

Short Contribution

## Status and Ethnobotanical Uses of *Pterocarpus marsupium* Roxb. in Hariyali Community Forest, Kapilvastu

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### ABSTRACT

*Pterocarpus marsupium*, Roxb., locally known as Bijaysal, is a medium to a large-sized deciduous tree that grows up to 33 m height. Confined to an altitude of 100-500 m is naturally distributed at the foothills of Siwalik. The study was carried out in the Hariyali community forest, Kapilvastu. The field data were collected from the study area through direct field observation, household survey, key informant interview, and focus group discussion whereas secondary data were collected from relevant published and unpublished materials. Out of 116 individuals found in the study area, 4 were trees, 79 were poles and 33 were saplings. The species were mostly distributed in North, North East, and North West aspects, within elevation from 97-139 m elevation, flat and undulating slope mainly in Calcaricphaezems soil order. Generally, local people were using the species for fodder, firewood, medicines, dyes, timbers, utensils, agricultural tools, etc. Cutting for fodder was the main human-induced threat followed by grazing, fire, medicinal use, and illegal felling. The major natural threat for the species was low germination and slow growth rate thus awareness for plantation, protection, conservation, proper utilization, and management of Bijaysal were mandatory for the long term to benefit from this valuable species.

Key Words: Distribution; Bijaysal; Ethnobotanical Uses; Conservation

### INTRODUCTION

*Pterocarpus marsupium* Roxb, locally known as Bijaysal, is a medium to a large-sized deciduous tree that grows up to 33m in height (Barstow 2017). The species is native to India, Nepal, Bangladesh, Sri Lanka, and Taiwan. Although species has a wide native range (tropical south Asia), it has become limited in distribution due to the natural stands of the tree disappearing rapidly (Anis et al. 2005). Though the national population status of this species is not estimated yet, there are few sporadic studies on their population status at local and district levels. There are about 400 mature trees in 12 community forests (CF) of Kanchanpur (Pyakurel and Oli 2014). Likewise, Buddhahumi-10 of Kapilvastu district has more than 500 mature trees and there are 396 trees at the breeding seed orchard of the Department of Forest Research and Survey (DFRS) in Butwal. Also, the Tree Improvement and Silviculture Unit (TISU) of the

Department of Forest (DoF) had established a breeding seed orchard in Kanchanpur district (DoF 2018).

It is mainly found at an elevation of 100-500 meters and annual temperature ranges from 22-34 °C (Pyakurel and Oli 2014). Bijaysal prefers the north aspect and is found either in the pure Sal forest or Sal mixed with other tree species like Karma (*Adina cordifolia*), Sindure (*Mallotus philippensis*), Harro-Barro (*Terminalia* spp.), Khair (*Acacia catechu*) and other trees characteristic of mixed deciduous forest. It is found on a variety of soil formations (preferring sandy loam), provided the drainage is good and prefers the northern aspect associated with Sal species (DoF 2018).

Geographic Information System (GIS) is a decision-supporting system involving the integration of spatially referenced data in a problem-solving environment. So, GIS technique and procedure have an important role to play in analyzing decision problems (Malczewski 2006). As a result, GIS has been used in policymaking

for environmental and forest planning and decision making over the past two decades (Upadhyay 2009). GIS and related technologies like GPS, Remote sensing, DEM, Soter, either individually or in combination provide foresters with a broad range of applications and complexity (Anon. 2015).

The NBSAP 2014-2020 and Terai Arc Landscape Strategy and Action Plan 2015-2025 emphasized the importance of conservation of Bijaysal and stressed the immediate need for strategic interventions to ensure its recovery and long-term survival. Habitat loss, degradation, and fragmentation are the major threats to Bijaysal. Low germination, slow growth rate, localized distribution, and overharvesting are the threats faced by this species. Because of these threats, the Government of Nepal has banned the felling, transportation, and export of this species under the Forest Regulation 1995 (DoF, 2018). The plant is listed as Near Threatened (NT) under the IUCN Red List category based on the threats present to the species, decreasing population and declining areas of occurrence (Barstow 2017).

The ethnobotanical uses of the species have a long history due to its multiple uses and values. Diabetic anemia is cured of its seed paste and decoction of heartwood (Badkhane et al. 2010). Traditionally, the wooden tumbler made up of heartwood is used for drinking water because of its medicinal property (Reddy et al 2008, Gairola et al. 2010). The bark is used for the treatment of stomachache, cholera, dysentery, urinary complaints, tongue disease, and toothache (Tiwari et al. 2004). Likewise, the heartwood is astringent, bitter, acrid, cooling, anti-inflammatory, depurative, hemostatic, repulsive, and anti-hermitic, constipating, and rejuvenating (Warrier 1995). The decoction of bruised leaves is applied to boils, sores, and other skin diseases (Singh and Hamal 2013). The gum resin (Kino gum) is used to regenerate insulin-producing beta cells in the pancreas (Mishra 1993) and to treat stomach and abdominal related problems including acute gastritis (Tiwari et al. 2004). Heartwood and gum are useful in the skin and blood-related diseases, rejuvenator, diarrhea, dysentery, toothache, and joint pain (Mishra 1993).

Leaves and twigs are collected as fodder for cattle, the lower part of trees are found exposed and gums are collected for wound healing, traditional as well as ayurvedic medicinal purposes, over-extraction of Kino gum by slashing bark and exposing the heartwood. Its economic value increases in recent years, mainly due to the use of timber. *Pterocarpus marsupium* has medicinal, fodder, and timber values. In the past, the species has been heavily utilized; consequently, the genetic

resource base of this species has been heavily eroded. Besides, the species being an associate of Sal forest was suffered from the consequences of deforestation in the Terai forests of Nepal (Acharya et al. 2002). This paper aims to assess the distribution, ethnobotanical uses, and conservation status of Bijaysal (*Pterocarpus marsupium*) in the Hariyali community forest, Kapilvastu.

## STUDY AREA

The study was carried out in Hariyali Community Forest (CF) of Buddhabhumi municipality, Kapilvastu district, Nepal (Figure 1). The total area of this CF is 157.85 hectares including 10.46 hectares of a pond. The study area was located at a lower tropical zone below 300m elevation with a temperature range of above 27°C during summer and below 15°C during winter. Sal, Teak, Sissoo, Khair, Bijaysal, Asna, Cane, Bamboo, elephant grass, etc. were the common species in the study area. Among 99 households with a total of 442 population living there, Awadhi and Tharu

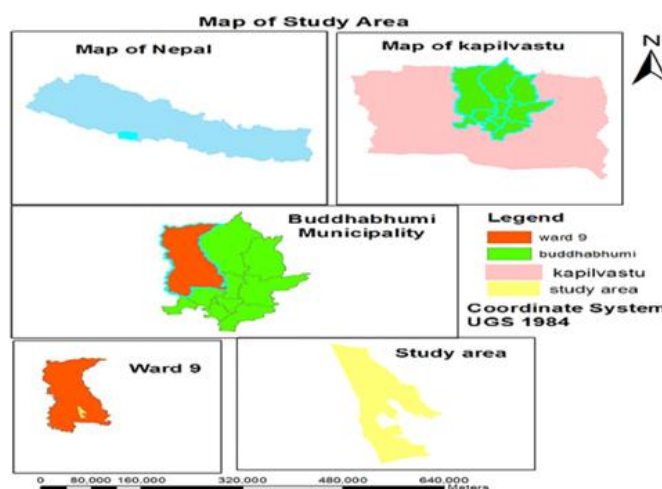


Figure 1. Map of the study area

ethnic group were the major inhabitants followed by Brahmin, Chhetri, Magar, etc.

## MATERIALS AND METHODS

The information was collected from both primary and secondary sources. The field survey and key informants interview were verified through direct field observations. Distribution of *Pterocarpus marsupium* (Bijaysal) within the CF was obtained by the GPS coordinates of all individuals of the species. Household survey with 20% sampling intensity was used in the random sampling

method. Key informant survey with local healers, Baidya, local elites, old people, members of community forest user groups, rangers, local leaders, Assistant Forest Officer and Division Forest Officer were taken as the key informants for collecting different types of information, and four focus group discussions were conducted to obtain information about its distribution, uses, threats, challenges, issues, and conservation measures. Various journals, government reports, and internet were used as sources of secondary data.

The data collected from field observation, Household Survey, Focus Group Discussion, and Key Informant Survey were analyzed quantitatively with the help of the statistical tool, MS Excel. Arc GIS 10.2 was used to prepare a distribution map of the species in the study area.

## RESULTS AND DISCUSSION

### Distribution of the Species

All together 116 *Pterocarpus marsupium* (Bijaysal) were found in Hariyali CF (Figure 2), out of which 4 were trees, 79 were poles, 33 were sapling and no seedling was observed.

The sandy loam soil with a good drainage system was found as preferred soil type in a previous study by (Troup 1921, DoF 2018). In the study area, 99% of total soil was in PHc i.e. Calcaric Phaeozems soil order which all the stands i.e. total number 116 stands of Bijaysal were distributed in Calcaric Phaeozems soil order with good drainage quality.

Most of the species (about 65%) were found in northern aspect i.e. S1 (N, NE, NW in Figure 3) either in Sal dominating or mixed forest of *Adina cordifolia*, *Terminalia* spp., *Accacia katechu* etc., and similar findings were observed by DoF (2018). Likewise, similar

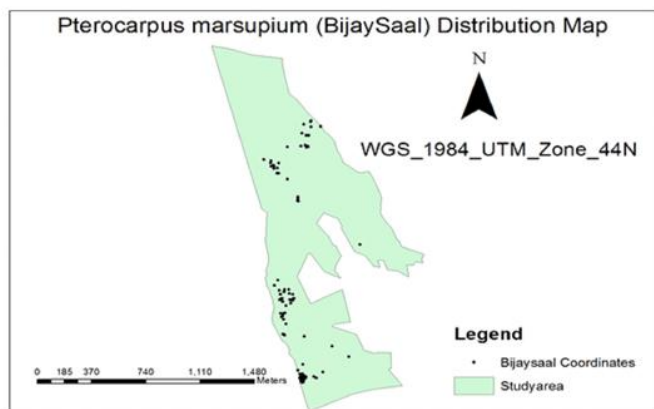


Figure 2. Distribution map of Bijaysal in Hariyali CF

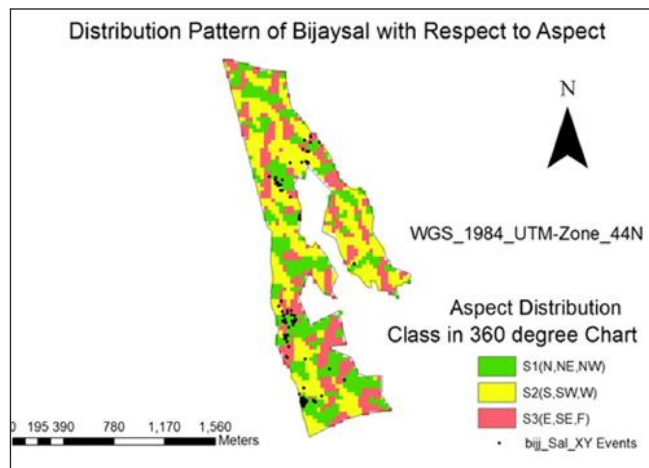


Figure 3. Distribution pattern of Bijaysal with respect to aspect

to the altitudinal gradient observed in this study, Pyakurel and Oli (2014) also reported that the natural distribution of Bijaysal was found ranging altitude of 100-500 m elevation in Kanchanpur district, western Nepal.

### Ethnobotanical Uses

Most of the plants of this species in the study area were used as traditional medicine. *Pterocarpus marsupium* was used as anti-diabetic since time immemorial. The beakers made from heartwood were filled with water and allowed to stand overnight for the cure of diabetic patients. Traditional medical practitioners like Baidhya, local healers, Guruwa, etc. in the area were engaged in folklore medicines. Likewise, it was used for making utensils, musical instruments, cup, glasses, etc. in earlier times; however, the people were not found to practice local medical treatment as compared to the past context in this area due to the knowledge gap and availability of modern tools and techniques. Overall ethnobotanical uses practiced so far of the species by locals have been listed in Table 1.

### Threats and Conservation Practices

From the data collected from the household surveys and key informant interviews, the cutting for fodder was the main threat followed by grazing, fire, medicinal use, and illegal felling. Besides these, low germination rates and slow growth were the major natural threat to the species. Endowed with high intrinsic value, this species was under threat from over-harvesting at the local level. Thus, derivatives of the Bijaysal are lucrative to illegal harvesters resulting in unsustainable harvesting, posing threat to their survival and sustainability (Nijman 2010) and thus the Government of Nepal has banned Bijaysal

Table 1. Plant parts, ethnobotanical uses, and way of uses

Parts Used	Uses	Way of Uses
Bark	Malaria	Inhale paste directly
	Gastritis	Inhale paste directly
	Body Temperature Regulation	Boil bark in water and bath
	Pneumonia	Apply grinding paste in chest
	Intestinal Parasite	Herbal Tea
	Diabetes	Soak in water overnight and drink directly
Gum	Body Pain, Leg Pain	
	Coughing, Cold	
	Gastritis	
	Increase Appetites	
	Heat Stroke	
	Antimicrobial	
	Diarrhea	
	Water Purifier	Mix about 5 ml in 1 litre of water
	Dyes	Chemical Processing
	Toothache	Apply on pain area
	Skin Disease	
Leaves	Astringent	Soak in water overnight and drink directly
	Fodders	Chopped directly
	Toothache	Twigs for teeth brush
	Animal Bedding	Dry leaves Collection
Branches	Skin Diseases	Crushed leaves
	Firewood	Cut directly
Roots	Essential Oil	Apply on pain areas
	Appetite	Dried powder of flower
Flowers	Febrifuge	
	Anorexia and fever	

According to data collected from Household Survey in the study area, it was found that Bijaysal was mainly used for fodder (46%), followed by medicines (41%), and dyes (7%) and handicraft (5%), etc. respectively.

for feeling, transportation or export (DoF 2018). Thus, there must be greater collaboration among government agencies, conservation partners, and the private sector in this regard. The Silviculture Division of Division Forest Office, Kapilvastu has initiated various conservation measures for such and other valuable species.

## CONCLUSION

Altogether 116 Bijaysal were found in Hariyali CF mainly distributed in North East and North West aspect having Calcaric Phaeozems soils with good drainage quality. Out of which, 4 were trees, 79 were poles, 33 were saplings but no seedling was observed. Bijaysal

is one of the valuable multipurpose forest trees, used for building furniture, agricultural and railway purposes, medicines, fodders, handicrafts, etc. Habitat loss, low germination rates, slow growth rate, high grazing pressure, extensive lopping for fodder, fire, over and illegal harvesting of Kino gum and heartwood for economic and medicinal purposes, are major threats faced by the species thus protection, conservation, proper utilization, and management were mandatory.

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**Author's Contribution:** The first author collected field data whereas the second author analysed the data and prepared the manuscript.

**Conflict of Interest:** This research formed a part of undergraduate dissertation. We hereby declare that there is no conflict of interest.

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