

INTRODUCTION

During the winter of 1998-99, research was carried out in eastern Bhutan to ascertain the vulnerability of indigenous bamboo species to commercial exploitation, with special attention given to the local sociocultural context and the role of bamboo in the traditional economy. The work was carried out through the Third Forestry Development Project (TFDP) in Bhutan's northeastern-most district of Tashigang (Tashigang 'Dzongkhag'). The TFDP has operated since 1994 in the region, bringing forest management and social forestry expertise to six districts that make up the eastern region^[1]. This study represents part of the project's mandate to apply social forestry principles and practices to the sustainable management of tree and forest resources.

The forests of eastern Bhutan

The forest ecology of Bhutan is complex, with 11 distinct forest types represented nationwide. Nine types are found in the six eastern districts^[2].

The bamboo vulnerability study was carried out in the predominantly Cool Moist Broad-leaved Forest (2,000–2,900m) of Khaling-Kharungla. This forest blends into a Warm Moist Broad-leaved Forest below 2,000m, and into alpine scrub above and outside of the study area. The high broad-leaved forest is described as a mixture of deciduous and evergreen species (e.g., *Quercus* spp, *Rhododendron* spp, *Castanopsis*, *Schima*, *Daphniphyllum*, *Symplocos*, *Exbucklandia*, *Acer*, *Persea*, *Alnus*). It is further characterised by a dense undergrowth of bamboos, shrubs, ferns, climbers, and many epiphytes.

Alternative forest resources in eastern Bhutan

Alternative (non-timber) forest resources (AFRs) are important in both the subsistence and commercial economies of eastern Bhutan. AFRs are defined as the **raw materials from a forest** that, taken together, fit neither the standard definitions of **non-wood** or **non-timber forest products** (NTFPs), nor of **minor forest products**. Rather, many of these raw materials are woody, are of major significance in the local economy and, technically, they remain as

¹ Eastern Bhutan's highest, coolest, and most northerly districts are Tashigang, Mongar, Yangtse, and Lhuentse; the lowest, warmest and most southerly are Pemagatshel and Samdrup Jongkhar. The region is bordered by China (Tibet) on the north, and by India on the east and south (Arunachal Pradesh and Assam states, respectively).

² The nine forest types of eastern Bhutan are: (1) Tropical Lowland Forest (also called Sub-tropical Forest), below 700m, and (2) Warm Broadleaf Forest (Lowland Hardwood Forest), 1,000–2,000m. These two are dominated by a variety of tropical and sub-tropical species; e.g., *Acacia catechu*, *Bombax ceiba*, *Duabanga grandiflora*, *Ailanthus grandis*, *Schima wallichii*, *Terminalia* and associates. (3) Chir Pine Forest, 900–1,800m, *Pinus roxburghii* in open stands, associated with lemon grass. (4) Evergreen Oak Forest, 1,800–2,600m, in which *Acer campbellii* and *Castanopsis* dominate, with *Quercus* and *Pinus wallichiana*. (5) Cool Moist Broadleaf Forest, 2,000–2,900m, *Quercus* and *Rhododendron* spp, with *Castanopsis* and other species, in association with bamboos, shrubs, and ferns, and so on in the understorey. (6) Broadleaf/Conifer Mixed Forest, 900–3,000m, *Pinus wallichiana* on southern aspects intermixed with *Pinus roxburghii* on eastern aspects. (7) Blue Pine Forest, 1,800–3,000m, *Pinus roxburghii* (*P. excelsa*) with *P. bhutanica*, intermixed with *Quercus* and *Rhododendron* spp. (8) Mixed Conifer Forest, 2,000–2,700m, *Picea*, *Tsuga*, *Larix* (sub-alpine and, in places as cloud forest bearded with mosses and lichens). (9) Fir Forest, 2,700–3,800m, *Tsuga* and *Betula* blending into alpine scrub at the highest elevations (*Juniperus*, *Rhododendron*, and others). (Based on MoA 1998; Grierson and Long 1983; and Noltie 1994; see also TFDP 2000: Ch.4)

resources until well after harvesting when they become, after a certain amount of processing, value-added products for marketing (Messerschmidt and Hammett 1998, 1994).

There are many types of AFRs in eastern Bhutan. Some of the most important found in the eastern dzongkhags include medicinal plants such as 'chirata' (*Swertia chirata*) and 'pipla' (*Piper spp*); traditional paper-making resources, locally 'shu-gu' (*Daphne spp*); essential oils (especially the aromatic 'citral' distilled from lemon grass – *Cymbopogon flexuosus*); many bamboos (known locally as 'shi' ; species of the genera *Arundinaria*, *Bambusa*, and *Dendrocalamus*); and a variety of other plants harvested for their food values, fibres, resin, turpentine, and ornamental qualities.^[1]



Plate 1: Bamboo mat roofs of Khaling village

Bamboos are widely distributed throughout Bhutan. Thirteen genera and 28 species have been recorded nationwide (Pradhan and Rinchen 1996, Stapleton 1994a, b). They occur in many sizes, at virtually all elevations, and are used widely for basket and mat-making, containers, hats and rain wear, fencing, roofing (see Plate 1), and construction of houses and huts, as well as for religious flag poles and water channelling (bamboo pipes).

Three species are found in the study area: *Borinda grossa* (Yi) Stapleton, *Thamnocalamus spathiflorus* (Trin.) Munro, and *Chimonobambusa callosa* (Munro) Nakai. These species are the focus of our study. In a later section we describe their botanical attributes and discuss traditional use and management, as well as their commercial values.