

Threatening of Invasive Alien Species (IAS) on Vegetation Structure and Aerial Arthropod Diversity in Protection Area of UB Forest

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Abstract

The aim of this study was to determine the vegetation structure of IAS and diversity of aerial arthropod under two level of invaded area. This study used quantitatively vegetation analysis methods for herbaceous, shrubs and tree plants through purposive plants sampling technique. Sampling areas were selected on two areas, divided into less and high invaded area of IAS. In each area, four sampling plots were randomly distributed with size 10x10 m² using nested sampling method. All plots area were marked using GPS and then identified, documented and calculated their density and dominance. Moreover, sampling arthropod was collected by sticky bite trap with white bread, rotten bananas and jackfruit as attractant. Invasive exotic plants found in sampling areas were *Debregeasia orientalis*, *Brugmansia suaveolens*, *Debregeasia longifolia* and *Araliaceae*. Aerial arthropod as pest were found both in less and high invaded area. Therefore, classification of protected forest in UB Forest vegetation is semi-natural system.

Keywords: arthropod, exotic, invasive alien species, UB Forest

INTRODUCTION

Protected Forest in UB Forest ecosystem is important because it is not only as a life support, but also natural biodiversity habitat [1]. Moreover, UB's protected forest has several risk factors associated with the threat to ecosystem integrity. Along with degradation, transformation of function protected forest as coffee garden, fragmentation and disturbance from human activities, invasive alien species (IAS) being one of the factors that poses a threat to integrity of protected forest in UB Forest [2].

Invasive alien species (IAS) are species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity [3]. IAS have great effect on an ecosystem including cause of serious problem in new habitat such as change the evolution path of local species through competition, high adaptation capability result in dominating habitat and eliminating of local species. Invasion of *L. camara* can reduce the number of native species and harm the ecosystem. It has strong impact on the regeneration of native vegetation especially in the riparian areas where this plant can flourish. Therefore, the existence of IAS in new habitat tend to be harmful due to it

potentially threaten the existing ecosystems and biodiversity [4];[5];[6].

In addition, many of evidence that invasions of alien species plant affect higher trophic levels. Arthropods provide an ideal model system to examine the effects of plant invasions on higher trophic levels. Studies indicate that shifts from native to invasive dominant plant species can reduce abundance and diversity of canopy arthropods and even change species composition. Their life history traits such as small body size, high reproductive rates, and short generation time translate into quick, easily measurable responses to environmental change compared with other organisms [7]. Therefore, understanding aerial arthropod responses to plant invasion helps expand our understanding of impacts on higher trophic levels.

The objective of this study was to determine the vegetation structure of IAS and variation of aerial arthropod important level under two level of IAS.

MATERIAL AND METHOD

Time and Setting of the Study

The study was conducted on November, 19th 2016 at protected forest in UB Forest, Karangploso, Kabupaten Malang, East Java. Sampling areas were on along track at 7°49'29.30"S and 112°34'42.21"E. Area study was located at mountainous region with elevation of 1200 m above sea level with fertile soil.

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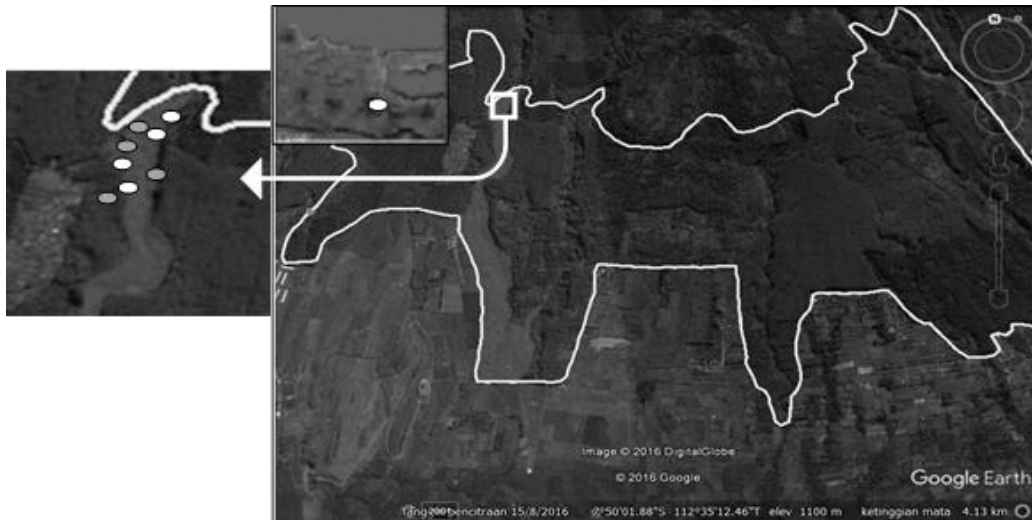


Figure 1. Location of sampling sites around the UB Forest.

Note : ○ : less invaded area; ● : high invaded area

Data Collection and Analysis

Vegetation sampling was carried out at eight randomly selected areas using purposive sampling technique based on the invasiveness level and then distributed into four sites in less and four sites in high invaded area (Figure 1). Meanwhile, invasiveness level was determined based on the abundance of exotic plant species in the area.

This research was quantitatively descriptive by using vegetation analysis method for herbaceous, shrubs and tree plants. Nested sampling plots with size 10x10 m² were applied in each sampling sites for tree. Smaller plots with 5x5 m² size were placed in the tree plots for shrubs vegetation and the smallest plot, 1x1 m², were also placed in the shrubs plots for herbaceous [8]. These plots were documented and marked the location using GPS. Arthropods were sampled in two sites, in less and invaded area. We used yellow sticky bite traps to sample the aerial arthropod community from 09.20–12.10 a.m. The attractants that used were white bread, rotten bananas and jackfruit. The traps strung among the leaves. After collected, each arthropod species was calculated its density and abundance.

Coordinate data of sampling sites using GPS was imported to the computer. The data was analysed and mapped using Google Earth. While, vegetation and arthropod data were tabulated, analyzed the taxa species and IV using Microsoft Excel. Moreover, analyzed degree of endemism and naturalness index.

RESULT AND DISCUSSION

Taxa species of herbs, shrubs, trees and aerial arthropod in less invaded area was higher than high invaded area (Figure 2a). We found 11 herb species, 14 shrubs species, 5 trees species and 4 famili, 3 species aerial arthropod.

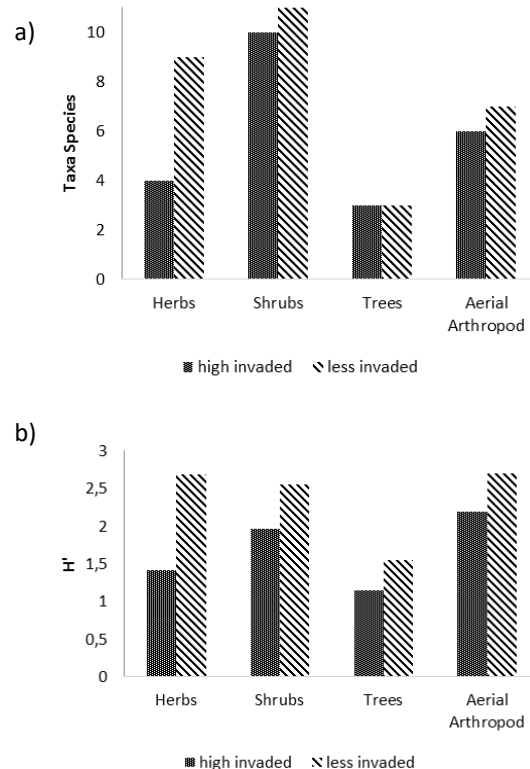


Figure 2. Community structure in high and less invaded area of IAS around protected forest in UB Forest (a) Taxa species and (b) Plant and aerial arthropod Diversity Index

Herbs found were *Debregeasia sp.*, *Portulaca oleracea*, *Artherium sp.*, *Brugmansia suaveolen*, *Homalomena sp.*, *Clorantus elatior*, *Psychotria*

sp., Gesneriaceae sp., Zingiberaceae sp., Elatostema sp. Moreover, shrubs found were *Pteridium aquilinum*, *Cycas rumphii*, *Debregeasia longifolia*, *Titonia ritondifolia*, *Amomum sp*, *Anthurium sp*, *Musa paradisiaca*, *Gigantochloa sp*, *Piper sp*, *Seedling Pileaceae sp*, *Pileaceae sp*, *Calliandra perturicensis*, *Pinanga coronata*, *Nenga pumila*. And the trees were *Ficus sp*, *Araliaceae*, *Ficus variegata*, *Schima wallichii*, *Engelhardia spicata*. We are collected aerial arthropod were *Saproxylic*, *Gryllus campestris*, *Aeolothripidae*, *Cicadellidae*, *Methoca ichneumonides*, *Tephritidae*, and *Philodromidae*. The existence of invasive plants species had negative impact on biodiversity and agriculture ecosystem. Invasive plants would being competitor for other plants in terms of sunlight capturing, nutrients and water absorption and inhibited the growth of other plants through producing growth inhibitor compounds. In addition, invasive plants could dominate other habitat in order to eliminating local species [9]. Hence, high invaded area showed low diversity not only on plant but also aerial arthropod (Figure 2b).

An abundance of native species in less invaded area was higher than high area but not on trees vegetation (Figure 3). Native species was found six species in herbs (*P. oleracea*, *Anthurium sp.*, *Homalomena sp.*, *C. eLatiar*, *Psychotria sp.*, *Gesneriaceae sp.*, *Zingiberaceae sp.*, *Elatostema sp.*, seedling *Angiopteris sp.*), eight species in

shrubs (*Amomum sp.*, *F. elastica*, *N. pumila*, *Pileaceae sp. seedling*, *P. aquilinum*, *Gigantochloa sp.*, *Pileaceae sp.*, *P. coronata*) and four species in trees (*E. spicata*, *S.wallichii*, *F. variegata*, *Ficus sp.*).

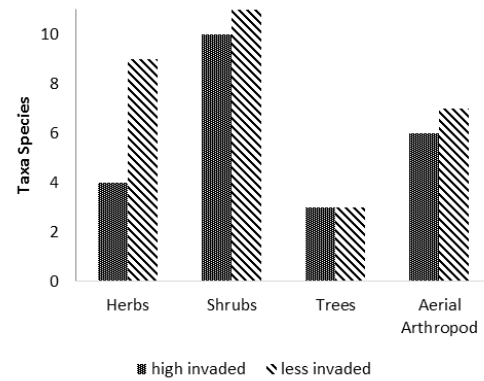


Figure 3. Degree of endemism in high and less invaded area of IAS around protected forest in UB Forest

Based on importance value index shown that percentage of exotic species was dominant in high invaded area than less but not in trees (Figure 4). In the high invaded areas were found 255,8% exotic herbs species consisting dominant of *D. orientalis* 160% and *B. suaveolen* 70,3%. Moreover, 208% exotic shrubs species consisting dominant of *D. longifolia* 103% and the less invaded area was dominant too.

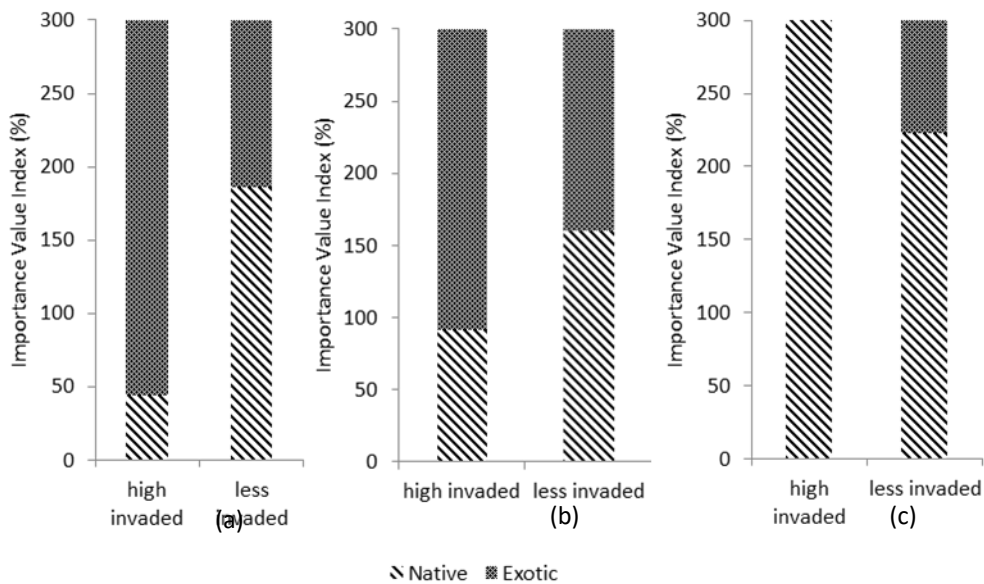


Figure 4. Plant species importance value index of native and exotic species in high and less invaded area of IAS (a) Herbs, (b) Shrubs, (c) Trees

In the trees, exotic species was not found in high invaded area but less invaded area, only Araliaceae 77,1%.

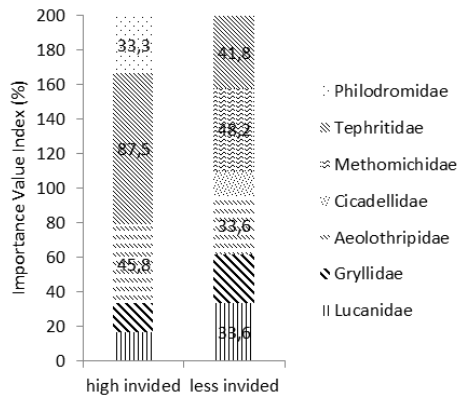


Figure 5. Aerial arthropod species importance value index in lower and lowest area of local plants

Furthermore, aerial arthropod was dominant in high invaded area is Tephritidae as pest while, Methoca ichneumonidae as parasitoid in less invaded area (Figure 5). In other side, were found saproxylic in less invaded area which indicated biodiversity and old growth forest [8].

In evaluating naturalness of vegetation, protected forest of UB Forest included in semi-natural system because possible dominance of wild exotic species so that native elements considerably reduced. Moreover, general dynamic still controlled by natural process and may include abandoned cultural system undergoing natural recovery [11].

CONCLUSION

Area surrounding the protected forest in UB Forest had been invaded by some dominated plants species such as *Debregeasia orientalis*, *Brugmansia suaveolen*, *Debregeasia longifolia* and *Araliaceae*. These invasive plants species had been decreased plant diversity and gave many negative impacts to environments. Furthermore, negative impact of plant invasion and forest structure on aerial arthropod communities showed the dominant of pest. Therefore, classification of protected forest in UB Forest vegetation is semi-natural system.

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