
Study of plantation effect on richness of herbaceous in forest area using biodiversity index in north of Iran

T. Rostami Shahraji, L. Baktash and H. Pourbabaie.
Assistant Prof., former MSc. student, Assistant Prof., Department of Forestry
University of Guilan

ABSTRACT

The depletion of forest in developing countries due to extended pastures, agricultural land, fuel wood and etc. is a serious concern. Therefore planting trees for reforestation and expanding forest area is an essential assignment. Forest plantation with a basic criterion affects to understory plant diversity. These effects may make some species absent or appear. The aim of this study was to assess the plant diversity of two different plantations which established by *Pinus teada* and *Acer insign* and compare them with a natural forest stand which were similar in geographical and climatic conditions. Twenty sample plots with 32 square meters were randomly selected. In each plot all herbaceous species were recorded. Richness and Evenness of plant species were calculated using the biodiversity indices (Simpson index and Margalov index). The obtained results showed that the value of plant diversity was higher in natural forest, while *Acer* plantation had the lowest value. The Richness and Evenness value were higher in natural forest stand, while Richness and Evenness value were lower for *Pinus teada* and *Acer insign* plantation respectively.

Keywords: Plant diversity, *Pinus teada*, *Acer insign*, Plantation

INTRODUCTION

In the developing countries forests face with numerous challenges, the depletion of these forest due to extended pasture, agricultural land, fuel wood and etc. is a

serious concern (Donkoo, 2000). Therefore numerous species are going to be extinct and even those that have not yet been identified are likely to be similarly threatened. On the other hand, reforestation on degraded forest land and extended forest area is an essential assignment, while forest plantation with a basic criterion affects to understory plant diversity. This effect may make some species absent or appear, on the other hand, uniformity of plantation crops brings possible biological risks and other disadvantage (Savil and Evans, 1986). Many researchers have shown that the effects of plantation on understory plant diversity should be considered. Different tree species plantation has different effect on understory plant diversity. For example diversity of herbaceous and shrubs under *Alnus* plantation were highly different with *Picea* plantation (Deal, 1997). Gilliam (2002) stated that forty year's old mixed coniferous plantation compared to an old natural stand had no significant effect on richness, and evenness of herbaceous in understory. Currently 3% of the world's forests are plantation which comprises 60 million hectare in developed countries and 55 million hectare in developing countries (WRI, 1998; FAO, 1999). Therefore challenges to forest plantation for reforestation and extended forest area increasingly rise up in developing countries.

Conservation and sustainable of herbaceous plant biodiversity necessitate to assess the changing of plant diversity due to different activities. The objective of this study is to assess the changing of plant diversity in understory of plantation compared to a natural forest.

MATERIALS AND METHODS

The studied area is located in the east of Guilan province in the south coast of Caspian Sea in Iran. Two monoculture plantations over ten years old which were established by *Pinus teada* and *Acer insign* and a natural forest stand which were similar in geographical and climatic conditions were chosen in the study area. Twenty sample plots with 32 square meters were randomly selected. From each stand the data were collected in spring, summer and winter time in 2002. Richness and evenness index were computed using following equations (Krebs and Charles, 1989).

Simpson diversity index:

$$D = 1 - \sum [n_i (n_i - 1) / N (N - 1)]$$

Where:

S: number of species
 ni: abundance of species
 N: total abundance

Margalove index:

$$R_i = [(S-1) / (\ln N)]$$

Where:

Ri: margalove index value
 S: number of total species
 N: number of total species abundance

Analysis of the collected data was carried out using the Divers.

RESULTS AND DISCUSSION

Number of species:

Data analyses of the collected species from three stands are shown in table 1:

Table 1 Number of species in each site.

No.	Type of stand	Number of species
1	Pinus teada	37
2	Acer insign	34
3	Natural forest	69
4	Common species in three stand	16

This result shows that the number of species under plantation is more than the

Acer plantation. In spite of evergreen crown of *Pinus*, in any opened crown, different type of herbaceous appear in understory.

Plant diversity:

Result of data analysis using Simpson index for understory plant diversity of three stands are shown in figure 1 - 3

As the figures indicated, the plant diversity value in natural stand is the highest in three seasons, while *Pinus teada* had the lowest value in summer and winter and *Acer insign* showed the lower value only in spring.

The main value of plant diversity in three seasons showed that the natural forest stand had the highest value while *Pinus teada* had the lowest (Figure 4).

Fig.1 Plant diversity in spring

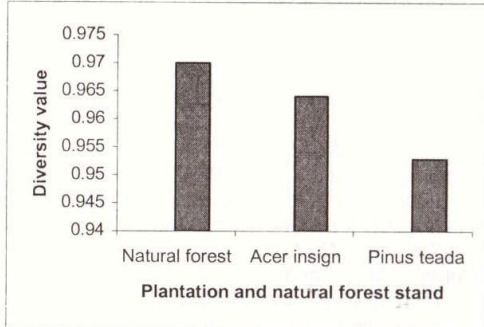


Fig.2 Plant diversity in summer

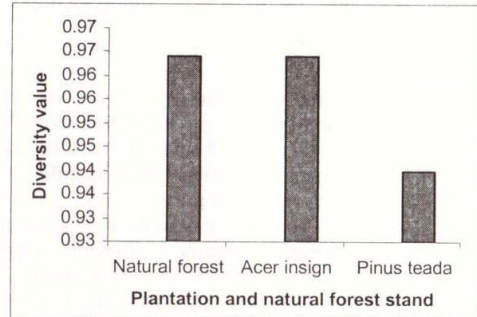


Fig.5 Richness in three sites

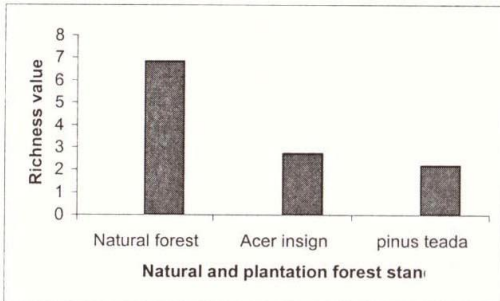


Fig.6 Evenness in three sites

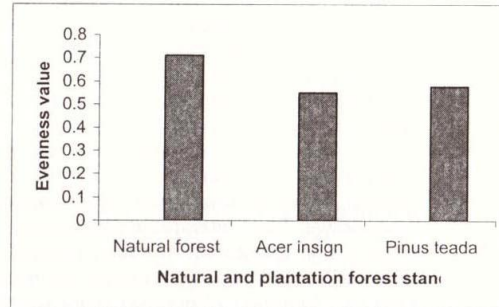


Fig.3 Plant diversity in winter

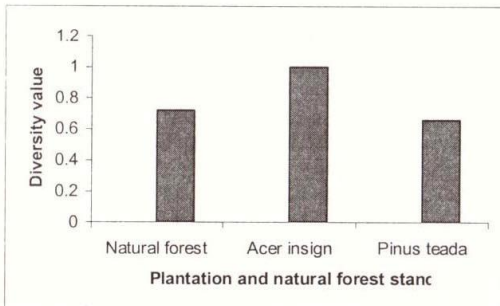
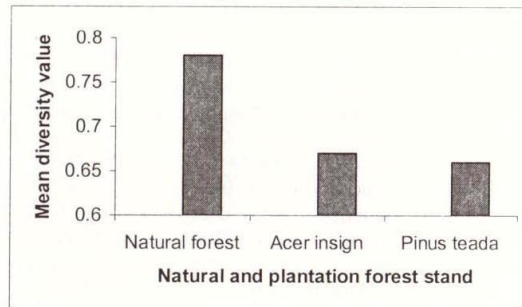


Fig.4 Mean value of plant diversity



Pinus teada with a high closed canopy prevent herbaceous to grow except in open area, as Savil and Evans (1984) stated that within a few years of planting, there is virtually no ground vegetation left when exotic species are commonly used for plantation. In the study area *Pinus teada* as an exotic species and evergreen coniferous provide a highly closed canopy and prevent ground vegetation to grow except few bushed and shrubs. Only in opened canopy different types of herbaceous should be considered. It is obvious that the plant diversity in understory of broadleave is much higher than coniferous. As Deal (1997) showed that in understory of *Alnus* plantation plant diversity was high, but plant diversity in understory of a very good stand of *Picea* was low. Also Rashmi (1987) showed that the plant herbaceous in understory of *Eucalyptus* was optimal, while in *Pinus patula* was very good. Data analysis for estimating the mean value of the Richness and Evenness of plant species in three stands are given in figures 5 – 6:

The value of Richness and Evenness showed that the natural forest stand had the highest while Richness and Evenness value were lower for *Pinus teada* plantation and *Acer insign* plantation respectively. As the obtained results show, undoubtedly the exotic species plantation effects on plant diversity, probably in long term may escape some unadaptable species to sever conditions.

REFERENCES

- Deal, R.L. (1997). Understory plant diversity in riparian Alder – Conifer stands after relation to woody substrate and successional stage in aspen mixed wood boreal forest. *Canadian – Journal of Botany* 76: 641 – 651, 45 refs 22.
- DonKoo and Lee (1999). Challenges to forest science in Asia forest science and forestry contributory to Quality of Human life in developing countries proceeding of an IUFRO Seminar in Copenhagen, 3rd September 1999.
- FAO (1999). State of the word, 1999 united nation food and Agricultural organization, Rome 154 pp. cited by Mitschka J. Hartly: 2002 Rationale and Methods for conserving biodiversity in plantation forests.
- Gilliam F.S. (2002). Effects of harvesting on herbaceous layer diversity of a central. Appalachian hardwood forest in west Virginia, USA forest Ecology and management 155: 33 – 43.
- Krebs, C.J. (1989). Ecological methodology. University of British Columbia. Harper Collins publishers, 432.
- Rashmi–Rajvan S. et al. (1987). Herbaceous undergrowth in some forest habitats in Niligiris. *Indian forester*. 113: 9 599 – 608: 7 ref. 15 - 18842.
- Robert, M.R. and Zue, L. (2002). Early response of the herbaceous layer to harvesting in a mixed coniferous–deciduous forest in new Bruns wick. *Canada forest Ecology and Management* 155: 17 – 31
- Savill, S.P. and Evans J. (1984). plantation silviculture in temperate Regions, Clarendon press. Oxford, U.K.
- World Resources Institute (1998). Oxford University press Oxford 369 pp cited by Mitschka J. Hartley 2002 Rationale and Methods for conserving biodiversity in plantation forests. *Forest Ecology and Management* 155 (2002) 81 – 85.