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Sustainability Status of Malaria Vector Control Program in Coastal Ecosystem

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Abstract: The purpose of this study was to analyze the sustainability status of malaria vector control programs in coastal ecosystems in malaria-endemic areas. The experiment was conducted in August-October 2013. The study was conducted in Pesawaran District, Lampung Province. A stage of the research was to develop aspects of the sustainability dimensions of malaria vector control programs, collect data and analyze the data. Aspects of the dimensions of sustainability includes social, economic, environmental and technological. These aspects are built through the study of literature and in depth interviews with experts. The data was collected using a questionnaire distributed to respondents' fishpond owners, religious leaders, community leaders and the District Health Office of Pesawaran. Sustainability assessment of the status of malaria vector control programs carried out by the method of Multi-Dimensional Scaling (MDS) Method is called with rap-malaria. The results of the research is the management of malaria vector control of abandoned farms have relatively large indexes on technological and economic dimensions while the chemical larvicides have a relatively large index of socio-cultural dimensions and programs Insecticide Residual Spraying (IRS) has an index of indoor and outdoor large relative to the dimensions of the environment.

Key words: Multidimensional Scaling (MDS), status of sustainability, coastal ecosystem, malaria vector control, dimensions

INTRODUCTION

Malaria is locally specific and global disease. Local because of the spread of malaria depends on the conditions of local areas. Malaria is spread by *Anopheles* sp. females. The behavior of *Anopheles* sp. as a vector of malaria is also different in each region. Breeding is highly dependent on local environmental factors, the proximity between the breeding sites of mosquitoes to humans and mosquitoes in the region.

Malaria is a global disease due to its transmission cross-border traffic which requires the completion of the integration of stakeholders. Similarly, the completions of the Anopheles mosquito breeding habitats are not only the responsibility of the head area on the smallest unit. Mosquito breeding problems can be a cross-border village, district, provincial and even.

Vector control is one of the ways to eradicate malaria. Vector control activities recommended is the modification and manipulation of the environment, chemical and biological larvicides, spraying insecticide outdoor space and indoor Insecticide Residual Spraying (IRS) (WHO, 2009).

The concept of Multi-Dimensional Scaling (MDS) is a modified approach to Rapid Appraisal Techniques for Fishery (RAPFISH) at the University of British Columbia initially measure the sustainability of resources and fish catches.

Almost all districts in Lampung Province is malaria-endemic areas. Pesawaran District is a malaria endemic area of malaria morbidity including medium case incidence is 12.51‰ in 2009. But that number turns contributed by only three districts namely Hanura (88.57‰), Padang Cermin (18.21‰) and Punduh Pedada (18.05‰).

The previous studies found that individual risk factors and enviromental around settlements in relation with malaria in Punduh Pedada. Malaria control in Pesawaran recommended was maintaining the environment quality: reactive abandoned fishpond to reduce breeding places (62%), chemical and biological larvacides (23%), IRS both indoor and outdoor (15%). Ernawati research results showed that the management of breeding sites of neglected fishponds with predators and mangrove rehabilitation interventions can reduce the incidence of malaria in the coastal areas Punduh Pedada, Pesawaran District. Susanna showed that

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the best alternative vector control can be applied in environmental management districts Pesawaran is displaced breeding fishponds. Based on the explanation, the research on the sustainability status of malaria vector control programs in coastal ecosystems in malaria-endemic areas has not been done.

The objective of this study was to construct an integrated model in malaria control in coastal ecosystem for sustainability program used Rapid Appraisal Techniques for Fishery (RAPFISH) and analyze the relationship between breeding fishponds habitat displaced by malaria in coastal ecosystems in Punduh Pedada Sub-Dictrict, Pesawaran Dictrict, Lampung Province, Indonesia.

MATERIALS AND METHODS

The study was conducted in August-October 2013 in Pesawaran District, Lampung Province with a focus on the study of three districts where malaria is endemic coastal ecosystems in the Sub-District Punduh Pedada, Hanura and Padang Cermin, Pesawaran Dictrict, Lampung Province, Indonesia.

Quick Time™ and a decompressor are needed to see this picture

The study was based on primary data and secondary data obtained from the field survey. The scope of research that explored includes ecological, economic, social, cultural and technological dimensions.

Implementation research was divided into several stages. First, did literature review and interviewed with the experts to determine the main attributes in every aspect of the ecological, economic, social, cultural and technological that affect the sustainability of malaria vector control programs in coastal ecosystems, conduct field surveys to collect data and perform analysis of sustainability.

Determination of the respondents was done by using intentionally (purposive sampling) with 30 respondents (30-50 years old), most of them were female and mostly govenrment employees. Respondents were chosen have relevance to the problems studied. Respondents of the health sector were the sub-district health center staff Punduh Pedada, Padang Cermin and Hanura and malaria control program staff of Health Office Pesawaran District. Other respondents were farm owners, community leaders and religious leaders in the area Punduh Pedada.

Sustainability analysis for management of mosquito breeding places was conducted by the management of Multi-Dimensional Scalling (MDS) approach. It is a method of computer based statistical analysis techniques using SPSS Software which performs transformations on each dimension and multidimensional sustainability management of malaria mosquito breeding places.

The analysis of sustainability was done through several stages. The stage of determining attribute of management places for sustainability of socio-culture dimension; the stage of determining attribute in ordinal scale based on sustainability criteria for each factor and ordination analysis based on MDS Method and the determination of indices and sustainability status.

Determination of attributes in all dimensions referred to an indicator of Rapid Appraisal Techniques for Fishery (RAPFISH) modified. Each attribute in each dimension is given a score that reflects the condition of sustainability of the dimension investigated; scores ranged 1-5, depending on the circumstances of each attribute which was defined ranging from bad to good. Bad value reflected the most unfavourable conditions for sustainability of management for mosquito breeding places; good value reflected the most favourable conditions.

Identification of the model based on vector control management which were divided into three categories; vector control for malaria through the management of mosquito breeding places by displaced abandoned fishponds by the owners (displaced a abandoned farm); chemical larvacide by health authorities; indoor and outdoor Insecticide Residual Spraying (IRS) by health authorities.

RESULTS

Sustainability of social dimensions: Based on the social dimension (Fig. 1) malaria vector control through chemical larvicides (criterion 2) have the highest sustainability index value and categorized as good while the malaria vector control through the management of neglected fishponds (criterion 1) and IRS indoor and outdoor (3 categories) include enough categories.

Sustainability of environmental dimension: Based on the dimensions of the environment (Fig. 2), malaria vector control through indoor and outdoor IRS (criterion 3) has the highest sustainability index value and categorized as good while the chemical larvicides (criterion 2) as enough and the management of abandoned farms have the lowest index value (criterion 3) and are included in the criterion of less sustainable.

Sustainability of economic dimension: Based on the economic dimension (Fig. 3), malaria vector control through indoor and outdoor IRS (criterion 3) has the highest sustainability index value and categorized as

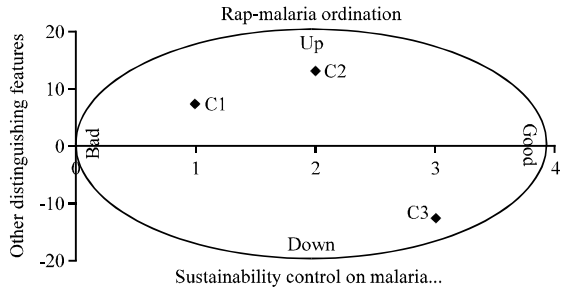

Fig. 1: Social dimention ordination; criterion 1: neglected fishponds management (C1); criterion 2: chemical larvicides (C2); criterion 3: indoor and outdoor IRS (C2)

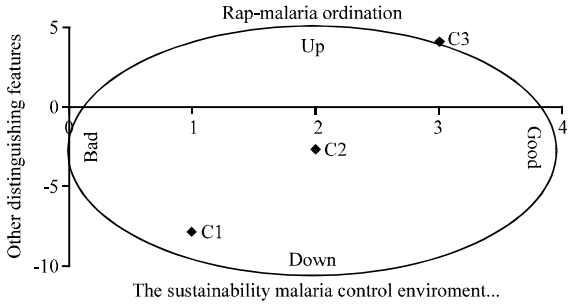

Fig. 2: Enviromental dimention ordination; criterion 1: neglected fishponds management (C1); criterion 2: chemical larvicides (C2); criterion 3: indoor and outdoor IRS (C3)

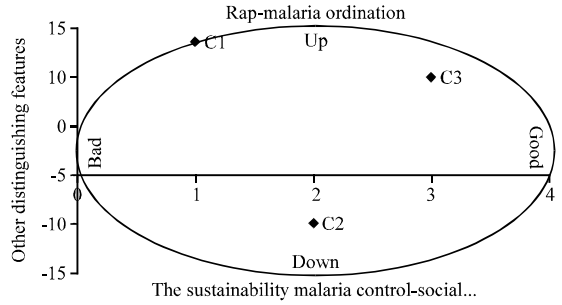

Fig. 3: Economic dimention ordination; criterion 1: neglected fishponds management (C1); criterion 2: chemical larvicides (C2); criterion 3: indoor and outdoor IRS (C3)

good while the chemical larvicides (criterion 2) have low index values sustainability and management of derelict fishponds (criterion 1) has a relatively low index.

The low status of fishponds management on the sustainability of the economic dimension indicates pessimism stakeholders in the management of negleted fishponds.

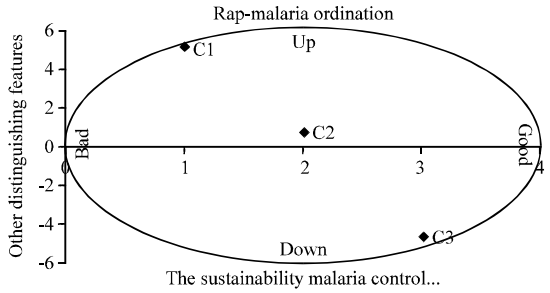

Fig. 4: Technological dimention ordination; criterion 1: neglected fishponds management (C1); criterion 2: chemical larvicides (C2); criterion 3: indoor and outdoor IRS (C3)

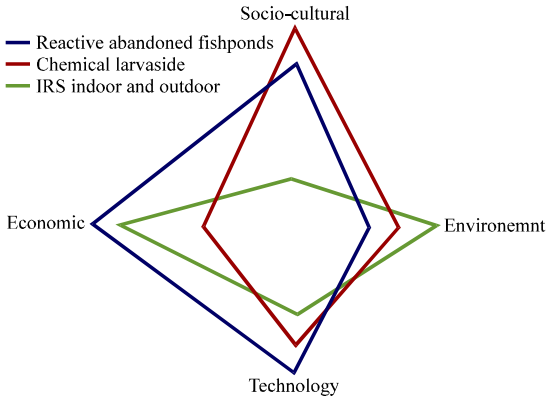

Fig. 5: Kite-diagram sustainability status of malaria vector control

Management of neglected ponds is a cross-cutting program involving various agencies. It also requires substantial funds. Because many of the parties involved and require large funds, the government's political will is crucial. Without the support and involvement of all the displaced, farm management activities would not be sustainable or arguably only temporary activities.

Sustainability of technological dimension: Based on the technological dimension (Fig. 4), malaria vector control through chemical larvicides (criterion 2) has the highest sustainability index score and categorized as good while the IRS indoor and outdoor (3 categories) and the management of abandoned ponds (criterion 1) categorized a enough.

Sustainability status of vector control program: Figure 5 shows that of the three models of malaria mosquito control are analyzed, the model turns control of abandoned farms have relatively large indexes on technological and economic dimensions while the

chemical larvicides have a relatively large index of socio-cultural dimensions and indoor and outdoor IRS has a large index relative to the environment dimensions.

DISCUSSION

Efforts to develop or modify Assesement Rapid Method for Fisheries (RAPFISH) in determining the sustainability status of vector control in Pesawaran District, Lampung Province has been able to get a four-dimensional description along with attributes corresponding to the conditions in malaria-endemic areas of coastal ecosystems. The fourth dimension is the dimension of socio-cultural, economic, environmental and technology. Determination carried out using the concept of sustainable development and integrated malaria vector control programs.

Blum explains that the medical model of health status is determined by the dynamic interaction between environmental determinants (physical, biological, socio-cultural), the determinant of behavior (attitude, lifestyle), hereditary determinant (population growth, population distribution, genetic) and the determinant health services (health care policy and health services (promotive, preventive, curative and rehabilitative). Determinants of the environment have a great influence on the health of individuals/communities.

Malaria is an infectious disease caused by the parasite Plasmodium. The disease is transmitted by the female Anopheles mosquito and the breeding highly dependent on local environmental factors, the proximity between the breeding sites of mosquitoes to humans and mosquitoes in the region (Shiff, 2002). Several environmental factors contribute significantly to the growth of mosquitoes as vectors of malaria is the physical environment, biology such as air temperature, humidity, light intensity, water flow, vegetation protection as well as predatory fish are all factors that affect the lives of mosquito larvae and spread, so that will affect the balance of the population of mosquitoes in nature.

According to Yassi *et al*. (2001), human health depends on the capacity of communities in managing the interaction between the human and environmental activities with physical, chemical and biological. These interactions should serve to protect and promote human health and at the same time continuing to protect the integrity of natural systems. If the interaction not balanced, there is a disturbance on human health. Various human activities in development such as abandoned pond, dam construction, tin mining and land clearing for agriculture and livestock caused environmental changes that cause man-made mosquito breeding places.

Malaria was affected by changes in the global environment (climate changeand also influenced by changes in the local environment. The increase in the earth's temperature will increase the number of vector borne disease and the occurrence of disease transmission. Climate change will have an impact long-term and short-term against malaria transmission. One of the effects of climate change is the potency to increase the incidence of various diseases transmitted by mosquitoes such as malaria, encephalitis due to West Nile Virus. Filariasis, Japanese encephalitis and Dengue.

In Indonesia, there are 90 species have been identified and 22 (some call it 16) of them have been confirmed as the mosquito-borne malaria. They have habitats ranging from swamps, fields, beaches, mountains and others. Species of Anopheles mosquitoes in Banyuwangi, East Java coast is *An. sundaicus*, *An. vagus*, *An. subpictus*, *An. flavirostris*, *An. barbirostris*, *An. annularis* and *An. indefinitus*. In coastal ecosystems in Nongsa, Batam City the type of malaria vector is *An. sundaicus*. Another coastal region of West Bangka Regency has mosquito species namely *An. Sundaicus* and *An. Letifer*.

Fishponds area is the direct conversion of mangrove forests. As we know, Mangrove be one place of care and place of spawning fish that become predators of Anopheles larvae. Mangroves are well developed will provide great functionality and advantages, both to support marine fishery resources and aquaculture as well as to protect the coast from erosion threat. Conversion of mangrove forests into farms cause a lot of harm ecologically and if the fishponds are not properly managed, the greater the loss of either a loss of ecological, economic and social. Susanna showed that the best alternative vector control which considers the principles of sustainable and can be applied in Pesawaran District is environmental management on breeding ponds neglected.

Environmental vectors are circumstances in which vectors can breed well including the physical environment, environmental chemistry, environmental biology and the social and cultural environment. Environmental factors have a major role in the play after the health of human behavior. Good environment will reduce the causes or vector-borne diseases. Therefore, in an effort to eradicate this disease malaria environmental factors must be addressed proportional.

Social and cultural environments and the local economy also affect the size of the contact between humans and vectors. Some of the causes of the appearance of neglected fishponds and become breeding places of Anopheles mosquitoes that land conflict, the

issue of the license fishponds, lack of education in society, low income communities, community participation is low. Malaria control programs in Sub-Saharan Africa with the environmental management program as the main program combined with other programs proven to be effective and efficient. Environmental management programs undertaken include cleaning and drying of the river swamp (Utzinger *et al*., 2001).

Important factor in malaria control are the views/perceptions of the community in an area against malaria. If malaria is considered as a requirement to be addressed, efforts to make healthy environment will be implemented by the community spontaneously. Control larvae of malaria vectors in Africa through environmental management wass to prevent the proliferation of larvae because it covers a wide area in the environmental management of the implementation requires community participation and cross-sectoral cooperation (Toure, 2001). But, Utzinger *et al*. (2001) suggested that in view of fewer adverse ecological effects, increased sustainability and better uses of local resources and knowledge, environmental management-integrated with pharmacological, insecticidal and bednet interventions-could substantially increase the chances of rolling back malaria. This idea might be implemented in the future area study in Pesawaran Lampung, Indonesia.

RAPFISH analysis methods can be used for the analysis of the sustainability status of vector-borne disease control program such as dengue fever and filariasis. The results of the study with RAPFISH Method can be used as a basis for formulating policies to control vector-borne disease selecting program recommendations which have dimensions of sustainability are high among alternative programs. RAPFISH modified used also in Sumbawa District to 'analysis the sustainability of mariculture management in Saleh Bay of Sumbawa District' (Marzuki *et al*., 2014) and 'to analyze the index and sustainability status of coral reef management in RMCA Bintan Timur.

CONCLUSION

Determining of the sustainability status of vector control in Pesawaran District, Lampung Province has been able to get a four-dimensional description along with attributes corresponding to the conditions in malaria-endemic areas of coastal ecosystems. The fourth dimension is the dimension of socio-cultural, economic, environmental and technology. The study indicated that according to experts, malaria vector control programs through better management of abandoned farms supported by economic and technological dimensions than the environmental and socio-cultural dimensions. Chemical larvicides program is supported by the socio-cultural dimension followed by a sequence of other dimension while the IRS program of indoor and outdoor is further supported by the environment and the economy than by socio-cultural and technological dimensions.

RECOMMENDATIONS

Research is necessary to study with the broader research area in coastal areas Pesawaran District to get an overview of potential farm land damage and potential vector breeding habitats.

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