Eucalyptus in Pakistan
Risks & Opportunities

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Background

Eucalyptus is a diverse genus of flowering trees and shrubs in the family, Myrtaceae. Members of the genus dominate the tree flora of Australia, New Guinea and Indonesia**.** Area under Eucalyptus plantations exceeds more than 20 million Ha. It has over 800 species[1]

- In Indian-subcontinent, Eucalyptus was first planted by Tipu Sultan, (the ruler of Kingdom of Mysore) in his palace garden on Nandi Hills in 1790 as an ornamental plant[1]. The first Forest Department *Eucalyptus* plantation was in 1877 at Malabavi (Devarayanadurga), Tumkur District, India.

- In Pakistan, Eucalyptus got impetus in the 1970's and in 1985 to motivate farmers in fuelwood plantations[2].

- A number of Eucalyptus spp were introduced in Pakistan but Pryor (1967), an FAO consultant, assessed work here on *Eucalyptus*. In his opinion it was futile to test scores of species and suggested that future trials may be confined only to the following five species in order of merit: *Eucalyptus tereticornis; E. camaldulensis; E. microtheca; E. melanophloia* and *E. citriodora*[2].

Uses of Eucalyptus

A number of authors described that Eucalypts contribute positively to the environment in controlling desertification; afforesting denuded sites; and providing a land use for saline and alkaline soils of pH up to 8.5. In some areas eucalypts help save biodiversity by meeting fuel and small wood needs otherwise coming from natural forest.

- Fence posts
- Arms for Electric poles
- Apiculture
- Charcoal
- Fuelwood (Brick kilns)
- Timber
- Tannin
- Fibre
- Construction Industry
- Medicines
- Chip board
- Essential oil
- Ornamental
- Shelterbelt

- In Bangladesh, in districts of Patuakhali and Barguna, farmers introduced Eucalyptus trees on saline-alkaline soils.
- In response to a questionnaire-based survey, farmers told that like other trees, Eucalyptus depress crop yields.
- 67% respondents believe that intensive plantation of Eucalyptus result in decline of crop yields.
- 39% farmers believe that Eucalyptus require less technological inputs and management.
- 61% respondents were satisfied with growth of Eucalyptus on saline soils.

- Haileab Zegeye (2010) from Ethiopia mentioned that Eucalyptus is one of the most successful trees; it adapts to a variety of environments. It provides multiple environmental and socio-economic benefits. It is useful for;
- provision of wood and other products thereby reducing the pressure on the natural forests,
- conservation of soil and water, rehabilitation of degraded lands,
- fostering the regeneration of native woody species,
- provision of food and habitat for wildlife,
- drainage of swampy areas,
- mitigation of climate change and provision of amenity.

The benefits of *Eucalyptus* are far greater than the negative impacts. The negative impacts are mainly because of the poor management rather than its biological characteristics.

Controversies of Eucalyptus

Eucalyptus is a controversial tree globally, due to its merits and as well as notoriety. Its merits like fast growing habit, quick adaptations to wide ranging ecological situations, several industrial applications and as means of livelihood.

Demerits:

- *depletion of groundwater,*
- *dominance over other species*
- *allelopathic effects,*
- *loss of soil fertility and,*
- *negative impacts on local food security issues.*

Depletion of Ground Water----1

- *Eucalyptus in Kolar district of Karnataka state in India indicated that 20 years of continuous cultivation of Eucalyptus in private and public lands deepened the water level in freshly dug bore wells to 260 m, as compared to the mean depth of water level in bore wells (177 m) in the study area of 21 villages of Kolar district.*
- *The distance from the eucalyptus plantation had negative correlation with the depth of freshly dug bore wells. The bore well yields were reduced by 35 to 42 per cent in the study area during the span of 3-5 years, when they were located within a distance of 1 Km from Eucalyptus plantations.*

Depletion of Ground Water----2

- In Lesotho, water use in three land- use types was significant and was in the following order: eucalypts plantation (3.37% per day) > indigenous forest (1.63% per day) > grassland/rangeland (1.56% per day). The high rate of soil moisture decrease of 3.37% per day could be attributed to high evapotranspiration rate of the eucalypts plantation[1].
- The high growth rate of Eucalyptus by utilizing more water makes it a water pumper in marshy lands. Eucalyptus has an inbuilt mechanism to utilize water luxuriously in marshy areas. Among the different Eucalyptus introduced, *Eucalyptus camaldulensis* and Eucalyptus tereticornis are found to be grown extensively. Depending upon the genetic makeup, Eucalyptus are showing good tolerance to salinity, water logging etc[2].

Depletion of Ground Water----3

- A study was conducted to investigate the impacts of exotic Eucalyptus plantation on the ground and surface water in district Malakand. Two villages (Kot and Totai) were selected randomly for data collection with a sample size of 25% of the population representing each village. The results of the study indicated that 64% springs were dried out so far in village Kot and 75% in village Totai due to high uptake of water. Eucalyptus plantation has adverse effects on ground and surface water. It was found that Eucalyptus has deepened the water table by 0.762m (0.833 yards) per year in both villages as a result the average depth of water table reached 20.116 m (22 yards) in village Totai and 15.544 m (17 yards) in village Kot. As a result, some springs became seasonal depending on rainfall[1].

Depletion of Ground Water----4

- *Ansari et al. 2007[1] mentioned that Eucalyptus camaldulensis*, which undoubtedly has fast growth rate and the potential of tolerating moderately saline conditions.
- Problem is related to allelopathic effects of Eucalyptus. The leaves contain volatile chemicals.
- *Eucalyptus* growers in Pakistan realized primarily ill effects on the adjoining crops, caused most probably by water depletion[1].
- Zahid et al., 2010[2] compared water uptake of *Eucalyptus camaldulensis* with *Acacia nilotica* Del., *Albizia procera* [Roxb.] Benth and *Azadirachta indica.* Results revealed that water consumption by one year old *Eucalyptus* [149.27 L] was almost twice that of by *Albizia* [82.84 L] and more than three times that of by *Acacia* [58.30 L], and *Azadirachta* [51.57 L].

Evapo-transpiration of Eucalyptus

In a study conducted by IWASRI, Pakistan[1] revealed that;

- A normal eucalyptus plant evapotranspire about 70 litres/day. The volume of water required to be evacuated from an acre having 1mm/day drainage coefficient, is about 4047 litres and 58 eucalyptus trees are enough as an alternate to engineering solution to control watertable at a desired depth.
- The study has revealed that eucalyptus or other plantation having high evapotranspiration rate can be used as an alternative to engineering solutions for permanently waterlogged (humid region) and saline lands for environmental improvement[2].

WUE and Eucalyptus

- Two species shisham (*Dalbergia sissoo*) and Eucalyptus (*Eucalyptus camaldulensis*) were grown to determine the difference in physiological responses and water use efficiency (WUE)[1].
- WUE and TC of Shisham were 0.89 and 7.94 g L^{-1} as compared to that of *Eucalyptus*, which were 0.93 and 4.06 g L^{-1}, respectively[1].
- Zahid et al., 2010 compared WUE of four species and found as 0.32 g L^{-1}, 0.48 g L^{-1}, 0.16 g L^{-1} and 0.77 g L^{-1} for *Acacia, Albizzia, Azadirachta* and *Eucalyptus,* respectively[2].
- Afzal et al., 2018 compared *E. camaldulensis* and *Tamarix aphylla* in terms of WSU and found higher total dry biomass (936.82 g) in *Eucalyptus camaldulensis* as compared to *Tamarix aphylla* (670.40 g) showing an increase of 28.43%.

Way Forward

- It is almost 400 years of introduction of *Eucalyptus* in Indian sub-continent. Hence it should be declared as “naturalized” rather than “exotic” species.
- A consistent research strategy should be chalked out to assess different species of Eucalyptus for;
    - Problems soils like water logged and saline
    - Marshy areas
    - Degraded areas
- Recommendations based on research should be framed for planting of Eucalyptus as
    - Social forestry / Urban afforestation programme
    - Industrial plantations
    - For pharmaceuticals
- Management guidelines of Eucalptus plantations may be published for professionals, wood-based industries and farmers.