

## Use and Conservation of Edible Wild Plants in Bhutan

Ken-ichi MATSUSHIMA, Mineo MINAMI and Kazuhiro NEMOTO

Department of Sciences of Functional Foods, Graduate School of Agriculture, Shinshu Univ

**Summary :** In an investigation of edible wild plants in Bhutan by the authors, plants samples were identified and categorized into 60 families and 172 species and 6 families and 18 species from Divisions Magnoliophyta and Pteridophyta, respectively. Management of the community forest is one effective way for achieving in-situ conservation of edible wild plants. Since gathering edible wild plants in a forest is performed simultaneously with the maintenance and management of the forest in Bhutan, gathering is thought to be helpful to forest conservation.

**Key word :** Bhutan, community forest, edible wild plant, *ex-situ* conservation, *in-situ* conservation

### Introduction

Investigations of the traditional uses of edible wild plants in Bhutan were carried out from 2005 to 2010 in a joint research program between Shinshu University and the Ministry of Agriculture of Bhutan<sup>11,13-18,25</sup>. These investigations were conducted in a farming village and at local markets in all of the dzongkaks (prefectures) in Bhutan. The species and distribution of edible wild plants, as well as data on the consumption of these species for all of Bhutan could be determined. Further, the relation between gathering edible wild plants in a forest and forest conservation was also investigated. This report discusses the sustainable use and conservation of edible wild plants in Bhutan. Furthermore comparison with the situation in Japan and Bhutan are also tried.

### Agriculture and food culture in Bhutan

#### 1. Altitudinal distribution of agriculture zones in Bhutan

Bhutan is located at the southeastern foot of the Great Himalayas. The elevation varies from 100

m above sea level (a.s.l.) in the south near the border with India to more than 7500 m a.s.l. in the northern high mountains. Thus, within this narrow country at low latitudes, there is a wide range of climates from low subtropical areas to cool highlands with wide-ranging biodiversity.

Agriculture in Bhutan also shows an altitudinal distribution. Tsukihara<sup>27</sup> divided Bhutan into three agricultural zones. The “Yak zone” is at the highest elevations from about 3600 m to 4150 m a.s.l. Yak (Fig. 1) and horses are grazed, and barley is the only cultivated crop in this cool area. In the “middle zone” at about 2500 to 2900 m a.s.l., buckwheat, barley and wheat are cultivated, and yak, cattle, sheep and horses are grazed. The “paddy zone” at the lowest elevations (below



Fig. 1 Grazed yak.  
Yoton-la pass (3400 m a.s.l.), Trongsa

Received December 26, 2011.

Accepted January 26, 2012.

about 2500 m a.s.l.) is mainly paddy fields (Fig. 2) along with some areas where maize, finger millet and buckwheat (Fig. 3) are grown. Livestock reared in this area comprise cattle, swine, horses and donkeys. According to another report<sup>10)</sup>, yak are grazed in areas above 3000 m a.s.l, buckwheat is cultivated in areas above 2700 m a.s.l., and paddy fields are cultivated at lower elevations (200–2700 m a.s.l.). As is the case for agricultural regions at low latitudes and high altitudes as in Bhutan, crop varieties as well as the natural vegetation are adapted for every altitude and show wide biodiversity.

Some of vegetables like chili peppers, turnips and others can be cultivated over a wide range of altitudes under about 3000 m a.s.l.<sup>27)</sup>. However, Nakao (1984)<sup>20)</sup> reported that cultivation of domesticated vegetables like chili pepper, cucumber, eggplant, radish and turnip, had begun in recent years. He further reported that before the

adoption of cultivating domesticated vegetables, wild vegetables were the main source of vegetables in the diet in Bhutan.

## 2. Coexistence of Tibetan dairy farming culture and Asian lucidophyllous forest culture

Another feature of agriculture and food culture in Bhutan is the coexistence of Tibetan dairy farming culture and lucidophyllous forest culture that is often seen in mountainous areas of Asia.

For example, dairy farming culture from Tibet provides “suja” (Fig. 4), a favorite tea of the Bhutanese, made by churning boiled tea with butter and salt (Fig. 5)<sup>1)</sup>. Butter is also used to make a butter lamp used at Buddhist temples. In Bhutan, yaks are grazed at high altitudes and cattle are grazed at middle to low altitudes. In



Fig. 2 Paddy field.  
Dagana (1600 m a.s.l.)



Fig. 3 Buckwheat field.  
On the way to Zhumgang from Trongsa  
(2000 m a.s.l.)



Fig. 4 Churning the butter tea, “Suja”.  
Dagana (1600 m a.s.l.)



Fig. 5 Left : cottage cheese, “Datsi”.  
Right : butter wrapped with leaf.  
Market in Thimpu (2400 m a.s.l.)



Fig. 6 Typical Bhutanese dish made from cheese and chili pepper, “Ema Datsi”.  
Thimphu (2400 m a.s.l.)



Fig. 7 Cereal yeast for alcoholic beverage.  
Market in Thimphu (2400 m a.s.l.)



Fig. 8 Alcoholic beverage extracted from brewed wheat grain using by cereal yeast.  
Wogayna (2400 m a.s.l.)



Fig. 9 Fermented soybean.  
Market in Damphu, Tsirang (1600 m a.s.l.)

addition to butter products, milk is also processed to cottage cheese “datsi” (Fig. 5), dried cheese “chogu” and whey beverage “dachu”. Cottage cheese is cooked with chili pepper to make the typical Bhutanese dish called “Ema Datsi” (Fig. 6)<sup>1)</sup>.

On the other hand, the influence of the mountainous forest culture of Asia, which is different than that found in Tibet, is also evident in the agriculture and food culture of Bhutan. For example, typical Bhutanese cultured foods and beverages such as alcoholic beverages brewed by cereal yeast (Figs. 7, 8), fermented soybean (Fig. 9), and reddish rice (Fig. 10). Sericulture and lacquerware production are also carried out by similar methods as those carried out over a wide area of Asia between the Himalayas and Japan and

centered on Yunnan in China. This culture is called the “lucidophyllous forest culture” as described by Kamiyama, Sasaki and Nakao<sup>8),9)</sup>. Buckwheat (Fig. 11) is grown and eaten over almost the same cultural area, and the use of various edible wild plants is also considered to be one of the features of this culture.

#### Use of edible wild plant in Bhutan

The Graduate School of Agriculture, Shinshu University and the Council for Renewable Natural Resources Research of the Bhutan Ministry of Agriculture conducted a joint research project on edible wild plants and the associated traditional knowledge from 2005 to 2010<sup>11,13~18,25)</sup>. The objective of this research was to investigate the edible wild plant resources in Bhutan and to reevaluate traditional knowledge of the effects on human

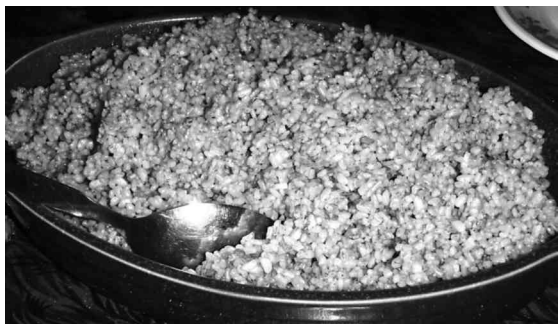


Fig. 10 Reddish rice.  
Thimphu (2400m a.s.l.)



Fig. 11 Buckwheat noodle, "Putu".  
Thimphu (2400 m a.s.l.)



Fig. 12 Damroo (*Elatostema lineolatum*).  
Thimphu market (2400 m a.s.l.)



Fig. 13 Namnam (*Pogostemon amaranthoides*).  
Thimphu market (2400 m a.s.l.)

health. The researchers from both institutes interviewed farmers in farming villages as well as vendors in local markets to collect information on edible wild plants and traditional knowledge. Samples of edible wild plants were collected and identified to species using keys in the book 'Flora of Bhutan<sup>2-7,21,22</sup>' and other literature. These plant samples were deposited to the herbarium at the National Biodiversity Center, Ministry of Agriculture. In 2008, the results from the first 3 years of this investigation were published in the pictorial book, "Edible Wild Plants of Bhutan and Their Traditional Knowledge"<sup>12</sup>.

Using the samples collected in the 6-year survey, plant samples were classified to 60 families

and 172 species in Magnoliophyta. The edible parts of these plants as vegetables include the shoot, leaves, stem and flowers. Also, tubers, fruits and nuts from wild plants are also eaten. The popular edible wild plants in Bhutan, which can be bought at local markets are Damroo (*Elatostema lineolatum*, Fig. 12), Namnam (*Pogostemon amaranthoides*, Fig. 13) and Patsha (*Plectocomia himalayana*, Fig. 14).

The plant samples from Division Pteridophyta were classified to 6 families and 18 species. Most of the samples belonged to the Woodsiaceae family. The fronds of young ferns, called Nakey (Fig. 15), were among the most popular items at the market. This local name is a common name applied to the edible ferns belonging to at least three species: *Diplazium esuculentum*, *D. maximum*, and *D. laxifrons*. In the local farming villages, several kinds of different ferns were gather-



Fig. 14 Patsha (*Plectocomia himalayana*).  
Thimphu market (2400 m a.s.l.)



Fig. 15 Nakey (*Diplazium maximum*).  
Trongsa market (2080 m a.s.l.)

ed seasonally and eaten from April to October.

### Conservation of edible wild plant of Bhutan

#### 1. *Ex-situ* conservation

*Ex-situ* conservation means “off-site conservation”. This is the process of protecting plant resources outside of their natural habitat, e.g., by maintaining a gene bank and plant specimens in a botanical garden. The National Biodiversity Center (NBC, Fig. 16, 17) was organized mainly from the National Gene Bank for Plant Genetic Resources (NGB-PGR), and the National Herbarium and the Royal Botanical Garden was established at Serbitang near the capital of Bhutan. The main objective of NGB-PGR is to conserve the genetic resources of crop varieties, especially traditional varieties, lest they became extinct in the natural environment<sup>18)</sup>. Field surveys of crop plant genetic resources were conducted in Bhutan in 2001<sup>19)</sup> and 2007<sup>23)</sup> by the National Institute of Agrobiological Sciences (NIAS) gene bank, Japan and the NBC-PGB, Bhutan.

In addition, herb gardens managed by collaboration between the Renewable Natural Resources Research Center (RNR-RC), Ministry of Agriculture and the Institute of Traditional Medicine Services (ITMS), Ministry of Health were as



Fig. 16 The National Biodiversity Center (NBC),  
Serbitang.

established at Lingshi (4000 m a.s.l.) and Lingmithang (600 m a.s.l.) to conserve medicinal and aromatic plant species<sup>18)</sup>.

Thus, the main targets of *ex-situ* conservation of plant resources conducted by government of Bhutan are crops, and medicinal and aromatic plant species.

#### 2. *In-situ* conservation

*In-situ* conservation means “on-site conservation”. This is the process of protecting plant resources in their natural habitats. The management system of the community forest is one effective way to carry out in-situ conservation of valuable wild plants.

In Bhutan, there are two legal systems for the management of the forest plant resources such as wild medicinal herbs: a permit system that

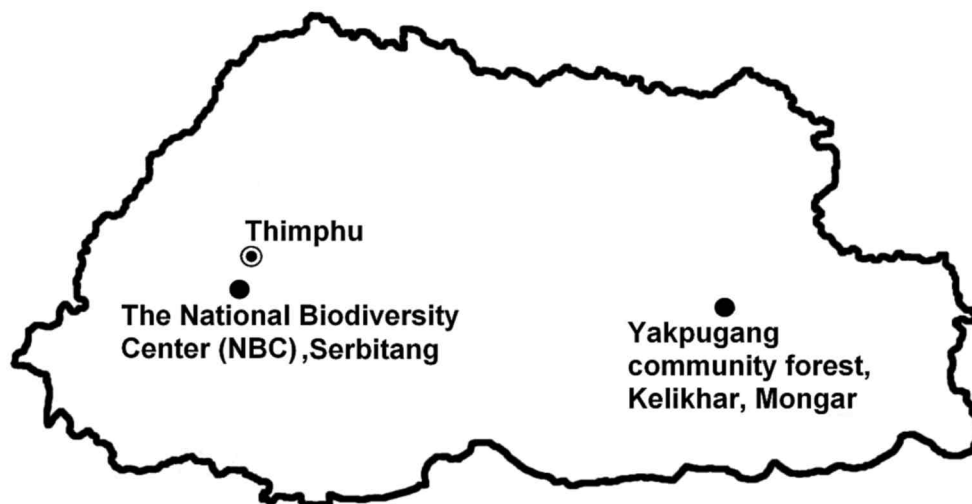


Fig. 17 Map of Bhutan



Fig. 18 Yakpugang community forest, Kelikhar, Mongar (1650 m a.s.l.)



Fig. 19 Survey in Yakpugang community forest, Kelikhar, Mongar (1650 m a.s.l.)

requires obtaining written approval from authorities to gather wild medicinal herbs and the establishment of community forests. There are more than 100 approved community forests, of which 13 have a primary focus of wild medicinal and aromatic plant management<sup>26)</sup>.

In the case of edible wild plants, a survey was carried out in April 2007 at the Yakpugang community forest (Figs. 17, 18, 19) at Kelikhar, Mongar dzongkhag (prefecture) in Eastern Bhutan, which was established in October 2001. The total forest area is 260 ha and the forest management group consisted of 103 households with 9 executive committee members selected from among the forest users. Some of the widely used edible wild plants were observed in the community forest: Solomon (*Pogostemon amaranthoides*, Fig. 20),

Wangpeimo (*Calanthe plantaginea*), Gaytso (*Houttuynia cordata*) and Saagon (*Fragaria nubicola*). Several edible ferns were also found in the community forest: Tonkey dawey (*Diplazium* sp.), Dankey dawey (*D. maximum*, Fig. 20), Gasha dawey (*Athyrium* sp., Fig. 20) and Nimin dawey (*Pteris exelsa*, Fig. 20). An admission fee of 15 nu per day was levied for gathering edible wild plants. The admission fee was collected from users and used to cover the administrative expenses of the community forest. It is considered that systematic forest maintenance by a management group was effective and that excessive gathering can be prevented by collecting an admission fee.



Fig. 20 Edible wild plants collected in Yakpugang community forest, Kelikhar, Mongar (1650 m a.s.l.)  
 Right: *Pogostemon amaranthoides*  
 Second from right: *Athyrium* sp.  
 Center: *Diplazium maximum*  
 Left and second from left: *Pteris exelsa*

### Conclusion

Various edible wild plants are eaten as seasonal vegetables from spring to early summer in Japan. Recently, we can easily buy some of the major species of wild vegetables, e.g. Western bracken fern (*Pteridium aquilinum*), Ostrich fern (*Matteuccia struthiopteris*), Taranoki (*Aralia elata*) and Udo (*Aralia cordata*) in Japanese markets because these major wild vegetables are cultivated for selling by farmers in mountain regions. In Bhutan, some species of edible wild plants are also sold in Bhutanese markets. However, almost all of them are gathered in the forest and few are cultivated. A concern with excessive economic activity concerning edible wild plants is that it will lead to the decimation of the forest environment and extinction of valuable plant species. However, to our knowledge, this concern does not apply to Bhutan. One of the reasons is the successful maintenance and management of edible wild plants through community forests established throughout Bhutan. The main activities of such a community forest are maintenance of the forest and afforestation with severe government restrictions on the felling of the trees. Gathering edible wild plants in from forests while simultaneously maintaining and managing the forest is thought to

be important not only for the conservation of edible wild plant but also for forest conservation. Similar conditions are seen in Japan. In village forests called SATOYAMA, people gather edible wild plants, mushrooms, and firewood at the same time as maintaining the forest.

As a side note, the principles of the “Gross National Happiness” (GNH) policy are the four pillars of sustainable and equitable socio-economic development, ecological preservation, preservation and promotion of culture and promotion of good governance<sup>24</sup>). Eating edible wild plants is one of the important traditions in the food culture of Bhutan. Gathering edible wild plants also leads to forest conservation, and selling edible wild plants at local markets promotes the socio-economic development of communities. For these reasons, it can be said that sustainable the use of edible wild plants is in agreement with a GNH policy.

### Acknowledgement

We would like to express our gratitude to Dr. Tashi Samdup, Mr. Narendra K. Pradhan (CoRRB, MoA), Ms. Kinlay Tsering (MoA) and Ms. Laxmi Thapa (RNR-RC, MoA) for kind cooperation for the joint research. We also thank all the people who cooperated in our investigation

in Bhutan.

### Reference

- 1) Chiden, K. Chili and Cheese Food and Societies in Bhutan. pp.227. White lotus Press (Bangkok). 2008.
- 2) Grierson, A.J.C., D.G.Long. : Flora of Bhutan Vol. 1 Part1. Royal Botanic Garden Edinburgh. pp186. 1983.
- 3) Grierson, A.J.C., D.G.Long. Flora of Bhutan Vol.1 Part2. Royal Botanic Garden Edinburgh. pp462. 1984.
- 4) Grierson, A.J.C., D.G.Long. Flora of Bhutan Vol.1 Part3. Royal Botanic Garden Edinburgh. pp834. 1987.
- 5) Grierson, A.J.C., D.G.Long. Flora of Bhutan Vol.2 Part1. Royal Botanic Garden Edinburgh. pp426. 1991.
- 6) Grierson, A.J.C., D.G.Long. Flora of Bhutan Vol.2 Part2. Royal Botanic Garden Edinburgh. pp1033. 1999.
- 7) Grierson, A.J.C., D.G.Long. Flora of Bhutan Vol.2 Part3. Royal Botanic Garden Edinburgh. pp1675. 2001.
- 8) Kamiyama, S. SHOUYOUJYURINBUNKA. pp. 208. Chuoukouronsha (Tokyo). 1969. (Japanese)
- 9) Kamiyama, S., K.Sasaki, S.Nakao. ZOKU SHOUYOUJYURINBUNKA. pp.238. Chuoukouronsha (Tokyo). 1976. (Japanese)
- 10) Kurita, Y. Subsistence Differentiation by Altitude in Bhutan. Bull. Nat. Mus. of Ethnology. 11(2), 457-488. 1986. (Japanese with English summary)
- 11) Matsushima, K., M.Minami, K.Nemoto. Usage of Edible Wild Plants in Bhutan. Jour. Fac. Agric. Shinshu Univ. 45 (1-2): 49-54. 2009. (Japanese with English summary)
- 12) Matsushima, K., M. Minami, K. Nemoto, N.K. Pradhan, L. Thapa and D. Delma., Edible Wild Plants of Butan-And Their Associated Traditional Knowledge-. Shinshu Univ. (M inamiminowa). pp130. 2008.
- 13) Matsushima, K., M.Minami, K.Tshering, L. Thapa, K.Asai, A.Kawamura, K.Murai, K.Nemoto. Investigation on Wild Edible Plants and their Traditional Knowledge in South-Western and North-Western Bhutan. Jour. Fac. Agric. Shinshu Univ. 46 (1-2): 31-53. 2010. (Japanese with English summary)
- 14) Matsushima, K., M.Minami, K.Tshering, L. Thapa, Y.Hamauzu, T.Ito, T.Yazaki, K.Nemoto. Investigation on Wild Edible Plants and their Traditional Knowledge in Eastern and South-Eastern Bhutan. Jour. Fac. Agric. Shinshu Univ. 46 (1-2): 55-80. 2010. (Japanese with English summary)
- 15) Matsushima, K., K.Nemoto, M.Minami, D.Delma, L.Thapa, M.Nakano, M.Masuda. Investigation on Wild Edible Plants and their Traditional Knowledge in Eastern Bhutan. Jour. Fac. Agric. Shinshu Univ. 43 (1-2): 43-59. 2007. (Japanese with English summary)
- 16) Matsushima, K., K.Nemoto, M.Minami, D.Delma, L.Thapa, A.Umeda, R.Okawa, S.Ozawa, A.Tsuji. Investigation on Wild Edible Plants and their Traditional Knowledge in Western Bhutan. Jour. Fac. Agric. Shinshu Univ. 44 (1-2): 9-20. 2008. (Japanese with English summary)
- 17) Matsushima, K., K.Nemoto, N.Nakashima, D. Dema, L.Thapa, A.Watanabe, F.Maegwa, T. Baba, G.Matsushita. Report of Investigation for Wild Edible Plants and their Traditional Knowledge in Bhutan. Jour. Fac. Agric. Shinshu Univ. 42 (1-2): 37-47. 2006. (Japanese with English summary)
- 18) Ministry of Agriculture, Royal Government of Bhutan. Biodiversity Action Plan 2009. pp.124. 2009.
- 19) Nagamine, T., K.Shirata. Preliminary Survey of Exploration/Collection of Plant Genetic Resources in Butan. Ann.Rept.Exploration and Intr. Plant Genetic Resources. 17: 141-133. 2001. (Japanese with English summary)
- 20) Nakao, S., K.Nishioka Flowers of Bhutan. pp.145. Asahi Shinbunsha (Tokyo). 1984.
- 21) Nolte, H.J. Flora of Bhutan Vol.3., Part1. Royal Botanic Garden Edinburgh. pp456. 1994.
- 22) Nolte, H.J. Flora of Bhutan Vol.3., Part2. Royal Botanic Garden Edinburgh. pp883. 2000.
- 23) Okuizumi, H. A.Tamang, U.Phuntso, M.Kawase, D.A.Vaughan, N.Tomooka. Plant Genetic Resources Collaboration Between Bhutan and the NIAS Genebank, Japan. Jour. Fac. Agric. Shinshu Univ. 45 (1-2): 67-73. 2009.
- 24) Samdup, T., H.M.J.Udo, M.N.M.Ibrahim, A.J.van der Zijpp. A Conceptual Framework to Assess Development of Smallholder Crop-cattle Farming Systems in Bhutan: Sustainable Development or Gross National Happiness? Jour. Fac. Agric. Shinshu Univ. 46 (1-2): 123-137. 2010.
- 25) Thapa, L., L. The Research Project on Edible Wild Plants of Bhutan and Their Associated Tra-



- ditional Knowledge. Jour. Fac. Agric. Shinshu Univ. 45 (1-2): 43-48. 2009.
- 26) Tshering, K. Agriculture and Usage of Natural Resources in Bhutan. Jour. Fac. Agric. Shinshu Univ. 45 (1-2): 33-42. 2009.
- 27) Tsukihata, T. Vertically Organized Structure of Subsistence Economies in Bhutan. Himalayan study monographs. 3: 133-176. 1992. (Japanese with English summary)
- 

## ブータンにおける食用野生植物の利用と保全

松島憲一・南峰夫・根本和洋

信州大学大学院農学研究科機能性食料開発学専攻

### 要 約

ブータンでの食用野生植物の調査の結果、種子植物で60科172種が、シダ植物で6科18種が確認された。共有林を維持管理していくことは、このような野生植物の生息域内保全に効果的である。ブータンでは食用野生植物の採取は森林の維持管理と一体的に行われているため、森林保全の一助にもなっていると考えられる。

キーワード：ブータン，共有林，生息域外保全，食用野生植物，生息域内保全