

Review on Current Status of *Betula utilis*: An Important Medicinal Plant from Himalaya

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ABSTRACT

The present medicinal flora is at risk due to different high human activities across the world. *Betula utilis* species is distributed in Himalayan range. The over use of *Betula utilis* is not only for medicinal purposes but also for basic needs of life i.e. for food, feed, shelter and making different items of daily usage leads to reduce its population. In this review the percentage of excess exploitation in the near future is mentioned with explaining its uses. Conservation status of *Betula utilis* is not clear due to which its risk of extinction is not understandable up till now. Major threats to *Betula utilis* includes over harvesting, deforestation, erosion, grazing, global warming and pathogen attack. These threats can be overcome by sustainable utilization, micropropagation, *in situ* and *ex situ* conservation as well as reducing the human population size, and conservation of *Betula utilis* species in botanical gardens.

INTRODUCTION

Habitat degradation, pollution, introduction of alien species, over-exploitation and climate change are major threats faced by plants which are central part of our ecosystem because native plants are important constituents of the global biological diversity [1]. Conservation status of species can be determined by considering many factors such as deforestation, grazing, agriculture land, fuel demand, breeding success rates and other threats [2]. Plants are primary source for survival of life on earth as they clean the atmosphere, continue hydrological cycle, source of food and can be used in pharmaceutical and scientific research. It is observed that about 60000 plant species will become extinct till 2050 which will have harmful effects to humans [3]. The rainforest over harvesting leads to disappearance of many plant species as fast as 50 acres per minute [4]. It is found that with the extinction of one plant some 30 other plant species also disappear [5].

The forests are in the midst of the most important natural recourses to continue life in both Hindu Kush and Himalayan ranges [6]. The major role of these forests includes the continuance of biodiversity, watershed protection, supply of timber, grazing land for animals, non-wood products, habitat for threatened fauna and flora in the world [7]. Deforestation and over exploitation in the Himalaya is generally attributed to demographic pressure and other related effects such as increase in demand of land for cultivation, livestock population, use of the remaining forest to meet growing needs for fodder, fuel wood, and timber. On the other hand, social issues such as social relationships, perceptions and values about natural resources as seen by different social groups, issues of access to and control over resources and issues of power in relation to deforestation have rarely been discussed in current literature as possible driving forces to deforestation [8]. The hotspots of Pakistan are covering the 13 natural regions starting from alpine pastures and ending up to mangrove forest, among which 10% of the flora is included in endangered category [9].

Betula utilis belongs to family Betulaceae. It is a moderate size tree that can grow up to 20 m in height. The bark is shining, smooth, reddish white or white with horizontal lenticels. The outer bark is having numerous thin papery layers, exfoliating in wide horizontal rolls. The inner cortex is soft and red in color. The leaves are elliptic, ovate to acuminate and serrate. The flowers usually spike and bloom in May June. Seeds are slim and winged [10]. The present review has been written to analyze the excessive use of birch plant (*Betula utilis*) with its miraculous benefits. This can also help us to know the major threats as well as the possible conservation actions needed to save the important medicinal plants (**Figure 1**).



Figure 1. Map showing distribution of *Betula utilis*.

Distribution

Himalayan birch (*Betula utilis*) is a famous forestry species, growing at elevations up to 4,500 m. It makes tree line vegetation all alongside of the Nepal Himalayas and also on northern shady slopes and ravine^[14]. It is a broad leaved angiosperm tree species in the Himalayas which is widespread at subalpine altitudes^[12]. Major countries include Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, Tajikistan and Uzbekistan^[13].

The plant is found in higher altitudinal zones between 2800 m to 3800 m of Himalayan sub valley. The “utilis” means many uses of the tree^[14]. According to Hussain and Ilahi they are present between timber and snowline zones of Kaghan, Chitral, Dir, Swat, Baltistan, Gilgit, and Koh Safed region^[15]. *Betula utilis* is the characteristic species of the sub alpine zone and distributed in region of Waziristan, Kohistan, Swat, Baltistan, Azad Kashmir and Northern Areas of Pakistan^[16,17]. studied the environmental niche of Himalayan birch by providing a map as shown in **Figure 2**.

Taxonomical Description

Betula utilis plant belongs to kingdom Plantae, division Magnoliophyta, class Mangoliopsida with order Corylales and family Betulaceae^[18,19].

Conservation Status

The plant (*Betula utilis*) falls into different categories locally according to its percentage of reduction in population size^[20]. Considered this plant to be endangered. *Betula utilis* used excessively in the treatment of malaria, cold, rheumatism, and asthma so placed in category of critically endangered^[21]. Excessive use for fuel and medicinal purpose considered *Betula utilis* as threatened plant^[22]. According to Beech *Betula utilis* has been evaluated but not qualified for any category so considered to be of least concern^[23] (**Table 1**).

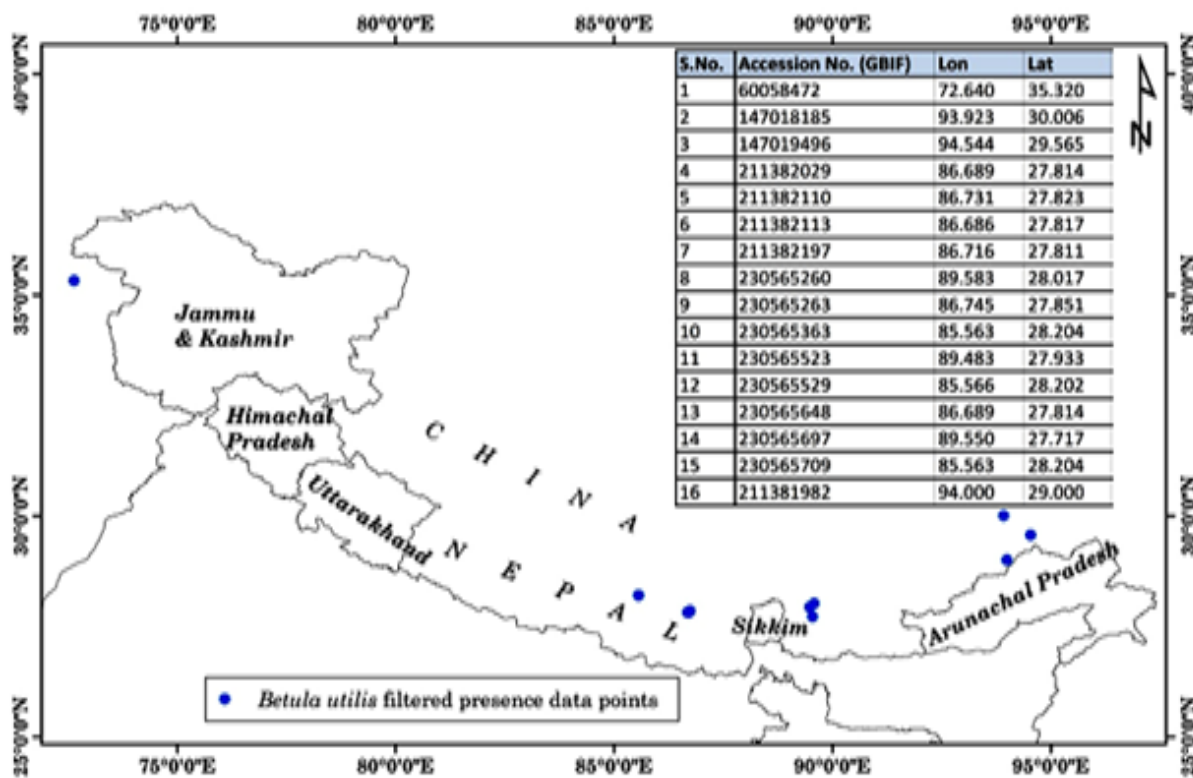


Figure 2. Environmental niche of Himalayan *Betula utilis*.

Table 1. Over look of status of *Betula utilis*.

Categories	Reference
Endangered	[20, 26, 48, 47, 49]
Critically Endangered	[21, 44, 50, 51]
Near Threatened	[26]
Endangered in NWH and Critically Endangered in JK	[44]
Threatened	[22]
Least Concern	[13, 23]

Uses of *Betula utilis*

Betulin, acetylo-heanolic acid, lupeol, oleanolic acid, betulitic acid, lupenone, sitosterol, methyl betulonate, and methyl betulate the chemical compounds which are extracted from its bark. Karachicrustics (triterpenoid) is aromatic and has antiseptic properties [24]. The compound Betulin shows anticancer activity by suppressing growth of malignant melanoma and cancer of liver and lungs [25]. Its phytochemical analysis shows that this species is rich in alkaloids and carbohydrates which show antibacterial activity [10]. Wood is used for fuel, leaf as fodder and for paper making. It helps in treatment of asthma, cold, malaria, cough gout and rheumatism [26]. The bark in the treatment of various diseases such as wound healing, skin disinfectant, bronchitis, convulsions, leprosy and diseases of the blood and the ear [27]. It is used in various antimicrobial, antioxidants, anti-inflammatory, anticancer, anti-HIV activities and hepato-protective. The plant has alkaloids which have therapeutic effects [18]. The bark is used in making wrapping material and roof construction, leaf for treating urinary tract infections, in kidney and bladder stones [28]. Leaf decoction is used as diuretics. Bark paper is used to release fear and cure fever. A portion of papery bark is reserved in homes to get harmony in families [29]. It is used as an antiseptic, carminatic and antibacterial agent. It also used on burns, cuts, ear complaint jaundice, wounds or religious Hindu ceremonies [21]. The bark paper is used for packing ghee and making binding ropes, for wood protection from soil and in ear related problems. The wood is used for making plough, spoons and is a source of fuel (Figure 3). Plant also provides food, gums and resins [30]. Many insects and beetles live in bark and roots of *Betula* so provides them niche [31].

Threats to *Betula utilis*

The major threat to this species is over exploitation due to its high medicinal value [13]. Over exploitation occurs when resource utilization is unsustainable [32]. This occurs in multiple forms as overcutting, excessive logging, illegal wildlife trade, poor soil conservation on agriculture land. Birch (*Betula utilis*) is the timberline tree that has reduced in population as well as in form due to deforestation, overgrazing, erosion, medicinal use and occurs as deformed shrub with open canopy [33,28]. The decline in the size of population of these species is due to its area of occupancy, extent of occurrence, potential level of exploitation, effects of

introduced taxa and attack of pathogens [21]. Mostly fungi causes canker disease on birch which infect and kill sapwood forming sunken areas on the trunk and its branches. There is no chemical control of this disease. Prevention of this disease is done only by keeping the tree healthy and avoids wounding. Usual fertilization will keep birch resistant to cankers and water in dry weather to stop water stress. Dieback is caused by a slow death of the branches. When the symptoms of disease occurs prune out dead branches (Figure 4). Many fungi can also cause leaf spots which when rigorous, can cause defoliation. Deforestation due to over cutting and smuggling of trees, for cultivation, grazing by all kinds of animals affects the regenerated plants. Forest fire, snow drift, lighting, erosion and landslide are also considered as minor threats [21]. The factors causing the loss are deforestation, global warming, overpopulation, changes in environment and pollution [34]. The decline in forest cover and major changes in community composition leads to reduction of medicinal plants and their traditional knowledge [35].



Figure 3. Bark of *Betula utilis* wood is used to make utensils, bowls and spoons.

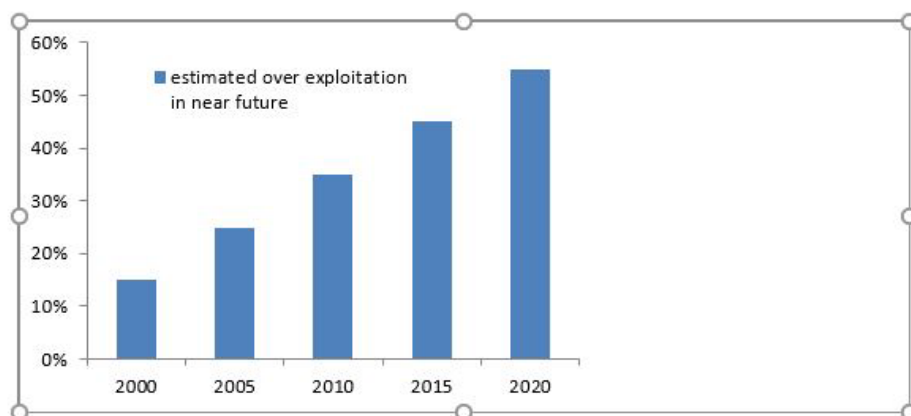


Figure 4. Estimated over-exploitation of *Betula utilis* in near future.

Conservation Strategies

Betula plants can be regenerated by callus formation [36,37] as leaf and roots are genetically invariable *in vitro* so results in increase in mass propagation of this clone. The best shoot differentiation is obtained on MS medium with BAP (1.5 mg/l) and maximum root differentiation is achieved on MS basal medium with NAA (1.5 mg/l). According to Zaki et al. [30] 80% cultures of *Betula* exhibited morphogenetic growth in tissue culture media (Figure 5).

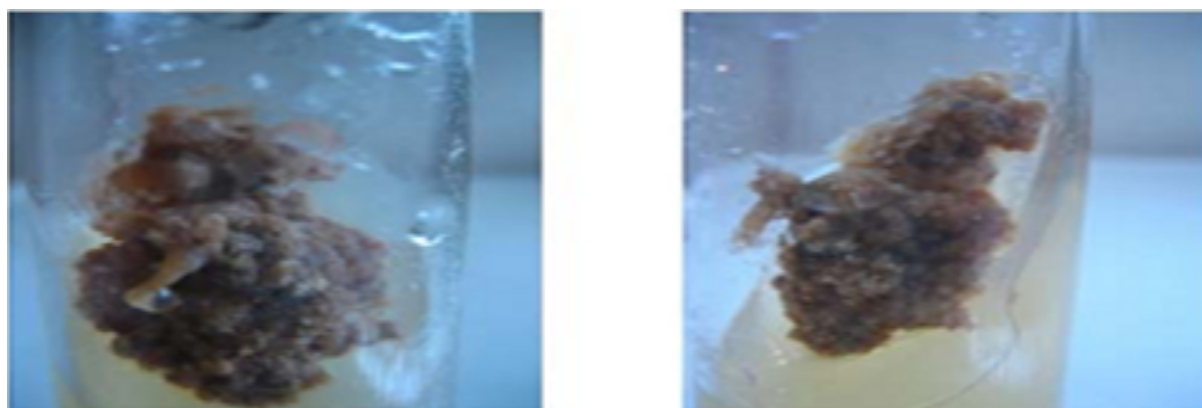


Figure 5. Proliferated callus cultures of *Betula* after 4-5 weeks of inoculation.

Harvesting must be sustainable to make sure the survival of these species and also use *in situ* and *ex situ* conservation strategies [13]. Tissue culture is one of the most encouraging way for conservation and mass propagation of many important

plants [38]. Indirect methods like calllogenesis and somatic embryogenesis can be applied for production of plantlets helping in establishment of large scale plant nurseries [33,39,40] established a protocol for synthetic seed production by using artificial coating material (sodium alginate) and complexing agent (calcium chloride). This synthetic seed technology can also be very helpful for medicinal plants such as *Betula utilis* species. These seeds can be stored and viable for comparatively longer period if provided suitable conditions. Germination of seeds can be enhanced by treating seeds with exogenous hormone like chemicals dissolved in water [41]. Keeping in view the high medicinal importance of *Asparagus* species, they should be introduced in botanical gardens. Efforts must be made to ensure public participation in conservation programs and awareness through training or utilization of mass media coupled with permanent monitoring programs. Permanent monitoring programs should be developed and conservation strategies should be planned to maintain threatened species [42, 43].

Clearing of wilderness, cutting, burning should be reduced as possible to save some of the remaining plant species, biodiversity and the gene pools for the settlement of the next generation [44]. Build effective relationship between farmers and growers, extension agents, private sector, NGOs or GOs, policy makers and enhance the information exchange. Deforestation should be overcome by using alternate resources to the peoples, uprooting and performing two years surveys to find their conservation status (Figure 6). Threatened species should be propagated in nurseries and conserved in botanical gardens. Human population should be controlled for controlling pressure on natural resources and provide habitats in order to evade their extinction [45]. International Union of Conservation of Natural Resources (IUCN) should pay attention to verify the proper category of this threatened plant globally as well as locally [46-48].

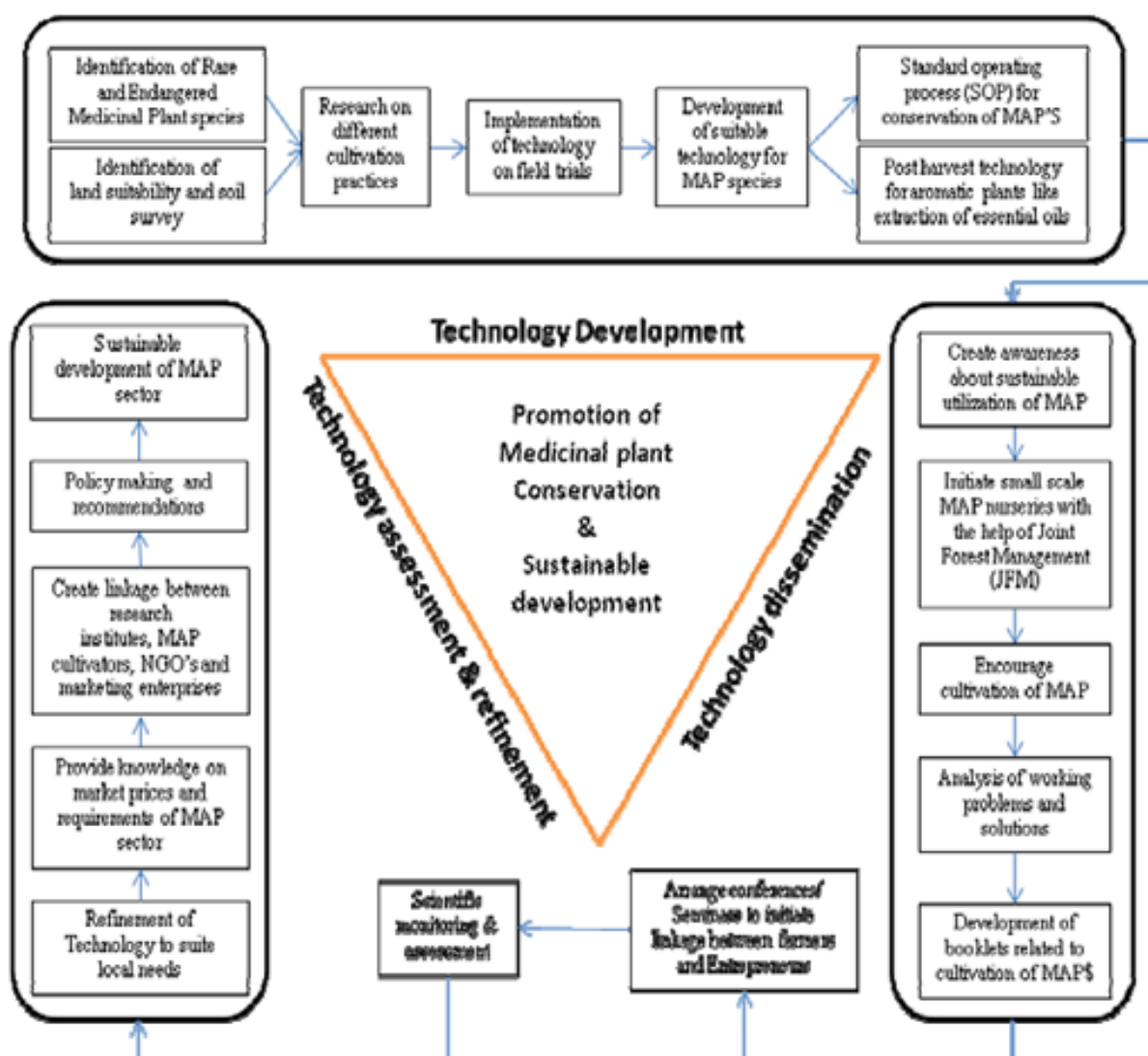


Figure 6. Model plan for conservation and sustainable development of MAP sector.

CONCLUSION

Betula utilis plants have so much significance but unsustainable utilization can lead to loss of species in near future. It is also not clear in which category of threatened species it belongs. It is central responsibility of the government to pay attention on the importance of it and should take different strategies for its maintenance. Possible alternate resources should be known to make ratios of its growth and exploitation equal. The conservation status of this species is not clear up till now so IUCN should carry out survey after every two years to make its status clear [49-51].

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