

## BAMBOO SPECIES, CONDITION AND USE

### Species and distribution

All three species of bamboo occurring within the FMU (*B. grossa*, *T. spathiflorus*, and *C. callosa*) are found in sequence along the altitudinal continuum as shown in Figure 1. A synopsis of species type, habitat, and utility is given in Table 2.

<sup>8</sup>From observations more recent than 1996, these figures seem low.

<sup>9</sup>In a recent study in all FMUs of eastern Bhutan, Yonzon (1998) recorded the relative frequency of encounters of humans and cattle. He found the frequency of human encounters to be 15 %, and of cattle to be almost 20%. The cattle encounters were 10 times above the frequency of native mammals and large-sized birds. (Wild boar were the third highest frequency; they are well known for the damage they inflict on both forest and agricultural lands.) See also Davidson et al. 1999.

<sup>10</sup>The Brokpa (from a Tibetan term, "brog-pa" (meaning nomadic livestock herders), are members of a relatively small ethnic group (with an approximate population of 3,000 ) who inhabit the high mountain valleys of Sakteng and Merak in north-eastern Tashigang District. Their livelihood is based on transhumance livestock husbandry with yak, cattle, and sheep, coupled with limited highland farming. In summer they reside at their home base in the villages in the high valleys of Sakteng and Merak. In winter, whole families of Brokpa migrate down to warmer regions with their cattle and sheep. At Khaling-Kharungla they have established long-standing economically symbiotic relationships with local residents, conducting trade and doing manual labor such as carpentry, wood cutting, and weaving bamboo mats while awaiting warmer weather to return home.

<sup>11</sup>Further discussion of traditional forest and pasture resource use and tenure in the Himalayas, including Bhutan, are found in FAO n.d.; Gyamtsho 1992; Miller 1988; Miller and Craig 1997; Richard and Miller 1998; Ura 1993a,b; Wangchuk 1998.

**Table 2: Bamboo species, habitat and utility at Khaling-Kharungla**

<i>Borinda grossa</i> (Yi) Stapleton. Local name: shi	
Habitat and altitudinal sequence	Utility to humans and animals
Occurs above c. 2,600m (up to c. 3,200m). Clump-forming thornless, frost-hardy bamboo growing up to 10-12m in height. Distinguished by its long, finely-grooved thin-walled internodes up to 50cm long and 4.5cm in diameter.	High utility. Extensively harvested by locals and contractors. Most important local non-timber forest resource. <ul style="list-style-type: none"> <li>- Mature culm (2<sup>nd</sup> season): mats for roofing, huts and temporary shelter, fencing and farm protection, household implements, walking sticks</li> <li>- Immature culm (1<sup>st</sup> season): cords, fibres (coarse 'rope'), baskets, winnowing trays, butter churn spindles, arrows</li> <li>- Tender shoots: human consumption, cattle feed (illegal); browsed by wild animals</li> <li>- Leafy portions: brooms, padding</li> </ul>
<i>Thamnocalamus spathiflorus</i> (Trin.) Munro. Local name: shi-za	
Overlapping and below <i>B. grossa</i> , above c. 2,400m (grows naturally up to c. 3,500m). Clump-forming, thornless, frost-hardy, growing to about 5m tall. In distinction to <i>Borinda</i> , the culms are smaller, brittle, and have swollen nodes with fewer branches.	Little utility to either subsistence or commercial economy <ul style="list-style-type: none"> <li>- Shoots and leaves: important food and concealment for wildlife</li> <li>- Young shoots, tender culms and leaves: heavily grazed by cattle in early winter</li> </ul>
<i>Chimonobambusa callosa</i> (Munro) Nakai. Local name: ra-shi	
Found at c. 2,000 – 2,500m elevation. Distinguished from the others, above, by the growth of solitary shoots from long-spreading rhizomes and by a ring of thorns around the culm nodes. Slightly frost-hardy with relatively thick-walled culms up to 6m tall and 4cm in diameter. (In the study area, a good example of its development can be seen in the electricity line corridor and lower bamboo hauling track.)	Little utility to either subsistence or commercial economy <ul style="list-style-type: none"> <li>- Mature culm: 'wattle and daub' wall construction, mats and baskets</li> <li>- Young shoots: grazed by cattle</li> </ul>

*Borinda grossa* is a clump-forming thornless, frost-hardy bamboo up to 10-12m in height, occurring above 2,600m elevation in the study area. This bamboo is distinguished by its long, finely-grooved, thin-walled culm internodes of up to 50cm long and up to 4.5cm in diameter<sup>12</sup> (see Figure 3).

*Thamnocalamus spathiflorus* overlaps with *B. grossa* above about 2,400m in elevation. It is most likely of the subspecies *spathiflorus*, since the culm sheath is symmetrical on the culms examined. This is also a clump-forming, thornless, frost-hardy bamboo growing to about 5m tall. In distinction to *Borinda*, the culms of *Thamnocalamus* are smaller, brittle, and have swollen nodes with fewer branches<sup>13</sup> (See Figure 4).

*Chimonobambusa callosa* is found from 2,000m to 2,400m elevation. It is easily distinguished from the other two by the growth of solitary shoots from long spreading

<sup>12</sup> *B. grossa* is synonymous with *Fargesia grossa* (Yi), and also with *Borinda chigar* and *Borinda emeryi* (Stapleton) (Masman 1995; Watson and Dallwitz 1992).

<sup>13</sup> In Chamling (1996), *Thamnocalamus spathiflorus* is mis-identified as *Yushania pantlingii*, a species common elsewhere in eastern Bhutan. This was probably due (in part) to the fact that local residents lump *T. spathiflorus* among those species which they refer to as 'maling' or 'malingo'. Our identification was keyed and verified in the field by the plant ecologist (J. Davidson).

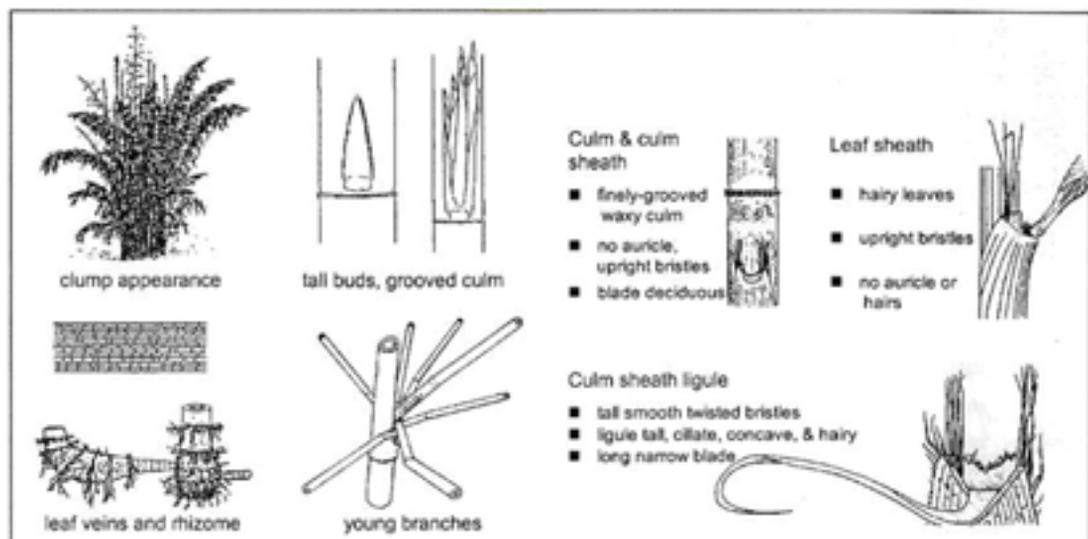


Figure 3: *Borinda grossa*

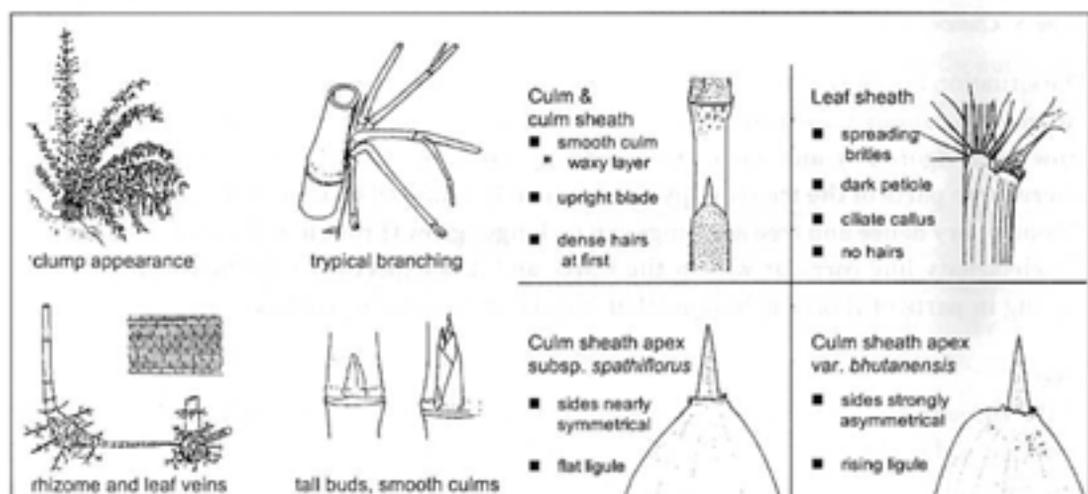


Figure 4: *Thamnocalamus spathiflorus*

rhizomes and by a prominent ring of sharp thorns around the culm nodes. This species is slightly frost-hardy with relatively thick-walled culms up to six metres tall and four metres in diameter. In the study area, the best development of this species can be seen along the electricity line corridor and the lower part of the walking track (the 'bamboo trail') which runs from the top of the FMU down across the forest road to the nearby highway and village of Wamrong (see Figure 5).

### Condition

When bamboos such as *B. grossa* and *T. spathiflorus* grow in clumps, tree seedlings usually regenerate in the gaps between the clumps. However, in this FMU, most such tree regeneration is grazed by cattle and does not survive except for unpalatable *Symplocos* species.

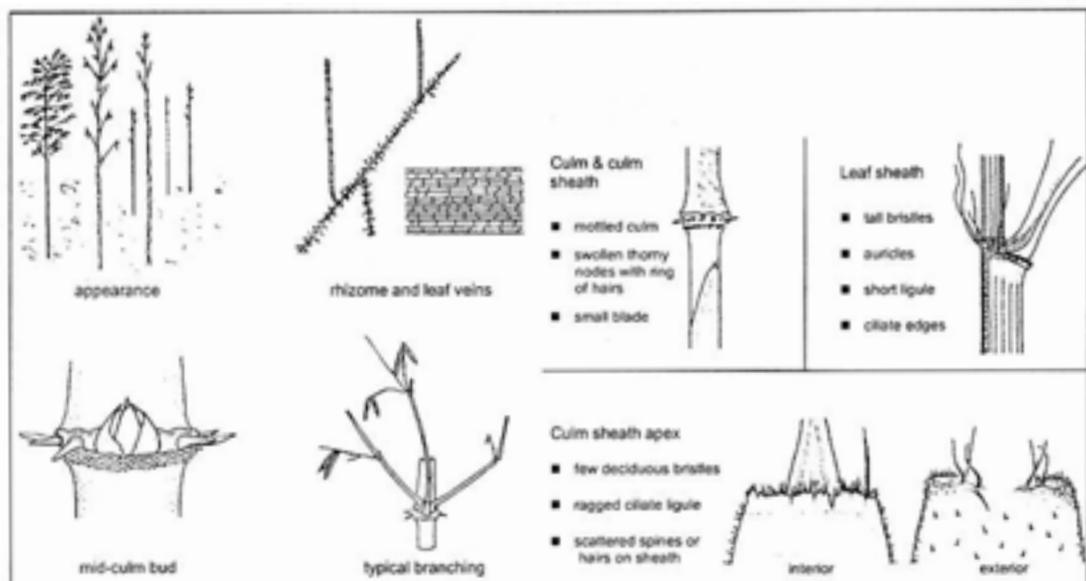


Figure 5: *Chimonobambusa callosa*

The situation is different for spreading genera like *C. callosa*. Under undisturbed conditions the mature canopy trees prevent sufficient light, reaching the ground for this bamboo to grow very vigorously and some tree seedlings can grow through the bamboo. However, where large parts of the tree canopy are completely removed by clear felling, the *C. callosa* becomes very dense and tree seedlings can no longer grow through it. This is the case along the electricity line corridor within the FMU, and it is expected to be the result of future logging in parts of those cable lines that impact on *C. callosa* patches.

## Use

Of the three species of bamboo, *B. grossa* is the most important economically. It is found in quantity and is the most heavily used for making a variety of mats for house roofing and fencing, and for the wattle and daub of house and hut construction. The other two species have little commercial value and only minor utility in the local economy.

## The harvested clumps

All of these bamboos are fast-growing, with short-lived aerial parts and long-lived rhizomes that continually renew themselves vegetatively. Periodically, the species are re-invigorated by a flowering and seeding cycle during which the previous vegetative generation completely dies out. The precise timing of flowering and seeding has not been determined<sup>14</sup>.

The normal growth pattern is for a new culm to emerge during the monsoon and reach maximum height extension by the onset of the dry winter season. During the second year, the culm wall becomes hard and dense, and branches and leafy crowns become pronounced.

<sup>14</sup> Local informants indicate that the local bamboos flower every five to nine years, but we were unable to verify this.

By the third year the culm is in decline and beginning to decay, becoming dark brown to black. Eventually, by the fourth or fifth year, the culm falls and or breaks off and decays on the ground. New culms come up in their place.

Culms are harvested during the second year. Harvesting is selective; only the straightest, smoothest, and largest culms are chosen. They are cut 20-50cm above the ground level by a single downward diagonal blow from a 'patang', the Bhutanese man's traditional machete-like knife.

Clumps that have many culms harvested tend to develop matted rhizomes which restrict subsequent new growth. In an ideal situation, the rhizomes should be allowed more space to grow by using various techniques for removing part of the clump (cross, crescent pattern, and others).

## Socioeconomic aspects

### Utility

Because of its level nodes, thin walls, and long internodes, *B. grossa* is easily split into strips for mat-making. This species is the most important alternative (non-timber) forest resource in the FMU and it is harvested and used extensively.

During the cutting and mat-making season (mostly from mid-October through December, but extending to April), *B. grossa* cuttings can be observed being dragged in bundles down the bamboo trail to the road where they are laid out, pounded flat, split, and woven into mats. Mats are used locally in house construction, roofing and fencing, and for household implements. Rough cords ('coarse rope') as well as baskets, hats, winnowing trays, and a few other items are made from the fibres of the immature, first season culms. The tender shoots of *B. grossa* are eaten by people and sometimes heavily browsed by domestic cattle, sheep, and wildlife. The leafy portions are sometimes cut to make brooms and for padding under heavy back loads (especially when the heavy bamboo culms are dragged down from the high forest).

In addition to its importance in local subsistence, *B. grossa* has considerable commercial value. Since 1979, commercial harvesting permits have been issued from the Divisional Forestry Office to contractors, some of whom come from a distance away (such as from Samdrup Jongkhar and Pemagatshel districts in the south, near the international border with India), as well as locally from towns and villages within Tashigang District.

Note that, despite the life form stamina and great utility of the resource, in this generally humid environment the lifetime of bamboo products is limited. Bamboo mats, for example, have poor long-term durability, because in this humid environment they are attacked by insects and fungi much more rapidly than some timber products. The typical mat roofing lasts for three years.

Compared with *B. grossa*, the culms of *T. spathiflorus* are small and brittle and not widely used. The shoots and leaves provide important food and concealment for wildlife. In the study area young shoots, tender culms, and leaves are heavily grazed by cattle in early winter.

The culms of the thick-walled *C. callosa* are inflexible and brittle; and the presence of nodal thorns makes them unpleasant to handle. Virtually the only use observed has been to fabricate wall panels in house and hut construction, a style of 'wattle and daub' where the culms are split and loosely woven, then covered on both sides by cement or clay for durability. The only other *C. callosa* parts of any use are the tender shoots that are browsed by cattle.

### Commercial value

Bamboo contractors hire local villagers to cut and deliver bamboo culms to the roadsides. There, the culms are split and woven into roofing mats and fencing material of commercial value. The rate paid for cutting, dragging, splitting, and weaving is Nu 50 to 60 per day (the standard day labourer's wage is the same for man or woman)<sup>18</sup> (see Plates 3, 4, 5 and 6)



Plate 3: Bamboo culm haulers in the high forest



Plate 4: Bamboo culm haulers in the high forest



Plate 5: Bamboo culm haulers in the high forest



Plate 6: Bamboo culm haulers in the high forest

<sup>18</sup> Ngultrum (Nu) 40 = US \$1.

A skilled mat weaver can complete four mats in a day, after cutting and hauling the resource to the roadside and splitting the culms (Plate 7). A finished mat consumes, on average, 15 to 18 culms (about one adult dragger's head-load, Plate 8). Finished mats measure approximately 2 x 5m and sell for Nu 50 to 60 each.

Productivity is measured in 'truckloads' of 150 mats each. One commercial truckload has a market value in the range of Nu 7,500 to 9,500 at current prices, depending in part on how far away the mats are delivered. The volume of cutting under commercial permit is shown in Table 3. The figures show that 684,660 culms were extracted under commercial permits from the forest between 1991 and 1997, increasing steadily each season. The sale of finished mats brings a good profit for contractors compared to logging and firewood cutting, for example.

It is clear that the commercial value of the bamboo is high, and also that it has important economic benefits for local residents who participate in commercial cutting and mat-making.

### *Subsistence value*

Bamboo mats for roofing and fencing are ubiquitous across Bhutan, and especially so in the eastern dzongkhags where natural bamboo resources are abundant. Traditionally, house roofs are constructed of mats, and some less substantial houses and huts use bamboo mats for wall construction. There are several varieties of mat, identified by the tightness of the weave. Split bamboo is also used to make a variety of other products, as already noted. Hence, the demand for bamboo in this subsistence economy is high.

**Table 3: Supply of bamboo by commercial permit, 1991-1997**

Year	Annual cut by government permit (culms)
1991	62,570
1992	85,670
1993	88,500
1994	75,550
1995	123,750
1996	120,545
1997	128,075*
Total	684,660

\*In 1997, an additional 3,000 culms were cut for making mats for a VIP visit. This was an extraordinary, non-commercial purpose, was managed by the government, and required no commercial permits; hence, they are not counted here.

Source: Forestry records, Range Office Warrang, Tashigang District



Plate 7: Splitting culms by the roadside



Plate 8: Weaving a mat

During the most intense bamboo harvesting season (October to December) some local families depend almost totally on this work for employment and cash income. During the dry winter season, men and teenage boys enter the high forests to cut the culms. They – and women and girls in some locales<sup>1361</sup> – may be seen dragging the raw material, the harvested culms, down to the roadsides. There, the culms are split and flattened to make them pliable for weaving. For some local families, seasonal income earned from the bamboo harvest and mat-making is considerable, although precise cash totals earned from this work are difficult to calculate.