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Short Communication: Rediscovery of a remnant habitat of the critically endangered species, *Hopea sangal*, in Pasuruan District, East Java, Indonesia

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ABSTRACT

Soejono. 2014. Rediscovery of a remnant habitat of the critically endangered species, Hopea sangal*, in Pasuruan District, East Java, Indonesia. Biodiversitas 15: 236-239.* During recent exploration for surviving indigenous flora carried out in Pasuruan District, East Java, the endangered tree species, *Hopea sangal* Korth., has been rediscovered in a previously unknown location in East Java. The IUCN Red List of Threatened Species, 2012, stated that *H. sangal* is critically endangered, A1cd, B1+2c, C1, D ver 2.3. This discovery of *H. sangal*, and other supporting species that may still survive, can support the program of recovery of threatened plant species. At least for Pasuruan region, the remaining habitat, can be used as the core for *H. sangal* protection, thus *H. sangal* can breed naturally and sustainably. This information also can be used as one of the references or consideration tools for stakeholders to determine the priority of restoration policy.

Key words: East Java, *H. sangal*, Indonesia, Pasuruan, rediscovered.

INTRODUCTION

Dipterocarpaceae is one of the biggest tree families strictly confined to the tropics, with over 500 species in 14 genera in the world, most of which are confined to Asia. Dipterocarp species dominate on zonal red-yellow podzolic soils, altitudes below 1300 m asl., and rainfall >1000 mm per year (Purwaningsih 2004). There are up to 238 dipterocarp species in Indonesia (Purwaningsih 2004). According to Ashton (1982), the dipterocarps are distributed unevenly among Indonesia islands, because they are found mostly in the west of Wallace's Line and the north-west in Sunda. Sumatra (106) and Borneo (267) are the two biggest islands with relatively high number of dipterocarp species, where they dominate the lowland forests in climates without a dry season or with less than four dry months (Ashton 1982; Purwaningsih 2004; Indrioko 2005; Rahayu 2008). They have produced most of the timber exported from Indonesia. They are also valued for their resin (Kusuma et al. 2013).

Based on herbarium collections in Herbarium Bogoriense, it is known that the distribution of 57.7 % of Indonesian dipterocarp species is confined within 0-500 m altitude (Purwaningsih 2004). Each species is limited in its edaphic range. In Java, 10 species of dipterocarps have been recorded, two of which are species of the genus *Hopea*, *H. celebica* and *H. sangal* (Heyne 1950; Backer and Bakhuizen v.d. Brink 1963; Ashton 1982). However, it was stated long ago that the populations of *H. sangal*, were rarely found (Heyne 1950; Backer and Bakhuizen v.d. Brink 1963). The article, which was published later, in 1982 by Ashton and 1994 by Wong, did not mention the distribution of *H. sangal* in East Java, Indonesia.

Explorations for rare plants have been carried out in Pasuruan District, East Java as part of the thematic subprograms activities of Purwodadi Botanical Gardens, in period years 2009 to 2013. Entitled study of "Vegetation and Rehabilitation of Habitats", the study has focused on remnant forest patches around springs. The study so far has found only one species of Dipterocarpaceae, and one mature tree, of *H. sangal* Korth. (Soejono 2013). The purpose of this study was to know in more details, the status and the conservation efforts of *H. sangal*, in East Java.

Conservation status of *H. sangal*

Ashton (2012) in IUCN, rated the status of *H. sangal* as critically endangered A1cd, B1+2c, C1, D ver 2.3. Based on literature and specimens in Herbarium Bogoriense, it is known that *H. sangal* occurred in East Java province in the past, only at Banyuwangi (1898), Malang (1934), Blitar (1935) (Kusumadewi 2013) and has never been recorded from Pasuruan. Bogor Botanical Gardens has conserved *ex situ* five individuals of *H. sangal*. However, all of these specimens came from Bangka Island, South Sumatra (Sari et al. 2010), while Purwodadi Botanic Garden has no living collection (Narko et al. 2013). Because the diversity of *Hopea* species in Java is relatively low and also its distribution is limited (Heyne 1950; Backer and Bakhuizen v.d. Brink 1963; Ashton 1982; Kusumadewi 2013), the threat of its sustainability becomes high. Therefore this

species should be a priority for conservation, both ex situ, for example in the Botanical Gardens, as well as, in situ, especially in their natural remaining habitat. In the absence of immediate conservation action, this plant has remained rare, endangered, critically endangered or even, until our rediscovery, possibly extinct in Java in the wild. It is important to note that currently, Pasuruan is recorded as a new location for the discovery of the critically endangered species *H. sangal*, Dipterocarpaceae in its remnant habitat.

Plant identification

The name of *H. sangal* Korth., family Dipterocarpaceae was obtained from the process of identifying based on several literature (Heyne 1950; Backer and Bakhuizen v.d. Brink 1963; Keng 1969; Asthon 1982; Wong 1994). Identification results have been verified by an expert of Dipterocarpaceae, Prof. Peter S. Ashton, Royal Botanic Gardens Kew, Richmond, UK. He ensured that the specimen was *H. sangal.* One of the important characters of the *H. sangal* is the fruit that has two long wings and calyx free or nearly so (Keng 1969; Asthon 1982) (Figure 1). Figure 1a, indicates germinating seeds, which was taken from under the parent tree which is believed to be the *H. sangal* in the natural habitat. Figure 1b shows seedlings of *H. sangal*. When the picture was taken, the seedling age was about three months old. The size of seedling varied, because seedling growth is determined by many factors such as the media and the adequacy of water and nutrients. It's just reassuring to us that this limited seed, can be germinated, and the seedlings are relatively easy to maintain, as preparation for the main purpose, conservation. Figure 1c shows the mature tree of *H. sangal*, which is dark, flaky-barked and buttressed, while Figure 1d, shows the leaves. The leaves are ovate or oblong, base obtuse, or more or less equal, without intramarginal nerve, apex rather long acuminate, 6-14 cm by 3-6 cm; nerve 10-12 pairs, slightly curved, tertiary nerves very slender, scalariform, midrib slender, prominent beneath applanate above; drying leaf dark grey–brown; petiole 0,5-1,5 (Heyne 1950; Backer and Bakhuizen v.d. Brink 1963; Keng 1969; Asthon 1982; Wong 1994). There is no available photograph of flowers of *H. sangal.*

Field and biogeographical observations

Pasuruan, where the remnant habitat of a critically endangered *H. sangal* was rediscovered, is one of the districts in East Java province, Indonesia (Figure 2). Figure 2 shows that, the previous discovery of *H. sangal*, is located in the three districts that are closer to the south of Java sea, while the rediscovery one is located closer to the north of Java sea. The plot in this new location was a mere one hectare of degraded forest on moist soil near a spring. The soil in nearby growing plants was moist, near the springs, but not flooded. There were leave litter, steep slope of about 45^0, pH 5.9 to 6.4, altitude 522 m above sea level. Only nine tree species were found in the plot: *Ficus sp.*, *Sterculia coccinea* Jack, *Pometia pinnata* J.R. & G. Forst., *Artocarpus elasticus* Reinw. ex Blume, *Alstonia scholaris* (L.) R. Br., *Dysoxylum gaudichaudianum* (A.Juss.) Miq., *Tabernaemontana sphaerocarpa* Blume, *Persea americana* Mill. and *Artocarpus heterophyllus* Lam. (Soejono 2013). The last two of them are introduced as orchard trees. As a whole, the indigenous taxa indicate that the remnant patch possibly represents original vegetation. Beside, this patch of forest remains is at the site of a spring. Especially in East Java and Bali, customary, from generation to generation, locations around the spring are more maintained than other places. Springs are often the site of sacred groves throughout Eurasia, from Japan through Asia and into Europe to Ireland. And they are often the only place where original vegetation still survives (Ashton 2014, personal communication). These forest formations are confined to a seasonal wet climate, seasonal climate with 1-4 dry (<100 mm rainfall) months, and with 4-7 dry months respectively. *H. sangal,* a species most commonly found, in that climate, in flood-free land near streams, on clay rich soils on river banks, scattered on fertile clay hill sides to 500 m, occurs scattered as rare individuals in mixed dipterocarp forest. It is confined to peninsular Myanmar and Thailand in seasonal evergreen dipterocarp forest (Ashton 1982; Asthon 2014 personal communication). Purwodadi Botanical Garden, 15 km from the location of plot and where there is a meteorological station, has five dry months (Arisoesilaningsih and Soejono 2001). The isolated locations of *H. sangal* in seasonal East Java seem to be suitable for refuges. At least for Pasuruan area, the remaining habitat which may be still supported by the environment and the various macro and microorganisms, can be used as the core for *H. sangal* protection, thus *H. sangal* can breed naturally and sustainable. This information can be used as one of the references or consideration tools by stakeholders for determining the priority of restoration or conservation policy. A priority for future exploration must be to search for survivors in past recorded locations and to document other surviving species at them (Morley 2012).

The single surviving mature *H. sangal* is about 30 m high, 1.10 m diameter, with narrow crown. Its bark is flaky and blackish, exudes dammar (resin) which characteristically crystallizes into white coxcomb-like accretions. It was observed that *H. sangal* had produced fruits although in small amounts. The evidence was by finding of seedlings on the land, which is not far from that single tree. Some seedling specimens have been prepared in the Purwodadi Botanical Gardens for *ex situ* conservation. Randomized soil samples were taken and analyzed in the Soil Chemistry Laboratory, Brawijaya University in Malang, East Java, Indonesia. The results are listed in Table 1.

Based on Table 1, soil fertility levels around *H. sangal* are moderate to quite fertile. The indicators, among others, are: pH H_2O > pH KCl; C organic > 2%; C/N ratio (11) in the range of 10-15; cation exchange capacity (83.48) relatively high. The soil is physically a humic clay loam (Hardjowigeno 2003; Sarief 1984; Sofiah 2013). Preliminary information about the condition of the soil in its natural habitat is very important to put forward as a reference, if the critically endangered species, *H. sangal*, is to be conserved. Please be aware that conservation of *H. sangal* not just aim to save it from extinction and

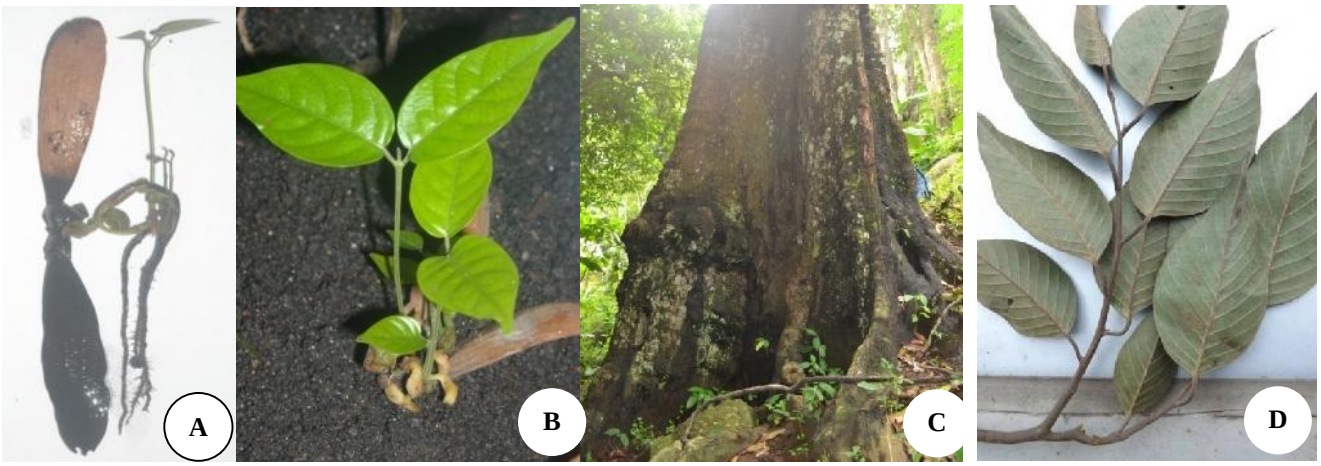

Figure 1. Germination, seedling, mature tree and leaves of *H. sangal* Korth. A. Germinated fruit; B. Seedling, about three months old.; C. Mature tree; D. Leaves

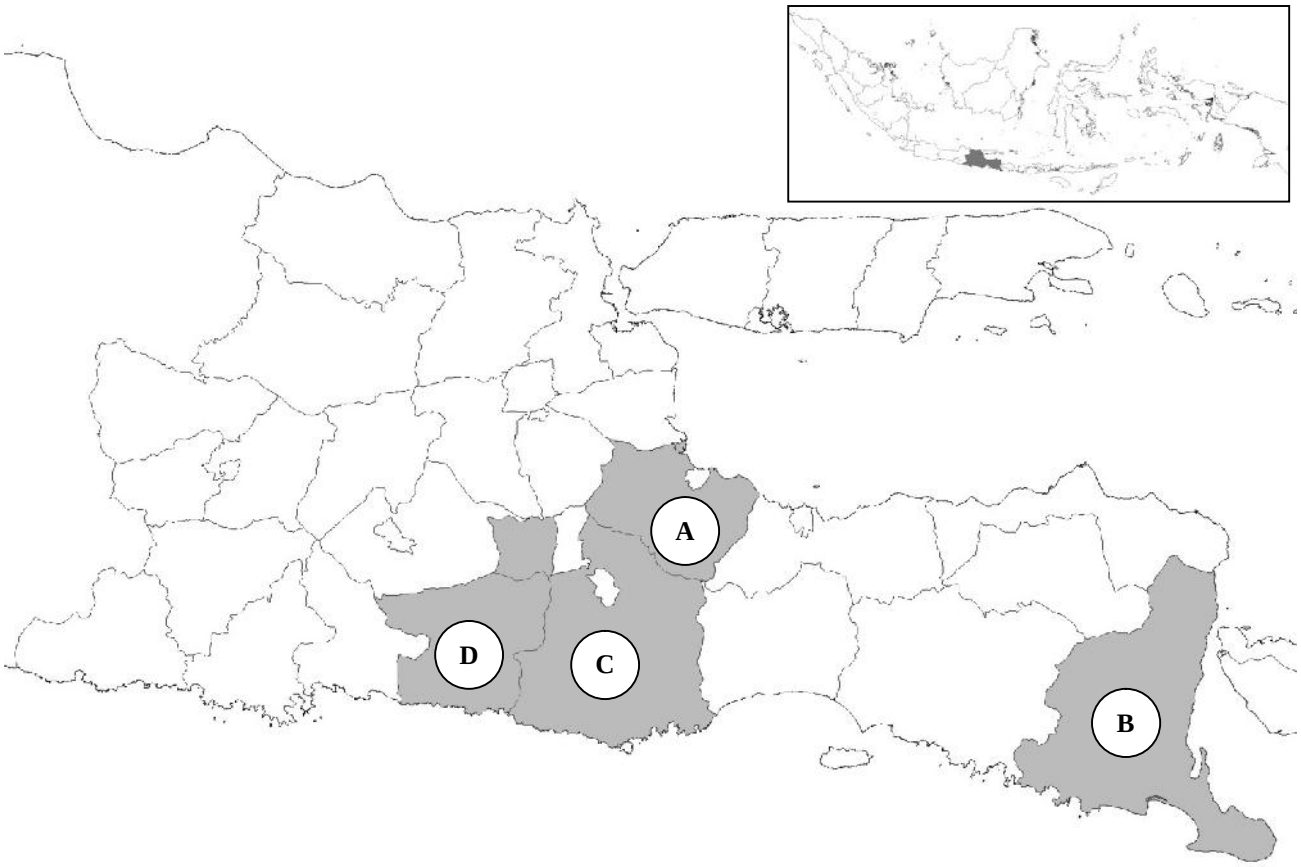

Figure 2. Location of rediscovery of a critically endangered species, *H. sangal*, Dipterocarpaceae, in Pasuruan District, East Java, Indonesia, A. Current rediscovery, Pasuruan District, year 2014, and previously *H. sangal* found, B. Banyuwangi District, year 1898; C. Malang District, year 1934; and D. Blitar District, year 1935.

Table 1. Resultsof analysis of soil samples taken from habitat around *H. sangal*

No. Lab	Code	pH 1:1		C Org.	N Total	C/N	P.Bray1	K	Na	Ca	Mg	CEC	Number of bases	Base satu-ration	Sand	Silt	Clay	Texture d
		H2O	KCL 1N					NH4OAC1N pH:7										
TNH345	Soil	56	48	225	021	11	mg/kg	me/100 g					37.19		%			Silty-
							816	007	213	22.29	12.70	83.48		45	19	61	20	clay

Note: CEC= Cation exchange capacity

preserve diversity but may also to develop it as an economic plant because of its potential as a producer of wood. Wong, (1994), mentioned that *H. sangal* is important source of merawan timber. Determining the location for the two measures as mentioned above need to consider the basic needs and requirements to grow of the critically endangered species, *H. sangal*.

Further management

This information is expected to be used as a reference by stakeholders for further management of *H. sangal*, both for conservation and cultivation purposes especially in Pasuruan district and other similar areas. We should take steps to ensure that this tree remains stable in its habitat, and that the area is also used as one part of a network of protection areas for there instatement of *H. sangal*, either naturally or by human support.

Another important reference in an attempt to restore the critically endangered tree, *H. sangal*, and convince to stakeholders is the publication of Philipson et al. (2012). They reported the results of their research on *H. sangal* that it had the highest growth rates in the low light, and very high growth rates in the other light treatments. It had the fastest diameter, height and biomass SGR in the low-light treatment, had the fastest height SGR in the low and middle light treatment, and the second highest height SGR in the high light treatment. Moreover, *H. sangal* also had lower mortality rate than 14 other dipterocarp species.

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