Quercus semecarpifolia Sm. in the Himalayan region: Ecology, exploitation and threats

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Oaks (Quercus spp.) are among the dominant vascular plants of the Himalayas, ranging from the subtropical to the sub-alpine zones. They play an important role in maintaining ecosystem stability. Oaks in the Himalayan region are intimately linked with subsistence hill agriculture as they protect soil fertility, watershed and local biodiversity. They also supply fodder, leaf litter, firewood and timber. Q. semecarpifolia is a high altitude oak, ranging up to the timberline in the Himalayan region and forming the climax community on the southern aspect; it is considered to be one of the oldest plants of the region. It is also one of the most over-exploited species and fails to regenerate adequately either in disturbed or undisturbed natural habitat. Since plantation has not been successful, it is important to manage natural forest more effectively. This can be done by implementing sustainable methods of lopping the trees for fodder, removing an adequate number of old and dying trees to make the canopy more open, and controlling the population of cattle and wild animals that damage seedlings through browsing and trampling.

Key words: Himalayan region, oak, Q. semecarpifolia, khasru, regeneration of Quercus

Oaks in general
Oak (Quercus), a genus under the family Fagaceae, is a large group of hardwood trees with about 600 species. Oaks are found in the northern temperate zone, subtropical and tropical Asia, and the Andes of South America. Oaks dominate many forest landscapes and are intimately linked with a large number of other organisms, ranging from fungi to ferns, birds to bears, and wasps to ants. Human beings have always had a strong connection with oak. Throughout history the oak has been a symbol of permanence, strength, and courage (Keator and Bazel 1998). Himalayan oaks are evergreen, mostly gregarious, medium- to large-sized tree, distributed at elevations of 800 to 3800 m asl throughout the Himalayan region. There are more than 35 species reported from this region (Negi and Naithani 1995), most of which are abundant in temperate forest. Eight species occur in Nepal (DPR 1997): Q. floribunda Lindl., Q. glauca Thunb., Q. lamellosa Sm., Q. lanata Sm., Q. leucotrichophora A. Camus, Q. mespiliformides A. Camus, Q. oxyodon Miq. and Q. semecarpifolia Sm.

The economical and ecological values of oak are generally higher than those of other species associated with oak. It is closely linked with hill agriculture as an important source of fodder for animals, litter for making compost, fire wood and timber. Oaks dominate the canopy in many temperate forests of the Himalayan region. In comparison to other forests such as pine, oak forests are characterized by higher species diversity, stratification, litter production and soil fertility. The bark of mature trees supports a luxurious growth of non-vascular as well as vascular epiphytes. Many oaks are keystone species without which the complex web of the ecosystem would soon unravel. Oaks also promote the recharge of mountain springs (Valdia 1998).

Unfortunately, the regenerative capability of this important forest element is poor not only in the Himalayan region but also in North America (Lorimer et al. 1994) and Europe (Andersson 1991). Some reasons that have been suggested to explain the poor regeneration of oak forest are erratic seed production, defoliation, acorn herbivory, browsing damage to seedlings, forest fire, extensive lopping, accumulation of thick litter with slow decomposition rate, infestation by stem parasites such as mistletoe, and leaf damage by insect pests. These factors, concatenated, interfere with the natural regeneration of oak forest.

Biology of Q. semecarpifolia
Distribution
Q. semecarpifolia (local name khasru) is an element of central Himalayan vegetation, which has occurred in this region for millions of years. Steppe formed after the final uplift of the Himalayas was invaded by this species and oak became the dominant element of then sub-alpine and alpine forest (Singh and Singh 1992). At present it is a dominant species in the Himalayas, from southwest China to Afghanistan, at elevations of 2100 to 3800 m asl. It occurs in moist temperate and sub-alpine regions with heavy snowfall and moderate rainfall, and is absent from the dry regions of the inner Himalayas (Negi and Naithani 1995).

Community structure
Khasru is a gregarious species forming pure forest stands. Its forest is one of the oldest vegetation types of the Himalayan region and a climax community, especially on the southern aspect (Negi and Naithani 1995). Disturbances such as lopping, felling, grazing and fire in most cases result in the development of mixed conifer-oak forest, which represents a seral stage of secondary succession. Major species associated with Khasru in mixed forests are Q. floribunda, Q. lanata, Q. leucotrichophora, Abies pindrow, Rhododendron
Unfortunately, it has become one of the most over-exploited tree and agricultural implements. Large branches and trunk wood are used for firewood. The bark yields tannins. The wood is fine, strong, durable and of good structural qualities, being resistant to termite attack. The wood is suitable for feeding the caterpillars of the silk moth when other green fodder is not available. The leaves are also suitable fodder. Khasru foliage is a staple dry season fodder from February to April (Shrestha and Paudel 1996). The economic and ecological benefits of khasru oak are substantial.

Use and level of exploitation

The economic and ecological benefits of khasru oak are substantial. Khasru foliage is a staple dry season fodder from February to April when other green fodder is not available. The leaves are also suitable fodder for feeding the caterpillars of the silk moth Antheraea pernyi. Litter collected from the forest floor is used for making compost. The bark yields tannins. The wood is fine, strong, durable and attractive, and can be easily shaped, making it useful for furniture and agricultural implements. Large branches and trunk wood are in high demand as firewood; the wood is also readily processed into charcoal of superior quality. The acorn is a favored food of many wild animals including bears, monkeys, squirrels and birds. Unfortunately, it has become one of the most over-exploited tree species of the Himalayan region.

The primary reason for the over-exploitation of khasru oak is the demand for dry season fodder, but large branches with foliage are lopped for firewood as well. In privately owned forests, trees are lopped for fodder once every two years, and sometimes even less often (Mathema 1991). In public forests, however, heavy and indiscriminate lopping continues throughout the year (Shrestha and Paudel 1996). Trees are reduced to naked poles. Flower and seed production are impeded to the point that the forest cannot regenerate itself. Leaf production is slashed to the point that the fodder supply is inadequate. And, to maintain the soil fertility of mountain farmland, more and more litter is collected, which prevents seedling establishment and upsets the nutrient balance of the forest.

The ecological benefits of any forest community cannot be expressed in monetary terms. As a dominant tree species of temperate and sub-alpine forest, khasru provides food for a wide range of fauna. The closed canopy allows the growth of shade-loving ground vegetation. Vascular and non-vascular epiphytic plants grow luxuriantly on the trunks and branches of mature trees. The abundant litter production helps to maintain soil fertility. The distribution of many plant and animal species depends on micro-climatic conditions maintained by khasru. In a climax community it is a keystone species, playing a critical role in environmental balance at both the local and also the regional level.

Due to over-exploitation and an inherently slow growth rate, khasru oak forest is degrading and shrinking in Nepal and the adjoining Himalayan region (for e.g., Mathema 1991, Singh and Singh 1992, Shrestha and Paudel 1996, Metz 1997). Degradation of khasru oak forest reduces the supply of dry season fodder, manure, high quality firewood and durable timber. Reduced supply of fodder forces the farmers to abandon the practice of animal keeping and ultimately reduces the crop production in the region (Shrestha and Paudel 1996), which has already faced the problem of food security. This will present the farmers with two alternatives: either to abandon cultivation and migrate or to adopt agricultural methods based on chemical fertilizer (Mathema 1991). However, hill and mountain agriculture based on chemical fertilizer cannot economically be profitable. The ecological cost of oak forest degradation is perhaps more important and damage is irreversible. The intensity of soil erosion and landslide is increasing and mountain spring recharge is decreasing. Many dependants, including epiphytic plants, ground vegetation and animal may be locally extinct.

Regeneration

Natural regeneration of khasru oak is poor both in disturbed and undisturbed forests. It is failing to regenerate under its own canopy. Lack of regeneration is sometimes attributed to the effect of climate change (Upreti et al. 1984), however there is no long-term data on population dynamics to support this. Healthy and regenerating forests owe their vitality to a continuing sequence of young, mature and old individuals of dominant species. In many undisturbed and little disturbed khasru oak forests, unfortunately, there are large old trees and seedling, but saplings and recruits are absent (Metz 1997); this indicates large-scale death of saplings and small trees before they reach the canopy. Annual, heavy and indiscriminate lopping precludes flowering and seed production for regeneration. Loss of photosynthetic surface as a consequence of repeated lopping not only leads to early senescence but also impairs the ability to coppice (Singh and Singh 1992). A comparative study has shown that trees lopped every year and at the interval of two years did not produce seeds, while trees lopped at the interval of three years or more do produce seeds (Shrestha and Paudel 1996). Litter collection, overgrazing and forest fire indiscriminately damage the seedling and sapling recruits.

Seed germination depends strongly on the quality and...
These management practices can increase the total fodder mother trees without lopping was recommended (Shrestha and Paudel 1996). Protection of a few districts of western Nepal (Parbat and Myagdi), facilitated by Lumle of khasru and other oaks (Shrestha and Paudel 1996). In some community forestry programmes in Nepal have not developed to reach the ground, have produced promising results in India (Negi and Naithani 1995). The accessible forest was divided into several blocks and a few blocks were opened each year for sustainable lopping practices. The tree density of khasru shows prominent signs of decline. Abnormal growth and branching (i.e., clusters of thin, profusely branched and slender branches with shorter internodes), increased defoliation and dying back of leader and branch tips, which are frequently observed in the forest, are sure signs of decline (Larcher 1995).

References


Tripathi RS and ML Khan. 1990. Effects of seed weight and micro-site characteristics on seed germination and seedling fitness in two species of Quercus in a subtropical wet hill forest. OIKOS 57: 289-96

