The invasion of *Eupatorium odoratum* in secondary tropical monsoon forest in the watershed of Bian-Kumbe in Merauke, Papua Indonesia

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Abstract

The forest watershed of Bian-Kumbe in Papua is a tropical monsoon forest. Some of the forest is characterized by scars of sporadic-forest floor and tree trunk fire. This forest was logged in 1980. The forest area is very important in supporting forest floor fauna such as cassowary birds. This bird feeds on the seeds from the tree canopy. Many large openings in this forest have been occupied by *Eupatorium odoratum*. Open forest areas of about 5 ha, next to the freshwater marsh, were one hundred percent covered by *E. Odoratum*, and no seedlings of canopy trees was found. These shrubs are 3 meters tall, and after dry season fires they grow quickly, utilizing both basal re-sprout and seeds strategy. This *E. odoratum* invasion is threatening the natural re-growth of the secondary tropical monsoon forest at Bian Kumbe in Papua.

Key words: invasion, *Eupatorium odoratum*, tropical monsoon forest, Papua

Introduction

The watershed of Bian-Kumbe at Merauke in Papua Indonesia is characterized by many types of forest ecosystems. These forests are tropical monsoon forests. These tropical monsoon forests experience natural fires every year. During the dry season, fires sporadically occur in these forests on a small scale. The small scale natural forest fires are important in maintaining the forest-species diversity. Small scale disturbance in the forest by natural fires acts to maintain the forest. On the forest floor live cassowary, *Casuarius sp*., birds, who depend on the seeds from the forest trees. The presence of many species forest canopy trees is critically important to the birds. In intact forests with full canopies, the fires stay small but in forest gaps without a canopy the scale of the fire accelerates (Djohan et al. 2004).

In 1980 large areas of the forests in Bian-Kumbe were logged. Furthermore in 2001, in an attempt to increase the local income, a large part of the forest next to Rawa Bian (*rawa* = wetlands) was converted to a cacao plantation. However, one year after creation of the plantation, it was burned in a natural fire (Matius Omak Mahuse, and Andreas Ndayau Mahuse of Muting District. 2004: Pers. comm.). Rawa Bian is a freshwater marsh, which was dominated by 99.9 % of wild rice (*Zizania* sp.). Every year during the dry season, part of the *Zizania* catch fire, especially in peripheral areas, where the water level is below the soil surface. Dead leaves and stumps of *Zizania* are a good material to initiate fire. That is why these young cacao trees did not survive even the first dry season

After the cacao plantation fire, this area was invaded by *Eupatorium odoratum*. The local people (native Papuan) have very good knowledge of ethno-botany, and they have native names for all the native plants. However, for the introduced species they do not have native names. Since they did not have a name for *E. odoratum,* they called this shrubby plant, Rumput dua ribu (rumput = grass; dua ribu = two thousand). They said this plant came to Merauke in 2000. They do not like this plant, because it takes over the open areas in the forest, and during summer it burns easily. The purpose of this research was to study the occupation of *E. odoratum*, in open areas and logged over forest in the Bian-Kumbe watershed next to Rawa Bian.

Methods

Locations for study were selected in the Rawa Bian area of the Muting District, Merauke using Landsat ETM 2003 (Figure 1). These locations were Bian 1 and Bian 2 with geographic positions as following:

Bian 1.3	Bian 1.4	Bian 2.1	Bian 2.2	Bian 2.3
045117	0450193	0455399	0455457	0455418
9190169	9189988	9185559	9185641	9195992

Bian 1 was located next to the Rawa Bian, and Bian 2 was farther away from the forest. At Bian 1, two sites were chosen, which were Bian 1.3 and Bian 1.4. Formerly Bian 1.3 and Bian 1.4 were forested areas, but the forest at Bian 1.3 was converted to cacao plantation. Bian 1.4 was a secondary forest. Similarly, Bian 2 is also secondary growth, logged-over forest, since 1980. During the logging era, Bian 2.1 and Bian 2.2 were converted to log storage yards. Bian 2.2 site was located between the sites of Bian 2.1 and Bian 2.3. In contrast, Bian 2.3 was secondary, logged-over forest. This study was carried out on October 2004, and during the study, this secondary forest was being logged again.

At each sites, the number of individuals and heights of *E. Odoratum* were collected using 30m x 30m quadrat plots. Soil nutrients were also measured, NO_3. NH_4, N total, PO_4, P total, K^+ (mg/kg), pH, as were soil moisture and soil and air temperature. At each site, soil samples for nutrient analysis were collected from five sample composites. The number of species and their life forms also were recorded in these plots (Djohan et al. 2004). Like all tropical monsoon forests, Bian-Kumbe forest watershed has very distinct wet and dry seasons. The density data of *E. Odoratum* was analyzed by comparing the converted-forest areas, logged yard, and logged-over forest.

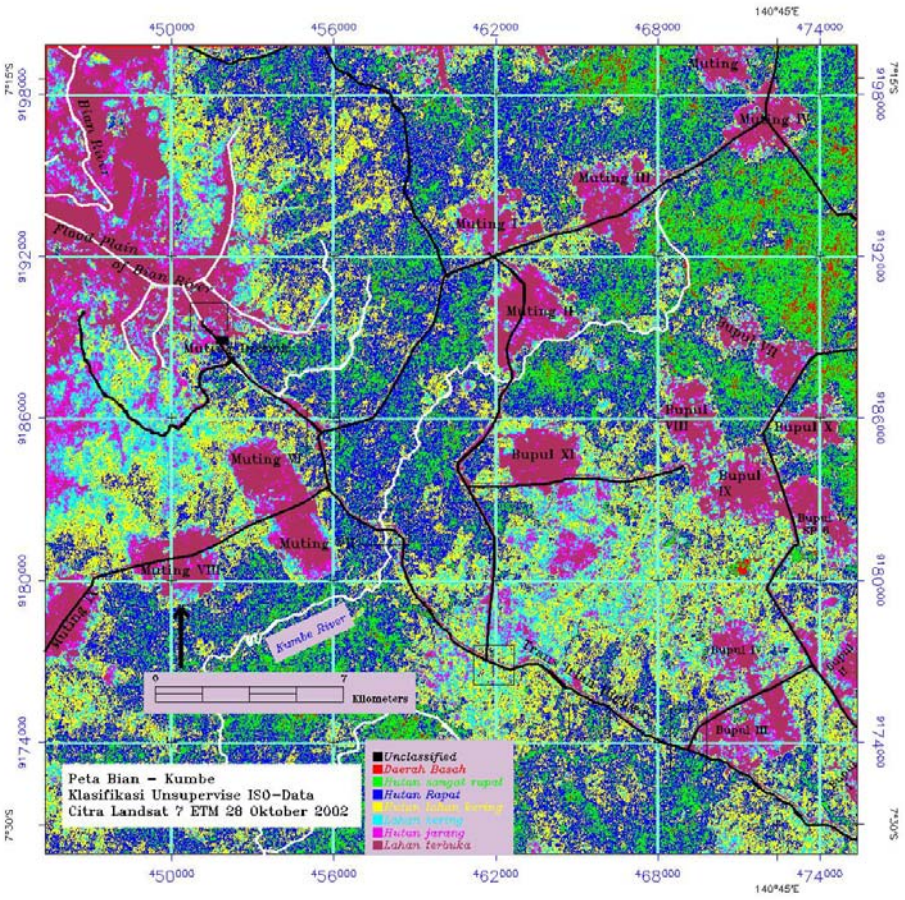
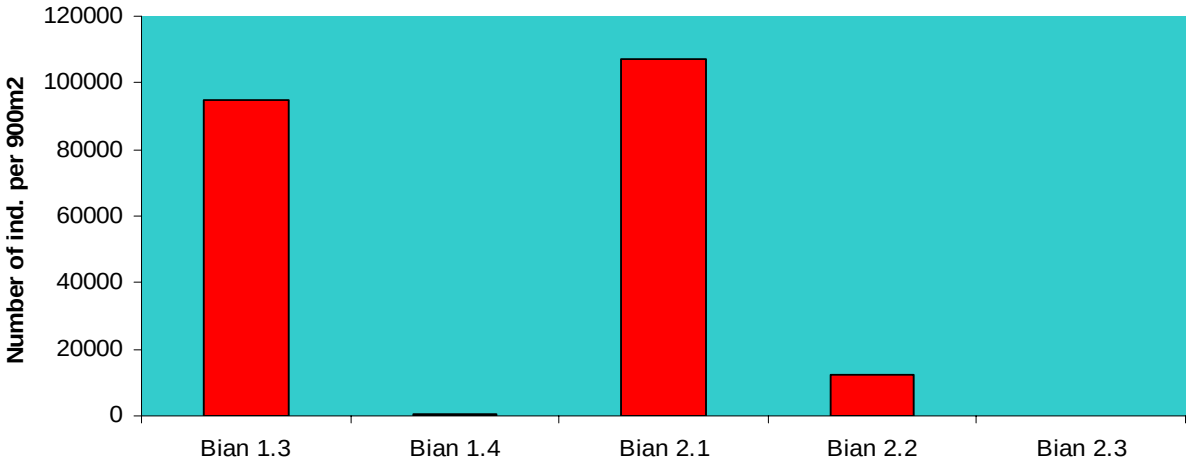
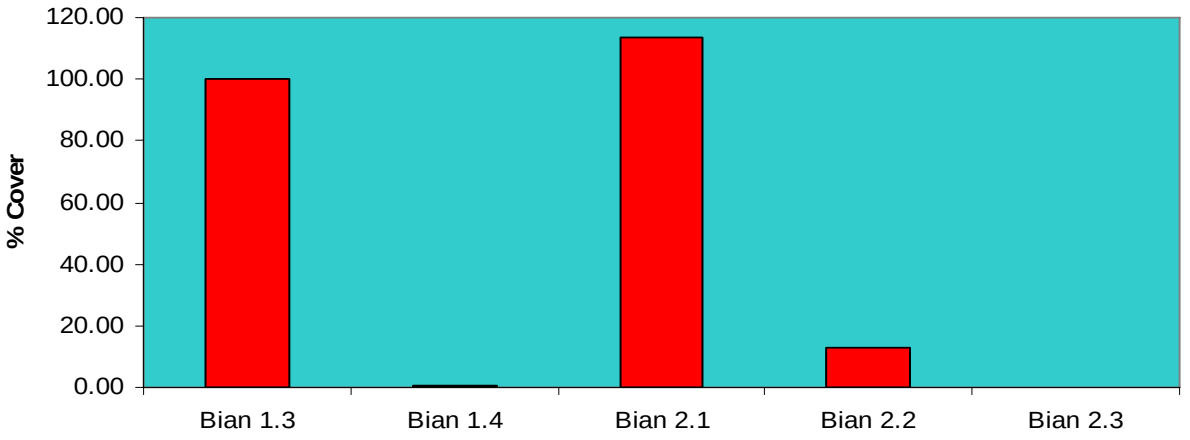


Figure 1. Landsat image of 2002 shows the study location at watershed Bian-Kumbe in Muting Distict, Merauke Papua, Indoensia. All the yellow color in the northern areas are *Eupatorim odoratum*, but in southern areas the yellow color represents a forest floor bamboo species, which dominated the forest in that area. Below is the natural fire in Rawa Bian (rawa = marsh) and as ecological processes in maintaining the tropical moonson ecosystem.





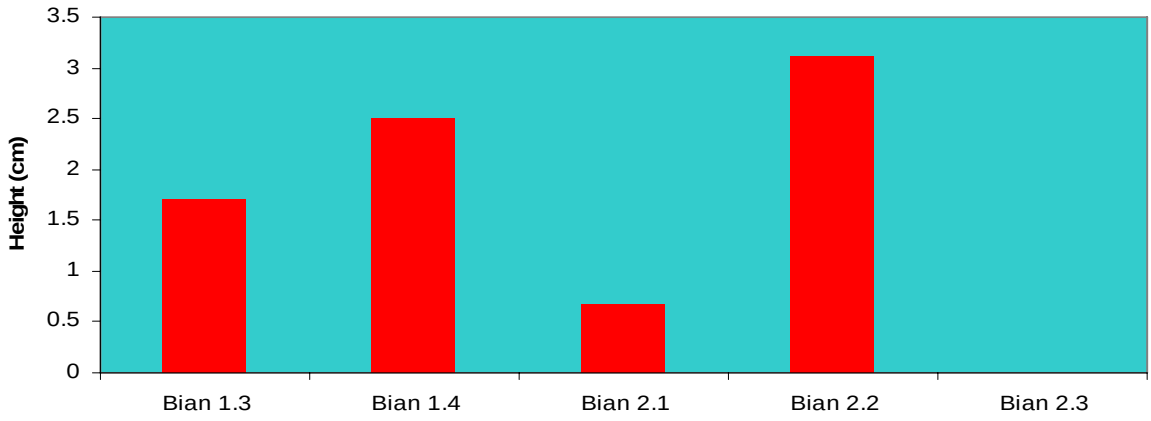
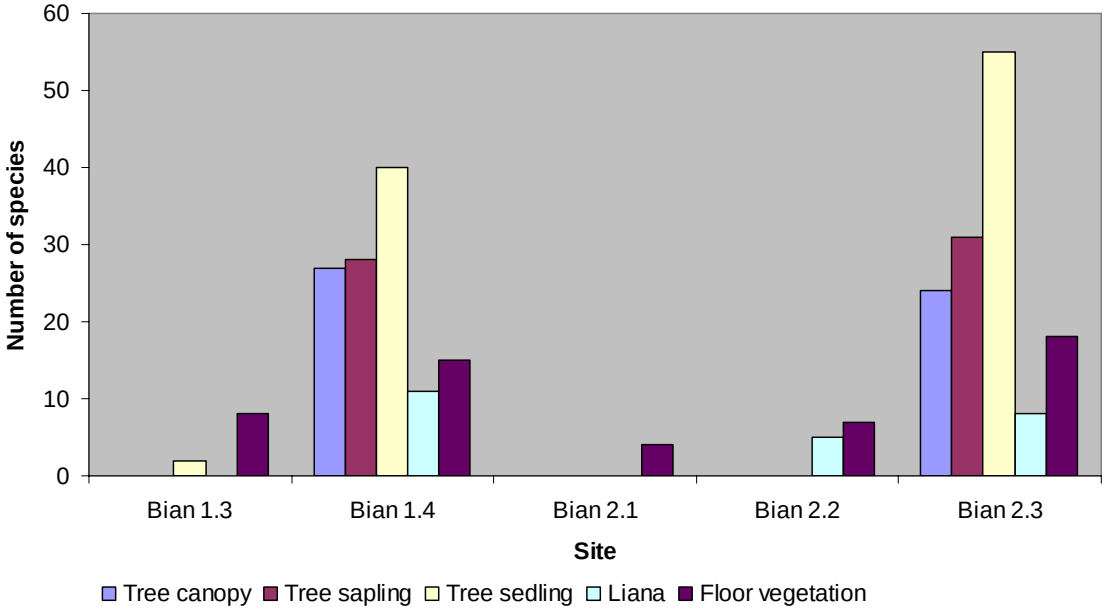


Figure 3. Density, height, and %-age of *Eupatorium odoratum* in former cacao plantation (Bian 1.3), log-storage yard (bian 2.1 and Bian 2.3), secondary forest in Rawa Bian, (Bian 1.4 and Bian 2.3) of watershed Bian-Bian Kumbe, Merauke.

Figure 4. Above shows former log-storage yard, Bian 2.1, and Bian 2.2 with background of logged-over forest (secondary forest) of Bian 2.3. Below shows logged-over forest at Bian 2.3 with canopy tree, and had low light intensity.



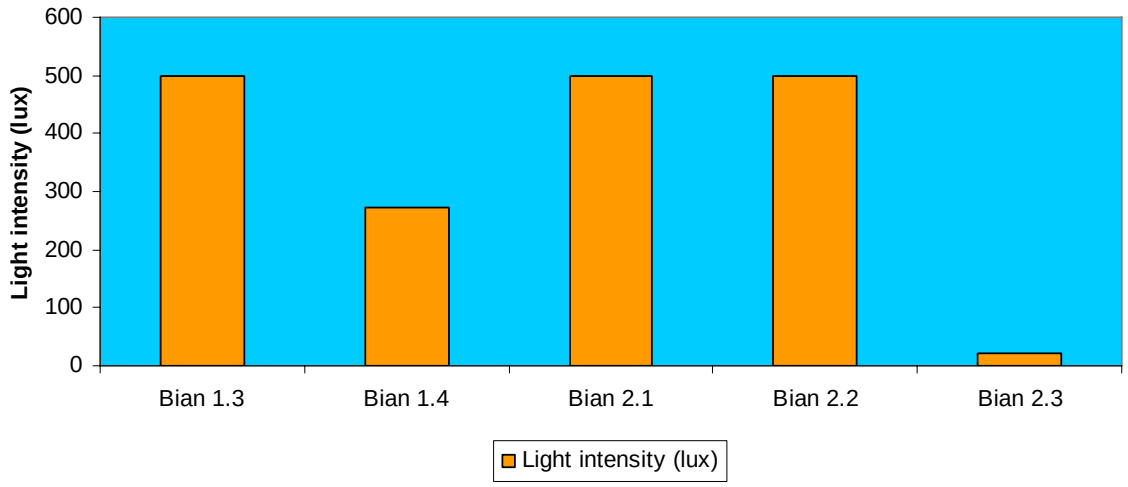


Figure 5. Above shows the number of species tree canopy, tree sapling, tree seedling, liana, and other floor vegetation in former cacao plantation, log-yard storage, secondary forest in Ra-wa Bian of watershed Bian-Bian Kumbe, Merauke. Below shows the light intensity at all study sites, and at logged-over forest of Bian 2.3, had the highest tree-, and sapling -, seedling-canopy species and there was no *E odoratum* found.

Table 1. The parameter measured of soil and air temperature (C^0), soil moisture(%), soil textures (%), and light intensity (lux).

Sites		Temperature		Soil moisture	Soil textures		
		Soil	Air		Silt	Sand	Clay
Bian 1.3	Former cacao plantation	32.5	33.5	0.0	24.53	42.43	33.04
Bian 1.4	Secondary forest	26,25	33.5	2.89	37.94	29.34	32.72
Bian 2.1	Log yard	33.8	32.8	4.47	32.59	30.0	37.41
Bian 2.2	Log-storage yard next to the secondary forest	25.20	29.2	3.0	39.03	38.20	22.27
Bian 2.3	Secondary forest	26.72	28	7.79	24.63	31.09	44.28

Table 2. The soil quality of NO_3. NH_4, N total, PO_4, P total, K^+ (mg/kg), and soil moisture, pH, and soil and temperature. Nd = not detected

Sites		NO_3	NH_4	N total	PO_4	P total	K^+	pH
Bian 1.3	Former cacao plantation	Nd	106,54	5584.0	230.4	751.81	361.03	7
Bian 1.4	Logged-over (secondary forest	Nd	114.15	3467.0	174.1	568.09	394.16	7
Bian 2.1	Logged yard	Nd	68.46	2731.0	86.65	282.75	377.52	7
Bian 2.2	Logged yard next to the logged-over forest	Nd	106.43	3109.0	125.21	408.58	398.89	6.8
Bian 2.3	Logged –over forest, secondary forest	Nd	53.69	2978.0	206.63	674.23	311.72	6.98

Conclusion

Undisturbed tree canopy will prevent the distribution of *E. odoratum*, but creation of large open areas in the forest of the watershed of Bian-Kumbe will threatened the future existence of the tropical monsoon forest and its animals.

Reference

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