i>Sonchus asper</i> (L.) Hill	큰방가지뚱	귀
<i>Tagetes minuta</i> L.	만수국아재비	귀
<i>Taraxacum coreanum</i> Nakai	흰민들레	
<i>Taraxacum officinale</i> Weber	서양민들레	귀
<i>Taraxacum platycarpum</i> Dahlstedt	민들레	
<i>Xanthium canadense</i> Mill.	큰도꼬마리	귀

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Xanthium strumarium</i> L.	도꼬마리	귀
<i>Youngia denticulata</i> Kitamura	이고들빼기	
<i>Youngia japonica</i> (L.) DC.	뽕리뱅이	
<i>Youngia sonchifolia</i> Max.	고들빼기	
<i>Coreopsis drummondii</i> Torr. et Gray	금계국	
<i>Coreopsis tinctoria</i> Nutt.	기생초	귀
<i>Ambrosia artemisiifolia</i> var. <i>elatior</i> Descourtils	돼지풀	귀,교
<i>Cosmos bipinnatus</i> Cav.	코스모스	귀
<i>Campanula punctata</i> Lam.	초롱꽃	
<i>Erigeron bonariensis</i> L.	실망초	
<i>Siegesbeckia glabrescens</i> Makino	진득찰	
<i>Chrysanthemum boreale</i> Makino	산국	
<i>Aster scaber</i> Thunb.	참취	
<i>Leibnitzia anandria</i> (L.) Nakai	숨나물	
<i>Ixeris dentata</i> (Thunb.) Nakai	씀바귀	
<i>Ixeris chinensis</i> var. <i>strigosa</i> (Lev. et Vnt.) Ohwi	선씀바귀	
<b>Subclass Monocotyledoneae</b>	<b>단자엽식물아강</b>	
<b>Order Pandanales</b>	<b>부들목</b>	
<b>Family Typhaceae</b>	<b>부들과</b>	
<i>Typha orientalis</i> Presl	부들	
<b>Order Alismatales</b>	<b>택사목</b>	
<b>Family Potamogetonaceae</b>	<b>가래과</b>	
<i>Potamogeton crispus</i> L.	말즘	
<b>Order Graminales</b>	<b>벼목</b>	
<b>Family Gramineae</b>	<b>벼과</b>	
<i>Agropyron tsukushiense</i> var. <i>transiens</i> Ohwi	개밀	
<i>Agrostis clavata</i> var. <i>nukabo</i> Ohwi	겨이삭	
<i>Alopecurus aequalis</i> var. <i>amurensis</i> (Kom.) Ohwi	뚝새풀	
<i>Arundinella hirta</i> (Thunb.) Tanaka	새	
<i>Avena fatua</i> L.	메귀리	귀

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Bromus japonicus</i> Thunb.	참새귀리	
<i>Digitaria sanguinalis</i> (L.) Scop.	바랭이	
<i>Echinochloa crus-galli</i> (L.) Beauv.	돌피	
<i>Elymus sibiricus</i> L.	큰이삭풀	
<i>Eragrostis ferruginea</i> (Thunb.) P. Beauv.	그령	
<i>Dactylis glomerata</i> L.	오리새	귀
<i>Eragrostis multicaulis</i> Steud.	비노리	
<i>Festuca parvigluma</i> Steud.	김의털아재비	
<i>Imperata cylindrica</i> var. <i>koenigii</i> Durand et Schinz	띠	
<i>Miscanthus sacchariflorus</i> (Max.) Benth.	물억새	
<i>Miscanthus sinensis</i> var. <i>purpurascens</i> Rendle	억새	
<i>Oplismenus undulatifolius</i> (Ard.) Rcem. et Schult.	주름조개풀	
<i>Panicum bisulcatum</i> Thunb.	개기장	
<i>Pennisetum alopecuroides</i> (L.) Spreng.	수크령	
<i>Phragmites communis</i> Trin.	갈대	
<i>Phragmites japonica</i> Steud.	달뿌리풀	
<i>Phyllostachys bambusoides</i> S. et Z.	왕대	
<i>Phyllostachys nigra</i> var. <i>henonis</i> Staff	숨대	
<i>Zizania latifolia</i> Turcz.	줄	
<i>Phyllostachys pubescens</i> Mazel	죽순대	
<i>Poa annua</i> L.	새포아풀	
<i>Pseudosasa japonica</i> Makino	이대	
<i>Sasa borearis</i> (Hack.) Makino	조릿대	
<i>Setaria faberi</i> Hermann	가을강아지풀	
<i>Setaria glauca</i> (L.) Beauv.	금강아지풀	
<i>Setaria viridis</i> (L.) Beauv.	강아지풀	
<i>Spodiopogon sibiricus</i> Trin.	큰기름새	
<i>Sporobolus elongatus</i> R. Br.	쥐꼬리새풀	
<i>Themeda triandra</i> var. <i>japonica</i> Makino	솔새	
<i>Zoysia japonica</i> Steud.	잔디	
<i>Cymbopogon tortilis</i> var. <i>geringii</i> (Steud.) Hand.-Mazz.	개솔새	
<b>Order Cyperales</b>	<b>사초목</b>	
<b>Family Cyperaceae</b>	<b>사초과</b>	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Carex bostrychostigma</i> Max.	길뚝사초	
<i>Carex dimorpholepis</i> Steud.	이삭사초	
<i>Carex dispalata</i> Boott	삿갓사초	
<i>Carex fernaldiana</i> Lev. et Vnt.	실사초	
<i>Carex humilis</i> Leyss.	산거울	
<i>Carex lanceolata</i> Boott	그늘사초	
<i>Carex siderosticta</i> Hance	대사초	
<i>Carex neurocarpa</i> Max.	괭이사초	
<b>Order Arales</b>	<b>천남성목</b>	
<b>Family Lemnaceae</b>	<b>개구리밥과</b>	
<b>Order Commelinales</b>	<b>닭의장풀목</b>	
<b>Family Commelinaceae</b>	<b>닭의장풀과</b>	
<i>Commelina communis</i> L.	닭의장풀	
<b>Order Juncales</b>	<b>굴풀목</b>	
<b>Family Juncaceae</b>	<b>굴풀과</b>	
<i>Juncus effusus</i> var. <i>decipiens</i> Buchen.	골풀	
<i>Luzula capitata</i> (Miq.) Miq.	평의밥	
<b>Order Liliales</b>	<b>백합목</b>	
<b>Family Liliaceae</b>	<b>백합과</b>	
<i>platyphylla</i> Wang et Tang	맥문동	식
<i>Smilax china</i> L.	청미래덩굴	
<i>Smilax sieboldii</i> Miq.	청가시덩굴	
<i>Tulipa edulis</i> Bak.	산자고	
<i>Hosta longipes</i> (Fr. et Sav.) Matsumura	비비추	
<i>Hemerocallis fulva</i> L.	원추리	
<i>Polygonatum odoratum</i> var. <i>pluriflorum</i> Ohwi	동굴레	
<i>Disporum smilacinum</i> A. Gray	애기나리	
<i>Scilla scilloides</i> (Lind.) Druce	무릇	
<i>Allium thunbergii</i> G. Don	산부추	
<i>Disporum sessile</i> D. Don	운판나물	
<i>Polygonatum lasianthum</i> var. <i>coreanum</i> Nakai	죽대	
<b>Family Dioscoreaceae</b>	<b>마과</b>	
<i>Dioscorea batatas</i> Decne.	마	

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<i>Dioscorea japonica</i> Thunb.	참마	
<i>Dioscorea quinqueloba</i> Thunb.	단풍마	
<b>Family Iridaceae</b>	<b>붓꽃과</b>	
<i>Iris pseudoacorus</i> L.	노랑꽃창포	식
<i>Iris rossii</i> Bak.	각시붓꽃	
<b>Order Orchidales</b>	<b>난초목</b>	
<b>Family Orchidaceae</b>	<b>난초과</b>	
<i>Cymbidium goeringii</i> Reichb. fil.	보춘화	

(\*Teuk: Specialty, Gwi : Naturalized, Sik : Planted)

## 6. Introduced species in Damyang County

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Phyllostachys fimbriatigula</i> Wen	각죽	
<i>Bambusa glaucescens</i> for. <i>albo-striata</i> Muroiet Sugimoto	간근봉황죽	
<i>Shibataea.chiangshanensis</i> Wen	강산왜죽	
<i>Phyllostachys sulphurea</i> cv. <i>Viridis</i>	강죽	
<i>Pleiolblastus juxianensis</i> Wenetal	거현고죽	
<i>Phyllostachys aureosulcata</i> for. <i>pekinensis</i>	경죽	
<i>Phyllostachys prominens</i> W.Y. Xiong	고절죽	
<i>Phyllostachys heterocycla</i> (Carr.) Mitford	구갑죽	
<i>Sasa kurilensis</i> Makino	권문죽	
<i>Pleiolblastus argenteostriatus</i> for <i>Pumilis</i> Muroi	근곡죽	
<i>Pleiolblastus chino</i> var. <i>viridis</i> S. Suzuki	근세	
<i>Pleiolblastus subsolisa</i> S.L. Chenet G. Y. Sheng	근실심다간죽	
<i>Pleiolblastus.Argenteo-striatus</i> for. <i>kimmei</i> Muroiet Y.lanaka	금명동근세	
<i>Semiarundinaria yashadake</i> for. <i>Kimmei</i> Muroi et Kashiwaagi	금명야차죽	
<i>Phyllostachys bambusoides</i> var. <i>castillonis</i>	금명죽	
<i>Phyllostachys aureosulcata</i> for. <i>spectabilis</i>	금양옥죽	
<i>Phyllostachys sulphurea</i> (Carr.) A.et C.Riv.	금죽	
<i>Pleiolblastuspygmaeus</i> var. <i>distchus</i> Nakai	기린죽	
<i>Pleiolblastuschino</i> var. <i>hisauchii</i> Makino	깃털죽	
<i>Shibataeaneanpingensis</i> Q.F. ZhengetK.F. Huang	남평왜죽	
<i>Phyllostachys viridi-glaucescens</i> (Carr.)A.et C.Riv.	녹분죽	
<i>Phyllostachys sulphurea</i> cv. <i>Hou Zeau</i>	녹피황근죽	
<i>Brachystachyumdensiflorum</i> (Rendie)Keng	단수죽	
<i>Pleiolblastusamarus</i> var. <i>Hangzhouensis</i> S.L. ChenetS.Y. Chen	당죽	
<i>Pleiolblastusgramines</i> (Bean)Nakai	대명죽	
<i>Phyllostachys aurea</i> for. <i>takemurai</i> Muroiet Hamada	대산죽	
<i>Indccalamus Tessellatus</i> Kengf.	대엽시죽	
<i>Sasaniponica</i> Makinoet Shobata	도세	
<i>Pleiolblatus Simoniif. viridistriatus-chrysophyllus</i> Muroiet.Hara	독녀죽	
<i>Pleiolblastus Viridistriatus</i> Makino	독세	
<i>Sasaellamosavar. ramosa</i>	동세	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Oligostachyum.spongiosum</i> G.H. Yeet Z.P. Wang	두죽	
<i>Phyllostachys aurea</i> Carr.exA.et C. Riviere	라한죽	
<i>Pseudosasa.japonica</i> var. tsutsumi ana Yamagota	랄구시죽	
<i>Phyllostachys Praecox</i> Prevernalis	뢰죽	
<i>Pleiolblastus.Linearis</i> Nakai	류구죽	
<i>Phyllostachys pubescens</i> Mazel	맹종죽	
<i>Phyllostachysaurita</i> J.L. Lu	모배수죽	
<i>Indosasaglabrata</i> var.albo-hispidula C.S. ChaoetC. D. Chu	모산반죽	
<i>Sasa</i> sp.	모위세	
<i>Phyllostachys heterocycla</i> var. pubescens	모죽	
<i>Phyllostachys heteroclada</i> for. <i>solida</i>	목죽	
<i>Pesudosasajaponica</i> sp	무산상이대	
<i>Pleiolblastusmaculatus</i> (McClure)C.D. Chuet C. S. Chao	반고죽	
<i>Sasaella.Glabra</i> for sp.	반입추곡세	
<i>Phyllostachysbambusoides</i> for.lacrima-deae	반죽	
<i>Arundinariacommunis</i> sp.	밭대	
<i>Phyllostachys dulcis</i> McClure	백포계죽	
<i>Phyllostachys bissetii</i> McClure	백혈죽	
<i>Sasa.Ohomina</i> for <i>albovariegata</i> MuroietH.okamra	백호세엽세	
<i>Pleiolblastus Argenteo-striatus</i> for. albo-striatus	백호이에렴	
<i>Sasaella.Glabra</i> for. <i>albo-striata</i> Muroi	백호추곡세	
<i>Bambusa multiplex</i> (Loureiro) Raeuschel	봉래죽	
<i>Bambusa glaucescens</i> for. <i>Elegans</i> muroi et Sugimoto	봉황죽	
<i>Phyllostachys nigella</i> Wen	부양조포계죽	
<i>Phyllostachys nigra</i> var. <i>henonis</i> Stapf	분죽	
<i>Sasafortunei</i> (VanHoutte) Fiori	비백죽	
<i>Sasa auricoma</i> E.G. Camus	비황죽	
<i>Oligostachyum.lubricum</i> (Wen)Kengf.	사계죽	
<i>Arundinariacommunis</i> Makino	산천죽	
<i>Pleiolblastus chino</i> (FranchetetSavatier) var. <i>vaginatus</i> (Hackel) S. Suzuki	상근죽	
<i>Pleiolblastus.Shibyanus</i> for. <i>tsuboi</i> Muroi	상전세	
<i>Pseudosasajaponica</i> sp.	서근시죽	



학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Pleiolobus Argenteo-striatus</i> for <i>akebono</i>	서세	
<i>Phyllostachys arcana</i> McClure	석록죽	
<i>Phyllostachys nuda</i> McClure	석죽	
<i>Sasa kurilensis</i> (Ruprecht) Makinoetshibata var. <i>kurilensis</i>	섬대	
<i>Indocalamusvictoralis</i> Kengf.	성리약죽	
<i>Sasaalbo-marginata</i> Makino et Shibata	소위세	
<i>Phyllostachys</i> sp.	소죽	
<i>Phyllostachys bambusoides</i> f. <i>shouzhu</i>	수죽	
<i>Pseudosasa japonica</i> Makino	시죽	
<i>Phyllostachys nidularia</i> for <i>Farcta</i>	실두죽	
<i>Sasa septentrionalis</i> var. <i>septentrionalis</i>	심산세	
<i>Shibataea chinensis</i> Nakai	아모죽	
<i>Pleilobusfortunei</i> for <i>Aiko</i> Muroiet. Yoshinaga	아이코 세	
<i>Phyllostachysnigra</i> for <i>Meguochiku</i> Nakai	아흑죽	
<i>Phyllostachys parvifolia</i> C. D. Chuet H.Y. Chou	안길금죽	
<i>Phyllostachys rubicunda</i> Wen	안길반수죽	
<i>Semiarundinaria yashadake</i> (Makino) Makino	야차죽	
<i>Pleiolobus Distichus</i> MuroidTh.Ckamura	어려도죽	
<i>Indocalamus guangdongensis</i> H.R. Zhaoet Y.L. Yang	엄동약죽	
<i>Semiarundinaria fastuosa</i> (Mitfird) Makino	업평죽	
<i>Indocalamus barbatus</i> McClure	염모약죽	
<i>Phyllostachys</i> sp.	염분죽	
<i>Phyllostachys nigra</i> (Lodd.) Munro	오죽	
<i>Sasa ellaramosa</i> Makino	오처세	
<i>Phyllostachys bambusoides</i> Sieb.etZucc.	왕대	
<i>Shibataea kumasasa</i> (Zollinger) Nakai	왜죽	
<i>Sasa.Veitchii</i> Rehder	외세	
<i>Phyllostachys</i> for <i>Boryana</i> (Mief.) Makino	운문죽	
<i>Monstruocalamus.sichuanensis</i> (Yi)Yi	월월죽	
<i>Pleiolobus Fortunei</i> Makai	유아세	
<i>Pleiolobus gracilis</i> (Makino) Nakai	유죽	
<i>Pleiolobus Chino</i> for <i>murakaminanus</i> Muroi	은대동근세	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Semiarundinaria yashadake</i> for <i>gimmei</i> Muroiet Hara	은명야차죽	
<i>Phyllostachys nigravar. henonis</i> Stapf	은명죽	
<i>Phyllostachys aurea</i> var. <i>flavescens-inversa</i> (HouzeauLehaie) Nakai	음명포대죽	
<i>Hibanobambusa tranquillans</i> Maruyama et Hibanobambusa.Okamura	음양죽	
<i>Pleiolblastus yixingensis</i> S.L. Chenet S. Y. Chen	의흥고죽	
<i>Pseudosasajaponica</i> (SiebetZucc.) Makino	이대	
<i>Pleiolblastu</i> ssp.	이에염	
<i>Phyllostachysb ambusoides</i> var. <i>tanakae</i> Makino	일향반죽	
<i>Phyllostachys Nigra</i> Munro	자죽	
<i>Phyllostachysnuda</i> for <i>localis</i>	자포두석죽	
<i>Pleiolblastuschino</i> var. <i>hisauchii</i>	장협고죽	
<i>Sasa Palmatasubap.Neblosa</i> Muroi	적고단죽	
<i>Phyllostachys meyeri</i> McClure	절강담죽	
<i>Sasa queipaertensis</i> Nakai	제주조릿대	
<i>Phyllostachys praecox</i> C. D. Chuet C. S. Chao	조죽	
<i>Phyllostachys vivax</i> McClure	조포계죽	
<i>Pleiolblastuschino</i> (FranchetetSavatier) Makino	좁해장죽	
<i>Arundinariasimonii</i> A et C. Riv	천죽	
<i>Phyllostachys acuta</i> C.D. Chuet C. S. Chao	침두청죽	
<i>Semiarundinaria viridis</i> Makino	청업평죽	
<i>Bambusatextilis</i> McClure	청피죽	
<i>Pleiolblastus gozadakensis</i> Nakai	추죽	
<i>Pleiolblastus fortunei</i> Nakai	치아세	
<i>Chimonobambusa marmorea</i> for <i>variegata</i> Ohwi	치아한죽	
<i>Arundinaria simonii</i> var. <i>Variegata</i> Hooker	통사죽	
<i>Sasatsuboiana</i> Makino	평정죽	
<i>Semiarundinaria makinoi</i> Hisautiet Muroi	포대업평죽	
<i>Phyllostachys aurea</i> CarriereexA.et C. Riviera	포대죽	
<i>Sasa argenteastriatus</i> Camus	포지죽	
<i>Pleiolblastus.Hindsii</i> Nakai	한산죽	
<i>Chimononbambusa marmorea</i> (Mieford) Makino	한죽	
<i>Arundinaria simonii</i> (Carr.) Riviere	해장죽	

학 명 (Scientific Name)	국 명 (Korean Name)	비고
<i>Shibataea lanceifolia</i> C.H. Hu	협협외죽	
<i>Phyllostachys incarnata</i> Wen	홍각외죽	
<i>Phyllostachys iridescens</i> C. Y. Yaoet S.Y. Chen	홍죽	
<i>Phyllostachys Praecox</i> cv <i>Viridisulcata</i>	화간조죽	
<i>Phyllostachys nidularia</i> var.	화죽	
<i>Phyllostachys glabrata</i> S. Y. Chenet C.Y. Yao	화포계죽	
<i>Indocalamus latifolius</i> (keng) McClure	활협약죽	
<i>Phyllostachys aureosulcata</i> for <i>aureocaulis</i>	황간경죽	
<i>Phyllostachys vivax</i> for <i>aureocaulis</i>	황간조포계죽	
<i>Phyllostachys angusta</i> McClure	황고죽	
<i>Semiarundinaria yashadake</i> For.Ahgon Muroiet.Yoshinaga	황금야차죽	
<i>Phyllostachys vivax</i> for <i>huanvenzhu</i>	황문죽	
<i>Phyllostachys heterocycle</i> cv. <i>Luteosulcata</i>	황조모죽	
<i>Phyllostachys arcana</i> for <i>luteosulcata</i>	황조석록죽	
<i>Phyllostachys Praecox</i> Notata	황조조죽	
<i>Phyllostachys aureosulcata</i> McClure	황조죽	
<i>Phyllostachys sulphureac</i> v. Robert Young	황피녹근죽	
<i>Sasaella. Glabra</i> for <i>aureo-striata</i> Muroi	황호추국세	
<i>Phyllostachys platyglossa</i> Z. P. Wanget Z. H. Yu	회수죽	
<i>Phyllostachys nidularia</i> Munro	후죽	
<i>Phyllostachys humilis</i> muroi	희담죽	

## 7. Pictures of Damyang Bamboo-field Cycling Agricultural System



<The Naeda Village Damyang Bamboo Field in Samdari area(Core area of KIAHS)>



<Interior view of the Naeda Village Damyang Bamboo Field in Samdari area>



<Water path management in Damyang Bamboo Fields>



<Water path management in Damyang Bamboo Fields>

<Water resource from the lower part of Damyang Bamboo Field used in rice paddy farm>



<Ground level cultivation in Damyang Bamboo Field- Tea cultivation, tea leaf picking>

<Ground level cultivation in Damyang Bamboo Field - Bamboo shoot harvest>



<Bamboo farming equipment>



<Bamboo as farming tool - Bamboo pillar>



<Damyang Bamboo Crafting>



<Bamboo Exhibition, Market. Experience area>



<Villagers on voluntary cleaning service for KIAHS site>



<Folk Ritual Service of Dangsanje takes place in the first full moon of the lunar year>



<Shrine is built toward the south of village for Daljib-burning Folk Ritual Service. The annual service is practiced during the first full moon of the lunar year>

## 8. Memorandums of Understanding on Conservation and Management of Damyang Bamboo Field Agriculture System

○ The Memorandum of Understanding was taken in January 2014 among bamboo organizations, including Damyang County, Bamboo Resource Research Institute, Agricultural Technique Center of Damyang County, Naeda Village Council, Bamboo Shoot Producer Association and Korea Bamboo Development Association. The MOU objects for conservation and management of Damyang Bamboo Field Agriculture System.

### 지방자치단체, 주민협의체, 참여기관 협약서

대나무 밭 농업유산 보전 및 관리 수행을 위해 제출한 계획서의 내용에 동의하며, 관련 법령 등 제반규정을 준수하고 적극적으로 유산의 보전·관리에 참여하며, 지방자치단체, 주민협의체, 참여기관들의 주제별 역할 등에 대하여 다음과 같이 협약을 체결합니다.

1. 담양군 「담양 대나무 밭 국가중요농업유산 보전 및 관리」 참여기관 및 단체(이하 "참여기관"으로 한다.)는 담양군 대나무 밭의 정비, 담양 대나무 밭 유산 보전지구 조성, 대나무 밭 경관조성, 대나무 밭 생태환경조사, 대나무 밭 보전지구 기반시설 조성 관리 등의 대나무 밭 농업유산 보전 및 관리 활성화에 적극 동참한다.
2. 담양군은 담양 대나무 밭 국가중요농업유산 보전 및 관리를 위하여 사업 추진단 설치·운영 및 사업총괄 관리, 참여기관의 역할분담, 예산확보, 사업비 집행 등에 필요한 행정업무를 총괄·지원한다.
3. 참여기관은 원활한 사업수행과 인력육성, 기술자문, 연구·개발, 컨설팅, 브랜드 개발, 홍보·마케팅 등의 해당분야에서 적극적으로 협력한다.
4. 담양군과 사업주체인 가사문화권 전통숙박, 전통음식, 전통체험, 지역향토산물 관련 산업체는 국고보조에 수반되는 지방비 및 자부담 확보를 성실히 이행한다.
5. 담양 대나무 밭 관리 주제인 내다마을 주민협의체, 한국대나무 발전협의회 등 담양 대나무 관련 단체는 참여기관에서 보전 및 발전을 위해 연구·개발하고 시행하는 사업에 대하여 적극적으로 협력한다.
6. 본 대나무 밭 중요농업유산 보전 및 관리활동 추진으로 인해 개발된 기술 및 지식재산권 등의 소유권은 담양군이 갖는 것을 원칙으로 한다.

2014. 1. .

(지 자 체 장) 담양군수

(참여기관장 1) 대나무 자원연구소장

(참여기관장 2) 담양군 농업기술센터소장

(참여기관장 3) 담양군 내다마을 협의회장

(참여기관장 4) 담양죽순 생산자 협회장

(참여기관장 5) 한국대나무 발전 협의회장

최형식

이한철

장종환

이일진

박영수

박충년

## 9. County Ordinance for Supporting Damyang Bamboo Field Agriculture System

○ The ordinance became active in 2013 to support bamboo related organizations to promote bamboo and its significance and to support organizations in bamboo industrial development.

**담양군 대나무관련 단체 지원에 관한 조례**

( 제정) 2013.12.02 조례 제2110호  
관리책임부서 : 대나무지원연구소  
연락처 : 380-2911

**제1조(목적)** 이 조례는 대나무 전문가의 교류와 학술대회, 포럼 등을 통하여 대나무의 가치와 중요성을 알리고 대나무 산업의 발전을 위해 설립된 대나무관련 단체 지원에 관한 사항을 규정함을 목적으로 한다.

**제2조(정의)** 이 조례에서 사용하는 "대나무관련 단체"라 함은 대나무에 관련 있는 학자, 생산자, 재배자, 판매자, 문화예술인 등을 회원으로 설립된 단체를 말한다.

**제3조(지원)** 군수는 대나무관련 단체의 다음 각호의 활동에 대하여 예산의 범위 내에서 경비를 지원 할 수 있다.

1. 대나무산업발전을 위한 포럼·학술대회·워크숍 개최 등 연구 활동
2. 대나무산업 발전을 위한 국내외 활동
3. 국내외 대나무 산업의 동향분석 및 실태조사

**제4조(지원절차)** ① 대나무관련 단체는 제3조의 규정에 의한 지원이 필요할 경우에는 다음 각호의 사항을 기재한 서류를 군수에게 제출하여야 한다.

1. 사업계획
2. 사업추진을 위한 경비
3. 사업에 필요한 사항 등

② 군수는 제1항의 규정에 의한 지원요청을 제출받은 때에는 담양군 자치농장위원회 임업분과위원회의 심의를 거쳐 다음 각호의 사항을 포함 하여 지원여부를 결정·통보하여야 한다.

1. 군에서 지원할 보조금액
2. 사업에 필요한 사항

**제5조(사업실적보고)** 제3조의 사업수행을 위해 사업비를 지원받아 사업을 완료한 후에는 지체 없이 사업실적보고서와 정산서를 군수에게 제출하여야 한다.

**제6조(보고·감사 등)** ① 군수는 대나무관련 단체로 하여금 그 업무에 관한 사항을 보고하게 하고, 소속 공무원이 그 업무를 감사하게 할 수 있다.

② 군수는 제1항의 규정에 의한 감사결과 위반 또는 부당한 사항이 있을 때에는 그 시정을 명하거나 기타 필요한 조치를 취할 수 있다

**제7조(전담부서 지정)** 군수는 대나무관련 단체의 지원업무를 담당할 전담부서를 지정하여 운영할 수 있다.

**제8조(준용)** 이 조례에서 규정하지 아니한 사항은 「담양군보조금 관리 조례」를 준용 한다.

**제9조(시행규칙)** 이 조례에서 규정한 것 외에 필요한 사항은 규칙으로 정한다.

**부 칙**

이 조례는 공포한 날부터 시행한다.



## 10. County Ordinance for Masters of Bamboo Craft Designation Procedure and Operation Standards

- The ordinance became active in 2012 for masters of bamboo craft designation and management system.

**담양군 공예명인 선정 및 운영에 관한 조례**

( 제정 ) 2012.06.07 조례 제2051호  
관리책임부서 : 지역경제과  
연 락 처 : 380-3041

**제1조(목적)** 이 조례는 담양군 공예산업 발전과 이에 종사하는 공예인이 자부심을 가지고 전문분야에 정진하도록 하며 전통 공예기술의 계승 발전에 이바지함을 목적으로 한다.

**제2조(정의)** 이 조례에서 "담양군 공예명인(이하 "명인"이라 한다)이라 함은 공예분야의 우수한 기능을 가진 사람으로서 공예 기술 발전에 공헌한 사람 중에서 이 조례에 의하여 선정된 사람을 말한다.

**제3조(선정분야)** ① 명인은 도자기, 금속, 유리, 석, 목, 한지, 나전칠기, 종이, 솜, 섬유, 가죽공예, 그 밖의 분야 등을 포함하여 선정하되 당해년도 선정계획에서 정하는 기준에 적합한 사람으로 한다.  
② 대나무공예에 관하여는 「담양군 대나무공예 명인 및 계승자 육성조례」가 정하는 바에 따른다.

**제4조(명인의 선정)** ① 담양군수(이하 "군수"라 한다)는 담양군공예명인심사위원회(이하 "위원회"라 한다)의 심의를 거쳐 명인을 선정한다. 다만, 심사결과 적격자가 없는 경우에는 선정하지 아니할 수 있다.  
② 군수는 명인의 선정인원·선정기준 등 선정에 관하여 필요한 사항을 미리 공고하여야 한다.  
③ 명인으로 선정 받고자 하는 사람은 읍면장 또는 관련단체의 추천을 받아야 한다.

**제5조(명인의 자격요건)** ① 명인은 다음 각 호의 모든 요건을 갖추어야 한다.  
1. 10년 이상 해당 공예분야에 직접 종사한 사람으로 공고일 현재 담양군에 5년 이상 주소를 두고 거주하고 있는 사람  
2. 장인정신이 뚜렷하고 공예문화 계승발전에 기여한 사람으로 명인 선정을 받기에 충분한 사람  
② 제1항에 따라 명인으로 선정된 사람은 전통공예기술 발전에 이바지하고 다른 사람의 모범이 될 수 있도록 노력하여야 하며, 명인으로서의 품위를 유지하여야 한다.

**제6조(예우 및 지원)** ① 명인으로 선정된 사람에 대하여 "명인"의 칭호를 부여하고 명인증서를 수여한다.  
② 사업장에 명인 인증서를 부착할 수 있으며, 예산의 범위에서 장려금을 지급할 수 있다.

**제7조(명인의 선정 취소)** ① 군수는 명인으로 선정된 사람이 다음 각 호의 어느 하나에 해당하는 경우에는 위원회의 의견을 거쳐 명인의 선정을 취소할 수 있다. 다만, 제1호에 해당하는 경우에는 명인의 선정을 취소하여야 한다.  
1. 거짓이나 부정한 방법으로 명인에 선정된 경우  
2. 명인으로 선정된 사람이 제5조제2항의 품위유지 의무를 위반한 경우  
② 제1항에 따라 명인의 선정을 취소하려면 청문을 하여야 한다.

**제8조(위원회의 설치 및 구성)** ① 군수는 명인의 선정 등에 관한 사항을 심의하기 위하여 위원회를 둔다.  
② 위원회는 위원장을 포함한 9인 이내로 구성하며, 위원장은 부군수가 되고 부위원장은 위원 중에서 호선한다.  
③ 위원은 위촉위원으로 군의회 의원, 공예·디자인관련 대학 교수, 공예산업 분야별 전문지식과 덕망이 있는 사람 및 이와 관련 있는 사람 중에서 군수가 위촉하고 당연직 위원은 해당업무 담당과장이 되어 당해년도 명인 선정이 완료된 날에 해촉된 것으로 본다.  
④ 위원회의 사무처리를 위하여 간사를 두되, 간사는 관련 업무를 주관하는 부서의 업무담당자 인다.

**제9조(위원회의 기능)** 위원회는 다음 각 호의 사항을 심의·의결한다.  
1. 명인의 선정 및 선정취소에 관한 사항  
2. 군수 또는 위원장이 심사와 관련하여 부의하는 사항  
3. 그 밖에 위원회의 운영에 관하여 필요한 사항

**제10조(위원장의 직무)** ① 위원장은 위원회를 대표하고, 위원회의 직무를 총괄한다.  
② 위원장이 부득이한 사유로 직무를 수행할 수 없는 때에는 부위원장이 그 직무를 대행한다.

**제11조(회의)** ① 위원장은 위원회의 회의를 소집하고, 그 의장이 된다.  
② 위원회의 회의는 재적위원 과반수의 출석으로 개의하고, 출석의원 과반수 찬성으로 의결한다.

**제12조(수당 등)** 위원회에 출석한 공무원이 아닌 위원 및 관계전문가에 대해서는 예산의 범위 안에서 「담양군 각종위원회 실비보상 조례」가 정하는 바에 따라 수당과 여비 등의 실비를 지급할 수 있다.

**제13조(시행규칙)** 이 조례의 시행에 관하여 필요한 사항은 규칙으로 정한다.  
**부칙**  
이 조례는 공포한 날부터 시행한다.