Review Article

Conservation status of *Taxus floridana*, a critically endangered evergreen coniferous plant

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Abstract

Taxus floridana Nutt. ex Chapm. is a slow growing, evergreen, coniferous plant restricted along the Apalachicola river in north-western Florida. Owing to its confinement to a small area and its declining population the specie is regarded as critically endangered plant according to IUCN. Besides its slow growth, many factors led to severe decline in the population of this species in past few decades. Ripened cones of *T. Floridana* are an important source of food for many bird species, beavers chew off the tops of young stems and white tailed-deer also rubs on these trees. Florida yew is also highly sensitive to fire. *T. floridana* also contains an important anticancer drug “Paclitaxel” which is also found in *Taxus brevifolia* and *T. Canadensis*. Paclitaxel is used in the treatment of various forms of cancer. These entire factors led to serious decline in the population of this species in past few decades. Florida yew is ideal to be used as hedge or in foundation planting but it seldom appears in nurseries. *T. Floridana* should be used in home landscapes in order to avoid its extinction. *T. floridana* can also be propagated through stem cuttings. It has been observed that mature wood cuttings taken in winter root well under mist. Several conservation studies and efforts were made to conserve it like other species of the same genus, but a more comprehensive and multiple-approach conservation strategy is required to ensure its conservation. Long term monitoring programs and propagation studies may prove fruitful in conserving such critically endangered species.

Key Words: Critically endangered plant, *Taxus floridana*

Introduction

Distribution of *Taxus floridana*

Taxus floridana Nutt.exChapm. is the scientific name of Florida Yew [1]. *Taxus floridana* (Fig. 1) is endemic species of Florida. This plant is restricted to a small area of bluffs and ravines along the Apalachicola River in north-western Florida (Fig.2). These habitats typically lie at an altitude of 15-30m, where it occurs with an even rarer endemic conifer species *Torreya taxifolia* [2, 3]. Several populations of Florida yew were also reported along a 24Km stretch of the river in Gadsden and Liberty counties [4, 5]. A single population was also reported in an Atlantic White-Cedar Swamp about 13Km southeast

of Bristol, Florida [6]. The Nature Conservancy have reported that Atlantic White-Cedar swamp population do not exist in present times [4]. Many of the plants are also growing in privately owned land areas.

Habitat and Community Structure

Taxus floridana is usually present in moist, shady ravines in hardwood forests, where soils are mostly acidic to neutral sandy loams [4]. The species usually occurs in small clonal strands and individual stems appear at very rare. *T. floridana* in its endemic habitat is dominated by *Ilex glabra*, *Magnolia grandiflora*, *Quercus laurifolia*, *Torreya taxifolia* and *Fagus grandifolia* [7].

Fig. 1: *Taxus floridana*

Fig. 2: Distribution of *Taxus floridana*

Morphological Description

T. floridana is a dioecious evergreen shrub or small tree about 10m tall and 38cm dbh. *T. floridana* belongs to Phanerophytes of Raunkiaer life forms [8, 9]. It develops irregular crown with spreading numerous branching. Its bark is purple-brown and smooth initially but with advancing age, it develops irregular scales. Its leaves are needle like, pliable, dark green, slightly falcate on the upper side while light green with two stomatal bands on the underside. Even though the wood is hard when it is dried but when alive it is flexible. Male cones formed along the shoots are yellow, solitary with 2-3mm of diameter. Female cones are formed on underside of shoots are initially fleshy green while on maturity become orange to red. Each female cone possesses a single seed measuring 5-6mm long and ellipsoidal in shape [2].

Conservation status

Taxus floridana Nutt. ex Chapm. is a critically endangered plant and its IUCN category and criteria is "Critically Endangered B1ab(iii,v) ver3.1" [10]. This category includes those plants which have very limited population or occurrence and are going to become extinct in wild in near future. The major reason behind its placement in the above category is that its extent of occurrence (EOO) is less than 100Km², which is only 24Km². Other factors include lack of regeneration and the impact of increasing deer population. Moreover the adult mortality rate is more than the recruitment leading to an overall decline in the population; therefore it is listed as critically endangered plant in IUCN red list of species [11].

Phytochemical characteristics

T. floridana contains the same important anticancer drug "Paclitaxel" found in *Taxus brevifolia* and *T.*

Canadensis [12]. Paclitaxel is found in the bark and needles of this plant. Paclitaxel is the generic name of drug "Taxol" used in the treatment of lung cancer, ovarian cancer, breast, head and neck cancer [13].

Importance of *Taxus floridana*

Despite the presence of Paclitaxel, Ripened Florida yew cones are an important source of many bird species which consume them completely. Beavers also chew off the tops of young stems and white tailed-deer also rubs on these trees. Mature trees of Florida yew are also excavated by Yellow-bellied sapsuckers, making holes for inhabitation of many insects [7].

Studies on conservation of *T. floridana*

Owing to the slow growth of Florida yew and endemic to a very small area of hardwood ravine forests of Apalachicola River Bluffs region of northern Florida [14-18], the species is considered globally rare [19, 20] and endangered in the state of Florida [21, 22]. Kwit *et al.* [19] performed a conservational effort by investigating the demography of *T. floridana* as a rare understory conifer in three populations in different ravine forests studying its entire geographic range alongside the Apalachicola River Bluffs in northern Florida. Spatial and temporal patterns were examined in demographic parameters and using four years of data population growth rates were assessed. The recruitment and survival of seedlings and established stems were also examined. It was found that about ten-fold increase was noted in all population's seedling recruitment in first year compared with other years. Stochastic matrix models projected declines in all population's growth rates. They concluded that conservation efforts directed at long-lived, slow growing rare

plants like *Taxus floridana* should protect established reproductive individuals and further enhance survival of individuals in other life history stages such as juveniles that often do not directly contribute to population growth [19].

Threats towards its extinction and controls

Florida yew is present in forests which may be subjected to logging and private development [23]. Presence of Taxol in similar quantities and its exploitation like those of *T. brevifolia*, *T. Canadensis* and *T. baccata*, may pose a danger to its population. In-vitro production of taxol may mimic the population decline of yew species.

Florida yew also occurs in some areas which have been protected like The Nature Conservancy's "Apalachicola Bluffs and Ravines Preserve" and "Torreya State Park" but many populations are still without any specific protection [24-26]. Some populations of Florida yew are also present in privately owned land and are not under protection. The major reason for this fact is that no such laws are effective across the world for protection of plant species in privately owned land. Formulation of such laws would be a milestone in the preservation of many such endangered species across the world.

Florida yew is a shade loving plant and is highly sensitive to fire so fire effects are highly detrimental to its population [27]. Due to the presence of these plants in humid forests however fires do not usually affect these plants and damaged plants may show sprouting but are of low vigour and usually do not survive [14]. Increase in global temperature and climate change may decrease their propagation and population density.

Study of all subpopulations showed that *T. floridana* is mainly present in the form of multi-stemmed individuals where stem densities range from several hundred to several thousand per hectare. Individual stem are relatively short lived and Small sized stems are especially more vulnerable to browsing and rubbing by deer. Though the plants produce seeds, but propagation through seedlings is very slow and varies among sites. The majority of seedlings occur under female trees and seedling growth is negatively affected by the density and presence of canopy. In a case study by Redmond, 1984 one hundred seedlings were tagged in each of the two sites, twenty one and thirty nine percent seedlings survived to ten months respectively in both cases. Seedlings are moderately shade tolerant and a very low level of seedling recruitment was observed at sites having a closed canopy. Seedling establishment and survival is also observed to be very low in deep shades. A study of four subpopulations over last 27 years showed that adult mortality rate is more than recruitment. For

Taxus spp. the only successful methods of propagation are layering and sprouting [18, 28].

During 19th century felling of *Pinus palustris* forests with selective logging of the slope forests have resulted in range reduction and habitat fragmentation during the nineteenth and twentieth centuries. Another important threat faced by Florida yew is the lack of its regeneration, the causal agent for that has not been established so far [29].

Florida yew grows in the form of dense clonal strands, which make it ideal to be used as hedge plant or in foundation planting but it seldom appears in nurseries. It should be used in home landscapes in order to avoid its extinction. Like other species of *Taxus*, *T. floridana* can also be propagated through stem cuttings [30, 31]. It has been observed that mature wood cuttings taken in winter root well under mist.

Conclusions

Taxus floridana is a slow growing, evergreen, coniferous plant, restricted to a small region in northern Florida. Due to slow growth and declining population it is listed as critically endangered plant in IUCN red list of species. There are a number of potential factors responsible for declining its population to an alarming level. Several conservation studies and efforts were made to conserve it, but a more comprehensive and multiple-approach conservation strategy is required to ensure its conservation. Long term monitoring programs and propagation studies may prove fruitful in conserving such critically endangered species.

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