

## Conservation Strategy of *Rafflesia zollingeriana* Koord in Meru Betiri National Park, East Java

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### Abstract

*Rafflesia zollingeriana* Koorders is a protected, rare, and endemic plants to Meru Betiri National Park. However, its population was declined. So, the study was focused on the analysis of the strengths, weaknesses, opportunities, and threats of conservation of *R. zollingeriana* to recommend some conservation's strategy and programs. This study was conducted at Meru Betiri National Park and its surrounding 5 villages. Data were collected by interviews, survey, observations, and literature studies. Qualitative data was analyzed by reduction, presentation and drawing conclusions simultaneously, while the quantitative data was analyzed descriptively. Matrix for SWOT analysis was processed by SPSS 16. The result showed that there were 4 elements that identified as strength, 5 elements that identified as weakness, 5 elements that identified as opportunity and 4 elements that identified as threat. The internal factor's value was higher than the external factor. The result of the SWOT analysis indicated that it needs aggressive strategy through collaboration among stakeholders to optimize both strength and opportunities. While the recommended program are: socialization the importance of *R. zollingeriana* conservation and developing a collaborative *R. zollingeriana* ecotourism.

Keywords: collaboration, ecotourism, stakeholder, SWOT analysis

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### Introduction

*Rafflesia* spp is an unique plant because of its large flowers and its presence that only realized when the buds exist and blooming. It was only holoparasit to *Tetrastigma* spp. (Barkman *et al.* 2004; Barcelona *et al.* 2011). *Rafflesia* spp. is rare because of its small population (Nais 2001). Populations of *R. lobata* in Mount Igtuog Philippines only 76 individuals (Galang & Madulid 2006). *R. manillana* population in Mount Makiling is also just 86 individuals (Yahya *et al.* 2010). Populations of *R. arnoldi* at 5 locations in West Sumatra only 80 individuals (Syahbuddin & Chairul 2010). Population of *R. patma* in Leweuung Sancang, consist of 96 individuals (Suwartini *et al.* 2008).

*Rafflesia*'s small population is caused by biological nature and ecological attributes (Susatya 2003), such as low reproductive rate (Nais 2001). From the 1,110 buds were observed by Nais (2001) in 3 years, only 10.18% that succeed to bloome while the proportion of female flowers only 12.39% and the fruit succeeded only 35.71%. The unbalanced sex ratio also indicated by Galang (2006) in *R. lobata* population. In addition, low reproduction occur because *rafflesia* is an unisexual (Meijer 1997; Refaei *et al.* 2011), so its pollination needs insects assistance (Zuhud *et al.* 1999; Davis *et al.* 2008; Kahono *et al.* 2010) and so does its seed dispersal (Bouman & Meijer 1994; Kahono *et al.* 2010).

Small population is also caused by its low survival ability. Hidayati *et al.* (2000) founded *R. patma* in Pangandaran that consist of 44% died knobs, 49% alive buds, and 7% blooming flower. Thousands of *rafflesia* that observed by Nais in Malaysia also showed high death rate before blooming until 90% (Milius 1999).

External factors such as fragmentation and habitat destruction were also pressured *rafflesia*'s small population. *R. patma* population in Leweuung Sancang was decreased, from 256 individuals (Priatna *et al.* 1989) in 5 areas to 96 individuals in 9 areas due to logging and deforestation (Suwartini *et al.* 2008). While population *R. banahaw* in the Philippines declined because of landslides and typhoons (Barcelona *et al.* 2007).

There were 30 species of *rafflesia* that successfully described. The recent *rafflesia* that successfully described were *R. aurantia* (Barcelona *et al.* 2009), *R. meijeri* (Wiriadinata & Sari 2010), *R. verrucosa* (Balet *et al.* 2010), and *R. lawangensis* (Matt-Salleh *et al.* 2010). The possibility of a new species description is widely open but racing with its extinction.

Among of those 30 species, 16 species are distributed in Indonesia. *R. patma*, *R. rochussenii* and *R. zollingeriana* are distributed in Java Island. *R. zollingeriana* less distributed than the other two species. It was only distributed in Betiri

Meru National Park (MBNP) and only grows in dry lowland forest, at an altitude of 1–270 m above sea level. *R. zollingeriana* was known with the local names patmosari. It was used for traditional medicine and collected illegally by the local people (Zuhud 1989), so its population is vulnerable to extinction.

Rafflesia is able to live in primary and secondary forests (Zuhud 1989; Syahbudin & Chairul 2010). Therefore, to sustaining its population, the forest ecosystem should be save in a primary state. Thus, save rafflesia will increase the motivation to save the whole ecosystem.

Conservation status of *R. zollingeriana* is rare (Wiradinata 2001) or R (rare) by WCMC (2013). While Susatya (2011) categorized it to CR (critical endangered). *Rafflesia* spp. also designated as a protected plant in Indonesia according to Government Regulation No. 7/1999. By Betiri Meru National Park Authority (MBNPA). *R. zollingeriana* has been designated as a species whose habitat is protected and nurtured (BTNMB 2003). However, reality showed that *R. zollingeriana* in TNMB population continues to decline. In 1988, the population of rafflesia found in 8 locations, while in 2003, the population can only be found in 3 locations (Hikmat 2006).

Along with its declining populations, there is a challenge ie: lack of its scientific information. So, the population of *R. zollingeriana* should be saved for research and assessment study. This is in accordance with the principle “Save it, Study it and Use it” in the Convention on the Conservation of Biodiversity. An ecosystem or a species has to saved before extinct and assessment of its usefulness should be done for the improvement of human welfare (Putro *et al.* 2012). The effective strategy to maintain the sustainability of *R. zollingeriana* population is required. This strategy can be formulated if the strengths, weaknesses, opportunities, and threats that have been made during the conservation are identified and evaluated.

## Methods

The study was conducted at Meru Betiri National Park and 5 villages surrounding (Wonoasri, Curahnongko, Andongrejo, Sanenrejo, and Sarongan), during January to December 2012. Data were collected by interviews, surveys, observations, and literature study. Interviews were conducted to MBNPA staff, academist, activists nature lovers, non government organization (NGO) activists, and government staff. While the survey was conducted to 157

local people that living in MBNP and its surrounding. These respondents are dominated by farmer (61.15%). Observations carried out in Sukamade and Krecek permanent plots. Qualitative data was analyzed by reduction, presentation, and drawing conclusions simultaneously. Quantitative data analyzed descriptively. SWOT analysis conducted by identifying the internal and external factors, then weighting, ranking and scoring of each elements (Maintindom *et al.* 2006). SWOT matrix to determine strategy is processed by SPSS 16.

## Results and Discussion

Meru Betiri Management at the 1970s until 1996 more focused on the protection and preservation for the java tiger than *R. zollingeriana* conservation. There was no specific regulation that ruled knob collection activity, so the sustainability of the *R. zollingeriana* was threatened. After became a national park and run by MBNPA, monitoring of *R. zollingeriana* and habitat protection (BTNMB 2003) are started. Data collection and routine observations in Krecek and Sukamade plots also being conducted and published in a book (Darmadja *et al.* 2011). In 2010, *R. zollingeriana* habitat in Krecek and Sukamade were made into permanent plots for education, research, and nature tourism. Railings, stairs, signage, and information boards about *R. zollingeriana* were built on the plot. Guiding from MBNPA officers were also given for visiting tourists. The existence of *R. zollingeriana* as a tourism attraction also socialized in MBNPA's brochures and website.

However, those conservation efforts are still dominated by MBNPA. Interviews showed no involvement from the other stakeholders and the *R.zollingeriana* tourism did not developed optimally. Number of visiting tourists was still low. From 640,492 visiting tourists to Jember (BPS 2011) and 443,938 to Banyuwangi (BPS 2011), visiting number to MBNP only 4,402 tourists (85.85% of them are domestic tourists). The visitor number of *R. zollingeriana* was predicted much lower. The survey respondents who knew that *R. zollingeriana* can be visited by tourist only reached 29.94% and the number of respondents who involved in this tourism activity only 12.10%.

Table 1 showed that populations of *R. zollingeriana* in TNMB were decline. Therefore, more effective strategies of *R. zollingeriana* conservation should be formulated through SWOT analysis.

Table 1 Number of *R. zollingeriana* in observation plots

Time of Research	Number of Plots	Number of <i>R. zollingeriana</i>	Means	Minimum	Maximum	Standard deviation
1988 <sup>5</sup>	8	171	21.375	2	68	23.3846
1989 <sup>6</sup>	10	202	20.2	10	32	8.1076
2012 <sup>7</sup>	19	152	8	1	19	5.2810

1) Hikmat (1988) in Lestari (2013); 2) Zuhud (1989); 3) Lestari (2013). Number of plots above are variated because the wide of forest area that has been explored by researchers are variated (Figure 2). Plots was purposively made based on *R. zollingeriana* existence at the observation.

**SWOT analysis** SWOT analysis is needed to identify and evaluate internal and external factors of *R. zollingeriana* conservation. Identification results showed that there were 4 elements of *R. zollingeriana* conservation strength, such as:

- 1 MBNP is a habitat for endemic *R. zollingeriana*  
*R. zollingeriana* is an unique rare and endemic species in MBNP (Darmadja *et al.* 2011). With its limited distribution, *R. zollingeriana* was more deserved to be a priority of conservation than the other species. This species conservation will also increase motivation to conserve the whole ecosystem in MBNP (Zuhud 1988)
- 2 *R. zollingeriana* is an endangered plant  
There were some laws underlied *R. zollingeriana* conservation management today. Such as Law No. 5/1990 on Conservation of Natural Resources and Ecosystems; Law No. 41/1999 on Forestry; Government Regulation No. 7/1999 about Plant and Animal Species Preservation, and IUCN Red List (Nais 2001)
- 3 Conservation of *R. zollingeriana* potential to enhance local people's prosperity.  
Rafflesia conservation in Malaysia can enhance prosperity of local people (Nais 1998). So did the ecotourism of *R. arnoldii* in West Sumatra (Ekawati 2001). If *R. zollingeriana* ecotourism in MBNP is also developed with local people involvement like those cases above, their prosperity will also increase gradually
- 4 Legal basis of MBNPA as a manager authority of MBNP.  
There are some basic laws that underlied MBNPA as manager authority of MBNP: the regulation of the Minister of Forestry of the Republic of Indonesia Number P.03/Menhut-II/2007 about the Organization and Administration of National Parks; Regulation of the Minister of Forestry of the Republic of Indonesia Number P.48/Menhut-II/2010 about Natural Resources Tourism in Asylum Areas, National Parks, Forest Parks and Nature Park

While the weakness of the *R. zollingeriana* conservation were:

- 1 Limitness quality and quantity of MBNPA staff  
MBNPA have a limited number of officers but large area of responsibility, so *R. zollingeriana* conservation was not performed optimally. They documented observation data irregularly, their inventories are still limited and without involving the local people. Habitat maintenance of *R. zollingeriana* in in Krecek and Sukamade permanent plots wasn't performed as the standard operating procedures
- 2 Low attention to *R. zollingeriana* conservation  
This is demonstrated by the low budget for conservation of *R. zollingeriana*. In 2011, MBNPA used 1.397% of their total budget for monitoring *R. zollingeriana* (BTNMB 2011). This budget is smaller than the wildlife conservation budget that reached 6.904%
- 3 Lack of law enforcement  
Although there is a Government Regulation No. 7/1999 about *Rafflesia* spp., but laws enforcement is lacking. There is no operation rule that stated about *R. zollingeriana* specifically, so the illegal collectors of *R. zollingeriana* knobs are handling informally. The *R. zollingeriana* knobs trading in Banyuwangi market still

remains (LATIN 2002) and there has been no formal handling and control efforts to its traders and manufacturers

- 4 The low survival rate and regeneration of *R. zollingeriana*  
Hikmat (1988) stated that he found 34% knobs of *R. zollingeriana* in dead condition. This showed that the death rate *R. zollingeriana* also as high as the other species. But unfortunately, research about *R. zollingeriana* survivality has not been done, so the solution has not been found yet

- 5 Lack capacity of MBNPA to promote collaboration with the other stakeholders

It can be seen from the percentage of survey respondents who knew about *R. zollingeriana* conservation activity that only amounted to 26.11% and the low level of involvement of respondents which only amounted to 7.64%. Interviews with the private sector, NGOs, organizations and other agencies also showed their lack involvement in the conservation efforts. Collaboration with another stakeholders is a key for MBNPA to overcome their internal problem and optimize the *R. zollingeriana* conservation

Meanwhile, there are 5 things that identified as an opportunity from external factors to *R. zollingeriana* conservation, such as:

- 1 MBNP lied in the tourism path  
MBNP lies between Yogyakarta and Bali, 2 favorite tourist destinations. Tourist arrival in Jember and Banyuwangi are quite high, amounting to 1,084,430 tourist. Existing tourist facilities ie accommodation, consumption, tourist guiding, and interpretation in the MBNP were sufficient in quantity and quality.
- 2 Huge number of local people  
The population of 5 villages around and inside the national park is 33,233 people. This huge number can be used to overcome the limited staff of MBNPA if their participation is enabled. Local people have to be involved because their live are connected and depend on MBNP sustainability.
- 3 A large number of universities, conservation cadre, nature lovers, and NGOs that could be involved in conservation.  
There are more than 30 universities, NGOs, and nature lovers community in Jember and Banyuwangi that concern to MBNP conservation. They also concerned that *R. zollingeriana* is an unique flora that close to extinct and they have desire to get involved in the conservation of *R. zollingeriana*.
- 4 Local people and stakeholder willingness to involve in *R. zollingeriana* conservation  
The survey showed that 74.52% of respondents want to involve in the next conservation of *R. zollingeriana*. MPNPA have to accomodate their willingness and arrange some stakeholder analysis to identify which people or stakeholder that going to be an active or a passive participant.
- 5 High attention to conservation topic  
Currently, conservation became a popular theme in the world, especially with the issue of global warming. There a lot of local, national, and global organization that interested in this issue and have the funding to further

engage. This can be used as an alternative to overcome limited funds of *R. zollingeriana* conservation.

While the threats faced by *R. zollingeriana* conservation are:

- 1 The low level of public knowledge  
 Surrounding communities have limited knowledge about *R. zollingeriana*. Although most of respondents (64.33%) knew that *R. zollingeriana* is protected, but they did not know its life cycle and reproduction. They did not know that unselected knob collection activity will lead *R. zollingeriana* to extinct.
- 2 *R. zollingeriana* habitat lies closely to the residential community  
 There are a lot enclaves in the national park. Some of their residence are close to *R. zollingeriana* habitat. If they did not involved in *R. zollingeriana* conservation, they did not know the importance of its conservation to their life and did not get any economic benefit from it, they tend to disobey it and exploit its knobs as before. Although knob collecting activity are decrease significantly now, but it is a temporary condition. If the knob price getting higher as before, those activity will rise again and the sustainability of *R. zollingeriana* populations will being threatened.
- 3 Low income levels and lower productivity of agricultural activities in the rehabilitation land  
 Most of the local people surrounding of MBNP are

peasants. So, their live are so depend to forest especially with the MBNP rehabilitation program that allowed them to do shifting cultivation in deforestation land. This activities adding their total revenue up to 21.45% (Suharti 2004). But this percentage is expected to be smaller and smaller because productivity of the seasonal agricultural decreases. If their revenue was lower and lower, the possibility to re-gather of *R. zollingeriana* knob will rise again.

- 4 The remaining request of *R. zollingeriana* for traditional medicine  
 Demand of knob *R. zollingeriana* for herbs still remaining. In Banyuwangi market, *R. zollingeriana* traded at IDR20,000 kg<sup>-1</sup> (LATIN 2002). Actually, the population will stay sustainably if the collection only done on died knobs.

**Strategy and program recommendation for the next *R. zollingeriana* conservation** Measurement of the internal and external factors are displayed in Table 2. It shows the internal factors and external factors are positive, but the internal factor's value is higher than the external factors. The matrix in Figure 1 shows that the intersection between the x-axis (internal factors) and the y-axis (external factors) lied in 1<sup>st</sup> quadrant. So, the strategy should be taken is an aggressive

Table 2 IFAS dan EFAS of *R. zollingeriana* conservation in Meru Betiri National Park

IFAS and EFAS	Weigth	Rating	Score	Total value
<b>IFAS</b>				
<i>Strength</i>				
- TNMB is an endemic habitat for <i>R. zollingeriana</i>	0.2	4	0.8	
- <i>R. zollingeriana</i> is an protected rare plants and a trigger to conserve the whole ecosystem in MBNP	0.1	4	0.4	
- <i>R. zollingeriana</i> potential to enhance local people prosperity	0.1	4	0.4	1.8
- Legal basis management of MBNP that run by MBNPA	0.1	2	0.2	
<i>Weakness</i>				
- Low attention of MBNPA to <i>R. zollingeriana</i> conservation	0.05	4	0.2	
- Limited number and quality of MBNPA staff	0.1	2	0.2	
- Lack of law enforcement	0.05	4	0.2	
- <i>R. zollingeriana</i> ability to survive and bloom are low	0.1	1	0.1	0.9
- Lack capacity of MBNPA to promote collaboration with another stakeholder	0.2	1	0.2	
<b>EFAS</b>				
<i>Opportunity</i>				
- Location of MBNP in the path of tourism	0.2	4	0.8	
- Huge number of local people surrounding	0.05	2	0.1	
- Huge number of universities, lover's nature and NGO that can be involved in <i>R. zollingeriana</i> conservation	0.1	3	0.3	
- Local people and stakeholder willingness to involve in <i>R. zollingeriana</i> conservation	0.1	3	0.3	1.55
- Conservation becomes a world's concern now	0.05	1	0.05	
<i>Threats</i>				
- Limited knowledge of local people about <i>R. zollingeriana</i>	0.2	1	0.2	
- <i>R. zollingeriana</i> habitat are close to residential of local people	0.1	2	0.2	
- Low income levels of local people and their agricultural productivity in the rehabilitation areas are lower and lower	0.1	3	0.3	0.9
- <i>R. zollingeriana</i> request for traditional medicine is remaining	0.1	2	0.2	

IFAS = Internal Factor Analysis Summary; EFAS= External Factor Analysis Summary

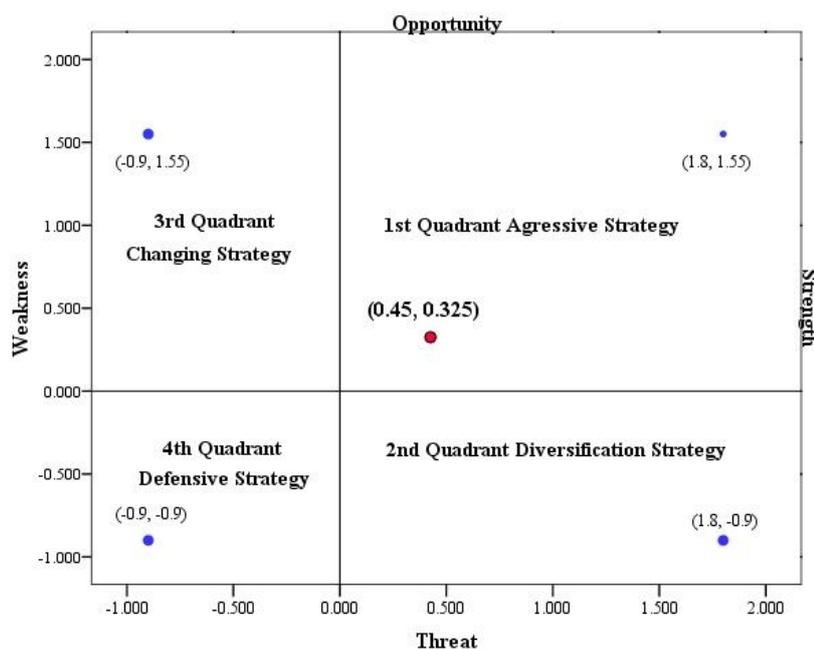


Figure 1 SWOT matrix of *R. zollingeriana* conservation in Meru Betiri National Park.

strategy: optimizing the strength so that opportunities can be optimally utilized. This strength can be optimized through collaboration with the other stakeholders.

Next conservation programs that recommended are:

- 1 Socialization the importance of *R. zollingeriana* conservation to increase stakeholders awareness  
 Collaboration with community, other agencies, and organizations are needed to optimize conservation. To establish collaboration, mutual trust, mutual respect and mutual benefit among stakeholders are needed (Putro *et al.* 2012). Stakeholders will collaborate if you already have an equivalent knowledge and understanding of the importance of conservation of *R. zollingeriana*. So the importance of *R. zollingeriana* conservation must be socialized massively through various mass media in international, national, and local level.  
 At the local level, MBNPA have to hold a workshop that discussing the ecologic and economic benefit of *R. zollingeriana* conservation. This meeting involves local people, the rafflesia researcher, nature lover organization, local government, and relevant agencies such as BKSDA, local forestry services, local agency of tourism department, etc. Information about the blooming *R. zollingeriana* must be arranged in many medias, such as audiovisual media (local and national TV broadcasting) and social networks like facebook, twitter, instagram, and youtube. This information have to available in Indonesian and foreign languages. *R. zollingeriana* should be an icons and identity flora of the MBNP to increase stakeholders awareness. It is worth to be MBNPA logo, complements javan tiger logo, because of its scarcity and endemism reason.
- 2 Developing a collaborative *R. zollingeriana* ecotourism

*R. zollingeriana* ecotourism have to involve the local people. If the local people get a higher income from *R. zollingeriana*, their motivation to sustain its populations of will increase. It is like what happened in Malaysia (Nais 1998). Ecotourism considered have more economic benefit than the other utilization. Revenue from the knobs collection is IDR10,000 kg<sup>-1</sup> dry knob. While the revenue from homestay service and tourist guiding is about IDR200,000 people<sup>-1</sup> day<sup>-1</sup>. Local people participation is possible because their willingness to involve in this tourism activity is high (74.52%). However, only 51.59% of them who know how to develop the *R. zollingeriana* ecotourism. Therefore, participation other stakeholders: private (tourist practitioner: travel agencies), NGOs, and the department of tourism, who are experienced in the planning and implementation of tourism programs are needed. They are needed to participate in local people capacity building. To develop ecotourism, MPNPA staff and local people competence need to be improved with some English language training, hospitality tourism training, souvenirs manufacture training, and *R. zollingeriana* training.

Information about *R. zollingeriana* blooming, especially when it can be visited must be updated regularly in MBNP's website. So does with the visiting procedures i.e. list of do and do not do at site. This information should be accessed any time. Contact number enlisted in website [www.merubetiri.com](http://www.merubetiri.com) must be contacted freely, both in the Indonesian and foreign language. Permanent plots must be furnished with a complete and interesting information so the visitor can get comprehensive information even they can not see *R. zollingeriana* blooming directly.

Map of *Rafflesia zollingeriana* Distribution in Meru Betiri National Park

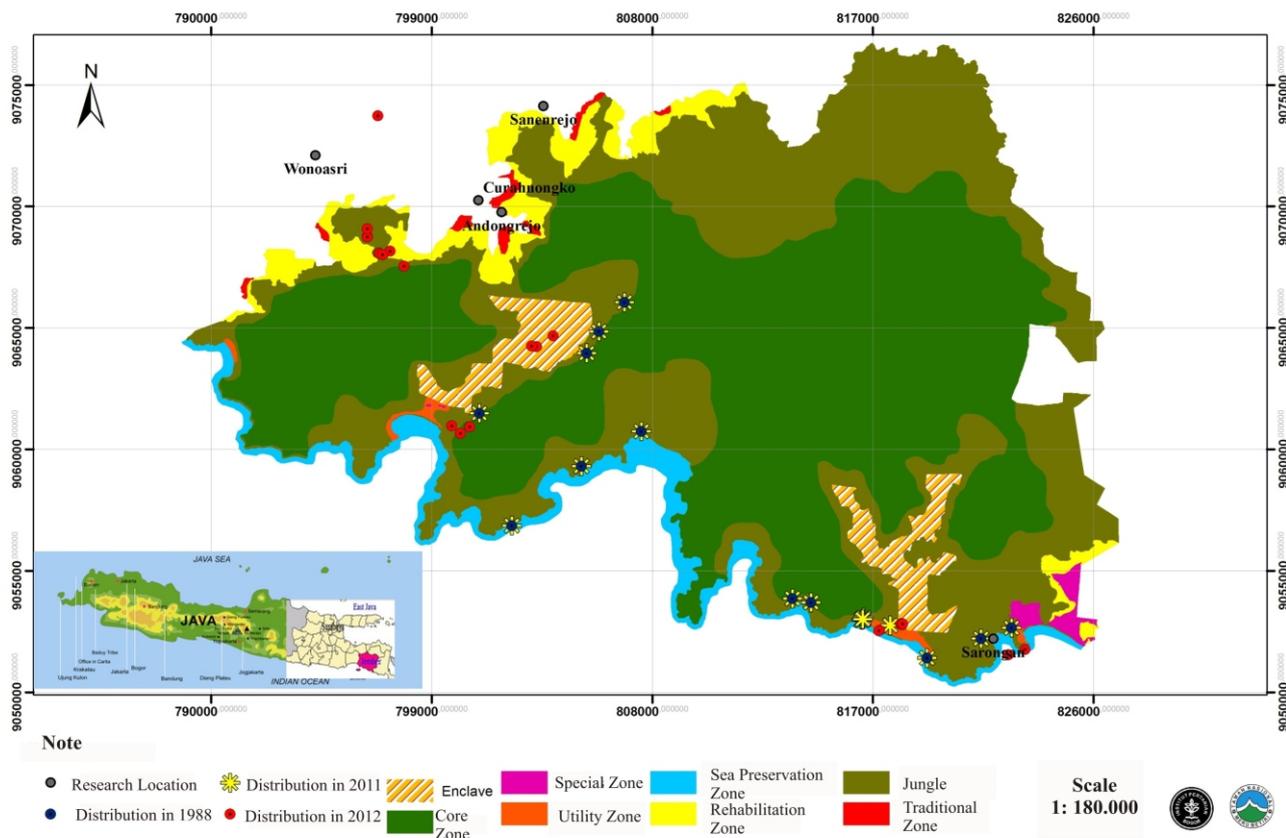


Figure 2 Distribution of *Rafflesia zollingeriana* Koord in Meru Betiri National Park (Lestari 2013).

### Conclusion

SWOT analysis showed that internal factor's value was higher than the external factor. Strategy that need to be developed is an aggressive strategy, optimizing strength through collaboration so that opportunities can be utilized optimally. While the recommended program are: socialization the importance of of *R. zollingeriana* conservation and developing a collaborative *R. zollingeriana* ecotourism.

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