

***Eucalyptus* in Social Forestry and Sustainable Development-District Malakand Pakistan**

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ABSTRACT: The study was aimed to document the suitability of *Eucalyptus* for Malakand (34.50° N, 71.75° E) social forestry project. The project was started in February 1987 with the aim to improve life style of villagers by improving the yield and use of the hillsides, and marginal lands. The methodology used was questionnaire survey; point count and line transect method. It was found that the project has not yet achieved its objectives and caused economical, ecological, and social problems in the project area. The revenue generated from *Eucalyptus* plantation remains in few hands of the community. It was found out that project is not socially acceptable, ecologically viable and economically feasible. The poor are suffering more as they are more dependent on the natural resources that are water and soil. The results showed that wheat production has been reduced from 1350 to 1100 kg per hectare. The results indicated that birds prefer native species (*Ziziphus mauritiana* 26% and *Acacia nilotica* 14.6%) over *Eucalyptus* (2.6%) for nesting. As a result *Eucalyptus* supports less bird's diversity as compared with native species. Many species of birds, cattle and other wild animals are suffering because of their dependency on water and soil. Government has to look for sustainable and environment friendly alternatives. Moreover introduction of new plant species to an area should be made after careful examination of hydrological and geological conditions of the area by keeping in mind the possible impacts on environment.

KEYWORDS: Social forestry; Revenue; *Eucalyptus*; Malakand; Bird diversity; Sustainable development.

1 INTRODUCTION

In Pakistan forests and planted trees cover an area of about 4.2 million hectares which is equivalent to 4.8 percent of the total land area [1] and it is decreasing due to a number of threats including continuous cutting of forest trees and commercial overexploitations. The forest cover is unable to meet the growing demand for wood and wood-based products in Pakistan which is the seventh most populous country in the world and the fourth in Asia with an annual population growth rate of 2.1% [2]. To meet the wood consumption demands of increasing population, to increase the forest cover and to support the wood dependent industries, 40 species of *Eucalyptus* were introduced in the late 19s in Pakistan [3]. In Punjab about 200 million trees were planted mostly on irrigated land, of which *Eucalyptus* is 2.2%. Similarly in Khyber Pakhtunkhwa (formerly known as NWFP) province 80 million trees were raised on farmlands, of which *Eucalyptus* was 2.7 % [4], [5]. Among the introduced *Eucalyptus* species *E. camaldulensis* was the most wide spread species and adaptable under all agro-ecological zones. The Social Forestry Project in Malakand district was started in February, 1987 with the objective that it will contribute to raise the standard of living in the project area by improving the productivity and use of the hill and marginal lands. The project was sponsored by the Government of the Royal Kingdom of Netherland along with the government of Islamic Republic of Pakistan. Till June 2000 large-scale plantations of *Eucalyptus camaldulensis* were carried out in the Malakand-Dir region on an area of 22,071.29 hectares (54,497 acres) yielding over 14.723 million *Eucalyptus* trees in addition to other plant species [6]. Malakand district is now suffering from many environmental problems like low water table, micro climate change, soil erosion, fauna and flora loss and dry springs. The key and worth-mentioning contributing factor to the above mentioned problems is *Eucalyptus* putting livelihood opportunities at grave stake as livelihoods of the people are primarily

dependent on water and soil. The objective of the study was to document suitability of *Eucalyptus* for Malakand social forestry project.

2 MATERIALS AND METHODS

2.1 SITE DESCRIPTION

The study was conducted in district Malakand (34.50° N, 71.75° E) Pakistan. The soil of Malakand District is loamy and moist, and is irrigated by the Swat River. Total forest area of Khyber Pakhtunkhwa is 4650561 acres in which Malakand District is contributing 101181 acres in the form of Protected Forest, Communal, Private Plantation and Miscellaneous [7].

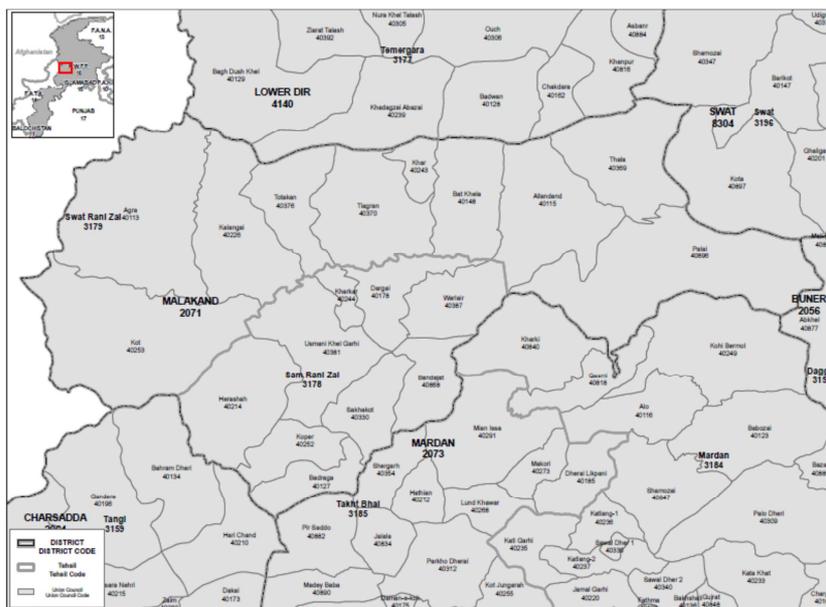


Fig. 1. Map of district Malakand [18]

2.2 QUESTIONNAIRE SURVEY

Stratified random sampling technique was used to satisfy the results of the study. The whole universe was divided into two strata based on population, income, *Eucalyptus* plants abundance and distribution. From each stratum 25% random sampling was carried out to ensure the authenticity of the results. The questionnaire covered various aspects like post and pre scenario of the *Eucalyptus*, behavior of the people towards *Eucalyptus*, people and their dependency, tree distribution, impacts on crop production and commercial value of trees in the study area [8].

2.3 BIRD'S NEST COUNTING

From each village hundred trees of *Eucalyptus*, *Ziziphus mauritiana* and *Acacia nilotica* were observed randomly in triplicate for nest counting by point count method [9].

2.4 BIRD'S DIVERSITY

A line transect of one kilometer was selected in triplicate. Line transect was accomplished by two parallel 500 meter long lines spaced at least 300 meters apart. The speed of travel was relative to the rate of bird movement to prevent individual birds from being counted more than once but not so fast as to pass a bird before it calls or sings 0.5 to 1.0 kilometer/hour [17].

2.5 GLOBAL POSITIONING SYSTEM

Global Positioning System (GPS, Garmin with 12 channels) receiver was used to find out the exact position length of the selected transect lines in the study area [10].

3 RESULTS AND DISCUSSION

3.1 WILLINGNESS TO PLANT *EUCALYPTUS*

It was found out that 85% of the respondents were not willing to plant *Eucalyptus* tree on the mountains while 10% of the residents have agreed with the plantation of the trees and 5% have shown no response in this regard. Similar results were founded by Hassan and Khan [11] 80% of the respondents were not agreeable to plant *Eucalyptus* tree on the mountains while 15% of the people were agreed to plant *Eucalyptus* trees.

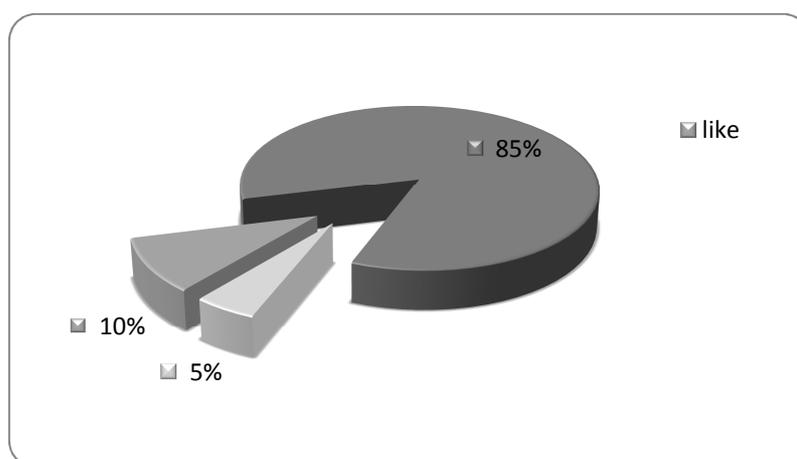


Fig. 2. Behavior of the people towards *Eucalyptus* plantation

3.2 *EUCALYPTUS* AS FUEL WOOD

The data indicated that 88% of the villagers are using farm wood and wild bushes as fuel wood followed by liquefied petroleum gas (LPG) 8% and animal dung 3%. One of the major species is *Dodonaea viscosa* which is used as a fuel wood. Only 1% people are using *Eucalyptus* as fuel wood. These *Eucalyptus* trees are those which are cultivated by the villagers on their own personal land as no one is allowed to cut down *Eucalyptus* trees which are under social forestry project. In other words *Eucalyptus* trees are not used by the villagers as fuel wood.

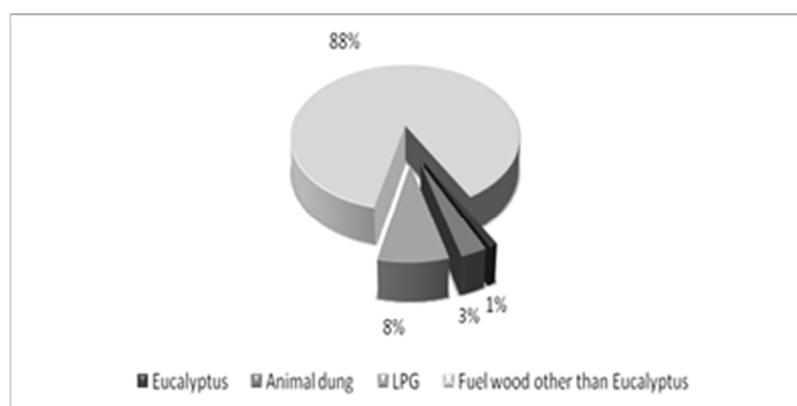


Fig. 3. *Eucalyptus* as Fuel wood

3.3 IMPACT ON AGRICULTURE PRODUCTION

Eucalyptus plantation also has impacts on the floral and faunal diversity of an area. *Eucalyptus* has allelochemicals and volatile compounds. These chemicals have harmful effects on the crops in the ecosystem resulting in the reduction and delaying of germination, mortality of seedling and reduction in growth and yield [12]. *Eucalyptus* competes vigorously with ground vegetation and with neighboring crops in situations where water is in short supply [13]. Similarly Blake [14] reported the inhibitory effect of *Eucalyptus* on the growth of its associated species by reducing their germination, photosynthesis and yield. According to the villagers water was in surplus for irrigation and domestic use before the *Eucalyptus* plantation. The results showed that wheat production has been reduced from 1350 to 1100 kg per hectare. The main stream in village Kot which was the main source of water for irrigation is no longer providing enough water for irrigation. People are going out of options they do not have adequate water to irrigate their fields. The cattle are also suffering as they are dependent on spring's water. Our previous study indicated that 64% springs have been dried out so far in village Kot and 75% in village Total and many have become seasonal [15].

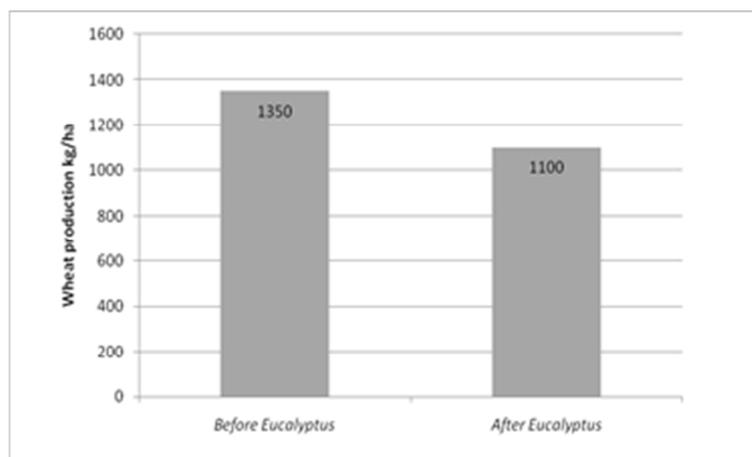


Fig. 4. Wheat production in kg/hectare

3.4 EUCALYPTUS AND BIRD NESTING

Eucalyptus plantation held the lowest abundance for most groups of arthropods and has negative impact on the ground arthropods [16]. *Eucalyptus* tree has smooth and flat bark; its branches are elastic and not dense like native species (*Ziziphus mauritiana*, *Acacia nilotica* and *Dalbergia sissoo*) etc to provide support for nesting and protection against predators. The results indicated that 26% birds preferred *Ziziphus mauritiana* over *Eucalyptus* trees for nesting. *Acacia nilotica* is preferred 14.6% by birds as compared to *Eucalyptus* 2.6 % for nesting. Birds that chose *Eucalyptus* trees for nesting are those whose nest size is 5 to 8 times larger than the bird size. Only house sparrow's (*Passer domesticus*) nests were observed in the study area, which were also vulnerable to wind storm. Large scale of monoculture plantation of *Eucalyptus* is fatal for the local fauna. Further research is needed to monitor the population of birds in the project area.

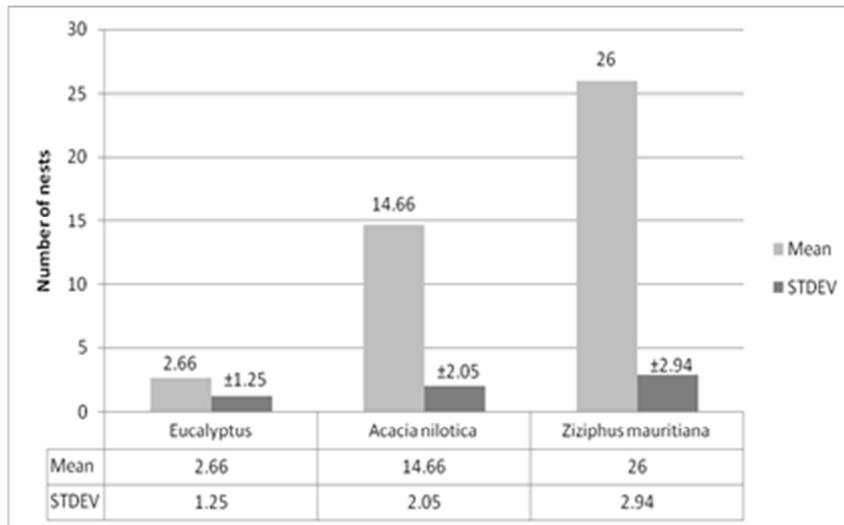


Fig. 5. Behavior of birds towards Eucalyptus for nesting

3.5 BIRD'S DIVERSITY

The results indicated that *Eucalyptus* monoculture forest has less bird diversity as compared to mixed native forest. Only three species (*Passer domesticus*, *Pericrocotus ethologus* and *Corvus splendens*) were found in *Eucalyptus* forest. On the other hand eleven species were found in mixed native forest. The species found were *Prinia criniger*, *Turdoides caudatus*, *Prunella atrogularis*, *Phylloscopus inornatus*, *Emberiza cia*, *Pycnonotus cafer*, *Anthus sylvanus*, *Pycnonotus leucogenys*, *Seicercus xanthoschistos*, *Pericrocotus ethologus* and *Corvus splendens*. The mixed forest was mainly composed of *Ziziphus mauritiana*, *Acacia nilotica*, *Dodonaea viscosa*, *Olea ferruginea*, *Acacia modesta*, *Morus nigra*, *Morus alba* and *Dalbergia sissoo*.

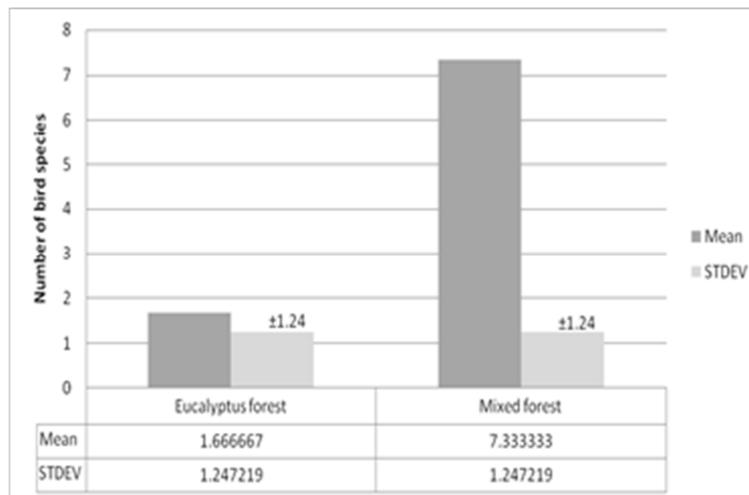


Fig. 6. Bird's diversity in Eucalyptus and mixed native forest

Table 1. Bird's diversity in *Eucalyptus* and mixed native forest

Forest type	Species
<i>Eucalyptus</i> monoculture	<i>Passer domesticus, Pericrocotus ethologus, Corvus splendens</i>
Mixed forest	<i>Prinia criniger, Turdoides caudatus, Prunella atrogularis, Phylloscopus inornatus, Emberiza cia, Pycnonotus cafer, Anthus sylvanus, Pycnonotus leucogenys, Seicercus xanthoschistos, Pericrocotus ethologus, Corvus splendens.</i>

3.6 SOCIAL IMPACTS

Eucalyptus plantation not only has impacts on flora and fauna but also has social impacts in the project area. The mountains are owned by different villages and then by different tribes (Kota khel, Utman khel, Toghla khel, Sandi khel, Stana dar, shahanian etc). The boundaries of the mountains are not obvious that's why they often fight with each other. According to the local police station they register one FIR (first information report) per month on disputes regarding *Eucalyptus* plantation. A farmer from village Totai said that *Eucalyptus* is a social evil. The other social problem that has caused by the *Eucalyptus* is the water scarcity for irrigation. The main stream in village Kot is no longer flowing and contains a few patches of water as a result limiting the amount of water for irrigation. Our previous study indicated that *Eucalyptus* has deepened the water table by 0.762m (0.833 yards) per year in study area [15].

3.7 REVENUE FROM *EUCALYPTUS*

The mountains are owned by the villagers and distributed among different tribes. The revenue generated from *Eucalyptus* plantation is supposed to be distributed among the villagers but the data showed that 100% of the people have not got any in the form of money from *Eucalyptus* plantation so far. The revenue generated from plantation remains in the hands of few, although *Eucalyptus* trees are consuming the common resources.

4 CONCLUSION

Nature has maintained a balance on the planet earth between the living and non living environment. Species are adapted to their habitats and habitats are adapted to them. Because of the limited knowledge about the earth processes and balance we humans often make mistakes that is importing and exporting exotic species.

Eucalyptus has been debated for decades because of its adverse impacts like soil erosion, dryness of springs, lowering water table, competition with crops, micro climate change, affect soil fertility, and consumption of much ground water associated with its high growth rate.

The results indicate that the social forestry project was not based on sustainable development and has not achieved the desired objectives. *Eucalyptus* plantation has adverse economical, ecological, and social impacts. Ground water resources, surface water resources, flora and fauna should be monitored regularly to determine the protection and regeneration of natural forests and better utilization and improvement of marginal and degraded lands. Moreover introduction of new plant species to an area should be made after careful observation of climatic conditions of the area and keeping in mind the probable effects of these species on environment.

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