



# Local Peoples' Appreciation on and Contribution to Conservation of Peatland Swamp Forests: Experience from Peninsular Malaysia

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**Abstract** Peatland swamp forests (PSF) deliver a range of beneficial, but often undervalued ecosystem services. In this paper we examined local peoples' appreciation on the values of PSF and their contribution to conservation. The study was carried out by interviewing 100 respondents living in adjacent to North Selangor PSF and holding three focus group discussions and a few key-informants' interviews following participatory rural appraisal and contingent valuation methods. Respondents appreciated PSF for direct values including timber, non-timber forest products, source of fish, and water for agriculture. They reported environmental values of PSF like flood prevention, biodiversity conservation, fresh air, soil fertility, perennial water source, and reduction of storm damages. They also reported several health and cultural benefits including sources of medicinal plants, fresh food, and agro-tourism. The monetary values of some benefits were estimated as USD 128/month/family (for fish), USD 128/month/family (agro-tourism) and USD 159,070/year (irrigation). Although direct benefits from PSF were minimal, respondents sincerely wanted to contribute to PSF conservation through

participation in community-based rehabilitation project, patrolling and fire protection, tree planting, cash donation, supplying seedlings, and joining in awareness creation programme. The intrinsic values and peoples' enthusiasm for PSF conservation suggest a community-based approach for sustainable PSF management.

**Keywords** Community participation · Direct and indirect benefits · North Selangor · Raja Musa Forest reserve · Willingness to contribute

## Introduction

Worldwide forests provide multiple benefits at local to global scales that include resources to satisfy human needs and life support functions, the global public good of carbon sequestration, biodiversity conservation, and local, regional and national level contributions to livelihoods for more than half a billion users (Chhatre and Agrawal 2009; Hayes and Persha 2010; Karky and Skutsch 2010; Newton et al. 2016; Cheng et al. 2017; Fritz-Vietta 2017; Murugan and Israel 2017). Recognition of the diverse socioeconomic and ecological contributions of forests has prompted many governments to pursue policies for improved livelihoods and conservation outcomes (Persha et al. 2011; Nath et al. 2016; Newton et al. 2016; Murugan and Israel 2017). The pristine PSF represents a unique wetland ecosystem of distinctive hydrology, which may be home to unique and rare habitats and species and globally significant stores of soil carbon (Posa et al. 2011; Page and Baird 2016; Evers et al. 2017). These forests provide essential ecological functions including biodiversity hot spots, flood mitigation, water storage, carbon sequestration and storage, river base flow control, and sediment removal (Ritzema et al. 2006; UNDP 2006; Miettinen and Liew 2010; Wetlands

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International 2010; Posa et al. 2011; Miettinen et al. 2012; Schrier-Uijl et al. 2013; Evers et al. 2017; Lampela et al. 2017; Uda et al. 2017).

In Malaysia, about 7% (24,577 km<sup>2</sup>) of its total land surface area is comprised of peat soil, of which 74% of the area occurs in western Malaysia (Sarwak and Sabah) and 26% is found in peninsular Malaysia (Wetlands International 2010). Only 20% of the peat soil areas in Malaysia are covered with PSF with a canopy cover of more than 70% (Wetlands International 2010). However, these forests are being destroyed through unsustainable logging practices, conversion to other land uses, and indiscriminate fires. In the 1980s the PSF coverage in peninsular Malaysia was halved from 0.67 Mha to 0.34 Mha in just a decade as forested land was cleared for agriculture (mainly palm oil), aquaculture, industry, and residential schemes (UNDP 2006). It is estimated that about 14% of the Malaysian palm oil plantations are established on peat land (Schrier-Uijl et al. 2013). The conversion of PSF to other uses causes deforestation, land subsidence, flash flooding, the loss of environmental services, carbon loss, and increase greenhouse gas emissions (Schrier-Uijl et al. 2013; Astiani et al. 2017; Lin et al. 2017). Peatland deforestation, drainage and conversion to agriculture drastically changes peatland ecosystems resulting in long-term, essentially irreversible changes in local environmental and hydrological conditions leading to tremendous changes in peatland functionality (Miettinen et al. 2016; Page and Baird 2016; Medrilzam et al. 2017). The destruction of tropical peatlands not only affects the environment it also has caused socio-economic problems, particularly for the communities living around and within the peatland areas, who relies on the ecosystem services and livelihoods provided by the PSF (Evers et al. 2017; Medrilzam et al. 2017; Uda et al. 2017). There is growing public concern regarding the harmful environmental and social impacts of large scale conversion of PSF into industrial plantations, mainly palm oil (Nagiah and Azmi 2012). There are serious concerns about the impacts of palm oil expansion on forest dependent communities and the social and ecological consequences of large scale conversion of peatlands (Schrier-Uijl et al. 2013).

Research on PSF in Malaysia mostly focuses on carbon emissions (Miettinen and Liew 2010; Posa et al. 2011; Page et al. 2011; Miettinen et al. 2012; Schrier-Uijl et al. 2013), biodiversity (Wetlands International 2010; Posa et al. 2011; Miettinen et al. 2012) and recently on policy and management issues (Evers et al. 2017). Even though forests provide many benefits to the local community, the value of PSF to the local people is still poorly understood. Peatlands deliver a range of beneficial, but often undervalued ecosystem services to people (Page and Baird 2016), and these services may explain or emphasize the social, cultural, and environmental values of non-human natural objects (Palmer 2003). Local people appreciate these values in two major ways: material (direct and

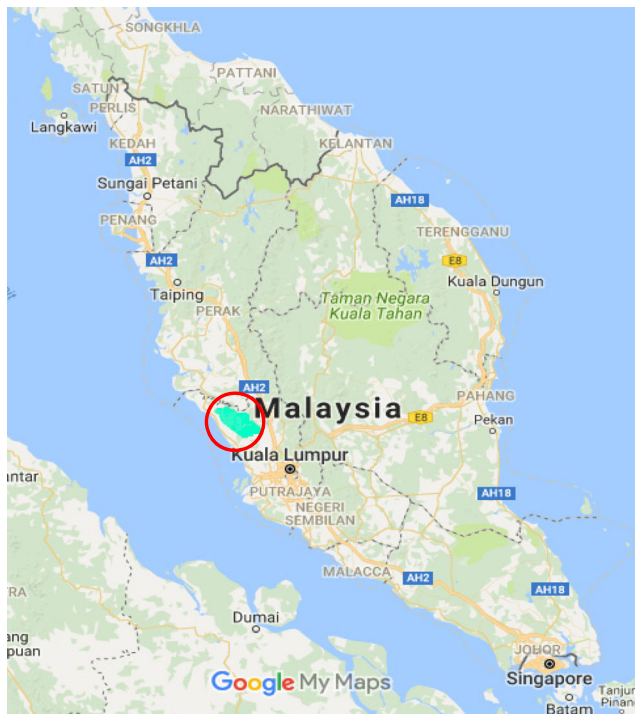
indirect use value) and nonmaterial (socio-cultural, ethical, spiritual, and aesthetic) (Paletto et al. 2013; Fritz-Vietta 2017; Uda et al. 2017). Peoples' appreciation on these values are becoming increasingly relevant as a central component of social and environmental sustainability because their knowledge, attitudes, needs, and support help the decision-makers in the management and preservation of forest resources (Macura et al. 2011; Paletto et al. 2013; Bakhtiari et al. 2014). When individuals obtain benefits from forest resources reciprocally they contribute to the conservation and protection of these resources (Schelhas and Pfeffer 2009; Macura et al. 2011; Nath et al. 2016; Galvani et al. 2016). The value that individuals place on such resources impacts how they perceive PSF and the actions they take to manage and preserve these resources.

The aim of this study was to understand local peoples' appreciation on the values of PSF in their lives, their understanding of the causes of PSF degradation, and their willingness to contribute (WTC) to the conservation and protection of PSF. By WTC we meant local peoples' intention to participate in PSF rehabilitation projects and other kinds of contributions towards PSF conservation and protection. We were not able to find any research related to these questions, especially on these aspects of PSF. It was anticipated that the findings would help policy makers to understand the importance of PSF in the lives of local communities and so take necessary steps for the conservation of PSF in collaboration with local communities.

## Methods

### Study Areas

The study was conducted in four villages inhabiting surrounding the Raja Musa Forest Reserve (RMFR), Kuala (North) Selangor, Malaysia (Fig. 1). Each village accommodates 120–200 families and most of the villagers are engaged with agricultural activities, notably paddy cultivation, growing vegetables, and palm oil plantations. The RMFR is one of four forest reserves of North Selangor PSF (NSPSF) covering an area of about 35,656 ha (Selangor State Forestry Department 2014). The NSPSF is located on a flat coastal plain in the northern part of the State of Selangor. The land uses adjoining the forest reserve are the *Tanjong Karang* Irrigation Scheme, large-scale palm oil plantation, and small palm oil holders (less than 5 ha), and sand and clay mining (Selangor State Forestry Department 2014). The RMFR was subject to intensive logging since 1950s before its gazettelement in 1990 as a forest reserve (GEC 2013). Intensive logging followed by draining through abandoned canals, encroachment of logged-over land, and unsustainable agricultural practices have caused serious forest degradation. In 2008, the Selangor State Forestry Department (SSFD) along with other



**Fig. 1** Map of west Malaysia showing the location of the RMFR (light blue area within the red circle) in North Selangor. Source: [https://www.google.com/maps/d/viewer?mid=1q00-cGznu\\_Dy56FLuEMGL0XuxME&hl=en\\_US&ll=3.567992100203127%2C101.24711400000001&z=11](https://www.google.com/maps/d/viewer?mid=1q00-cGznu_Dy56FLuEMGL0XuxME&hl=en_US&ll=3.567992100203127%2C101.24711400000001&z=11)

state agencies recovered about 1000 ha of degraded PSF, evicted 304 encroachers, and initiated a rehabilitation programme in partnership with the Global Environment Centre (GEC), a non-government organization and local community group (GEC 2013). Since then they have been replanting the degraded RMFR sites with suitable native tree species.

### Data, Instrument, and Procedure

The local peoples' appreciation or valuation of natural resources involves their perceptions on the values of PSF. These values can be identified through qualitative and quantitative analysis (Paletto et al. 2013; Bakhtiari et al. 2014). The qualitative techniques of semi-structured interviews, focus group discussions, and key-informant interviews have been used to improve the awareness of respondents' perceptions, understanding, attitudes, and categorization of environmental goods when they are answering questionnaires (Paolisso 2002; Fischer and Young 2007; Schelhas and Pfeffer 2009). We adopted both qualitative and quantitative methods for this study.

Data were collected through a participatory rural appraisal method by administering a pre-tested semi-structured questionnaire and holding two group discussions with villagers. We also conducted key-informants' interviews with GEC staff members and carried out another group discussion with the

members of Friends of North Selangor PSF (FNPSF). We randomly selected and interviewed 100 households in four villages located in around the PSF. We collected data on respondents' basic information including gender, age, education, household income and distance from the PSF, direct benefits or products obtained from the PSF, environmental, health, and cultural benefits, merits and demerits of PSF conversion, actors responsible for the conversion of PSF, and their opinion on conservation or prevention of PSF conversion.

Following the principle of contingent valuation method (CVM) (Mitchell and Carson 1989) we explored the local peoples' WTC to the conservation of PSF. The CVM is a standardized and widely used method for determining peoples' willingness to pay (WTP) for conservation by asking them how much they would be willing to pay to acquire improvement or to avoid negative aspect in them (Mitchell and Carson 1989). However, this methodology has limitations. It only asks for monetary contribution or value for conservation. The respondents may understate or overstate the value for conservation as they are not familiar with market price of the ecosystem services to be valued (Lee and Hatcher 2000; Kamri 2013; Makarius et al. 2017). It is also possible for respondents placing high WTP to exaggerate the value in the hope of expecting changes in management policy (Kamri 2013). We assumed that local people would respond well when asked about their WTC rather than WTP. Respondents might have several options to answer when asking WTC rather than only money in case of WTP. Local communities who are generally economically underprivileged may not respond well to the questions when asking their WTP in monetary term rather asking their WTC for conservation. There are several ways through (e.g., patrolling, planting, etc.), which local communities can contribute to resource conservation. During the pre-testing of semi-structured questionnaire, we asked a few villagers about their WTP for PSF conservation and protection. They felt uncomfortable to answer the question. Then we decided to adopt WTC instead of WTP. We found that some researchers (e.g., Lankiaa et al. 2014; Yogo 2014) used WTC narrowly (only asked for WTC labor) along with WTP in the management of recreational facility and environmental goods.

In group discussions, 6–8 village elders, including the manager of agro-tourism homestay at Sungai Sireh participated. The group discussions were facilitated with a checklist consisting of questions including the importance of PSF, activities of agro-tourism homestay, reasons for PSF conversion, and their interest to participate in PSF conservation. To assess peoples' participation and the effectiveness of a peatland rehabilitation project a separate group discussion was held with six members of the FNPSF and GEC staff members. Participation was conceptualized and assessed as a process of communicating and working together with different stakeholders to achieve common goals (Isager et al. 2002) where

the GEC played a role as mediator between the SSFD and local communities. The effectiveness or achievements of peatland rehabilitation project was assessed in terms of creation of awareness among stakeholders (local communities, corporate agencies, school students), formation of FNPSF, regular tree planting programme, survival rate of planted seedlings, and control of forest fire. In the group discussion we discussed the background of the rehabilitation project, involvement of local people in the restoration and forest conservation activities, and achievements so far. We also asked questions such as knowledge of project activities, benefits of projects, and villagers' involvement on rehabilitation project activities during the household survey. To assess the survival rate and height growth of the planted seedlings 20 plots (10 m × 10 m) were laid out at several planting sites. The number of seedlings was counted and their height was measured with a meter tape.

The survey questionnaire and the check-lists were first developed in English and then translated into Bahasa Melayu because the villagers were more comfortable with their local language. The field procedure data were then transcribed into English. Ethical approval for the participants' survey was obtained from the research ethics committee, Faculty of Science, University of Nottingham Malaysia Campus. Participants were anonymous, remained unidentified, and verbal consent was obtained to participate in the survey. Research in the permanent forest reserve in Malaysia requires written permission and the same was taken from the Forestry Department before conducting the study.

The collected data were compiled and the frequencies and percentages were calculated. A Chi-square test was conducted to find out the association between respondents' attributes and their responses on indirect values, conversion of PSF and WTC. However, no significant differences were found. The findings are presented and interpreted qualitatively with some quantitative inferences.

## Results and Discussion

In this section we provide a brief description of the respondents' profile followed by the values of PSF to the local people, their WTC towards PSF conservation, and peoples' participation in the restoration of PSF in RMFR.

### Respondents' Profile

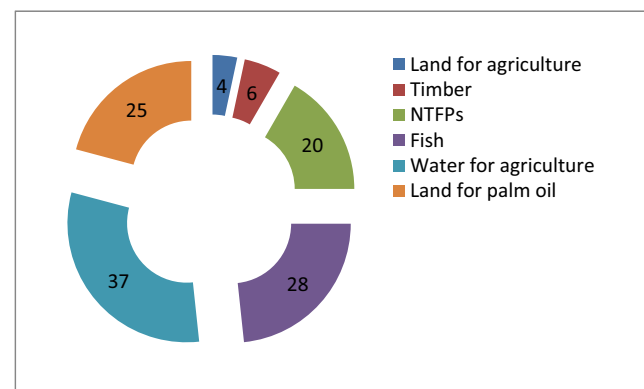
Both male (69%) and female (31%) respondents took part in the interviews and their mean age was 37.5 years, indicating that they were mature enough to understand the survey questions and to respond accordingly. Most (63%) obtained secondary education and the majority (37%) were farmers. About

67% of the respondents lived within 1–2 km of the PSF, which revealed that these people had a close connection with the PSF. The respondents' mean monthly household income level range was USD 349 to USD 581 [1US\$ = RM4.30 as of July 2015], mainly from agriculture, business, and service.

### Values of PSF to Local People

Like other types of forests, the PSF also have great importance to the local people. Even though the villagers were not heavily dependent on PSF for their living, they reported obtaining several products from these forests. They valued PSF for both direct and indirect benefits. The direct benefits they reported included timber (6% respondents), non-timber forest products (NTFPs) such as medicinal plants, wild vegetables, leaves for craft making and tender shoots (20%), water for agriculture (32%), and a source of fresh water fish (28%) (Fig. 2). Respondents' appreciation on these values echo the observation of Ninan and Inoue (2013) who reported that forests help protect watersheds and provide hydrological services, such as supplying water for domestic and industrial consumption, irrigation, and power generation. In Indonesian peatland, Uda et al. (2017) identified seven values including timber production, palm oil production, biomass production for pulp, paddy production, carbon sequestration, biodiversity habitat, and ecotourism. Respondents commented that they get fresh water fish from the canals and use the water for paddy field irrigation year round. Based on their responses we estimated that each respondent caught about 46 kg of various fish species every month, mostly for their own consumption and they estimated a market price (USD 128) of that catch.

Villagers reported that year round irrigation in the Raja Musa area produces about 40% of Selangor state's rice, yielding approximately 10–11 tons per season (5 seasons every 2 years) whereas the average Malaysian rice yield is 5–6 tons per year. They also commented that the peat water brings



**Fig. 2** Respondents' opinion on the direct values of the PSF. Data labels indicate the percentage of respondents

nutrient rich leachate from the PSF and hence they use less fertiliser. It was reported that peat soil is composed almost entirely of organic matter having considerable amounts of nutrients that are available for leaching (Heathwaite 1990 cited in van Beek et al. 2007; Laiho and Pearson 2016). The farmers said that they do not pay for irrigation for cultivating about 18,000 ha of farm land in these areas. Toriman and Mokhtar (2012) reported an average irrigation cost of USD 8.80/ha/yr. in Malaysia, and as such, the monetary value of irrigation water supplied from the RMFR was about USD 159,070 per year.

In group discussions the participants reported that the PSF is an important source of income for some of the villagers who collect Palas (*Daun palas*) leaves from the forests to make handicraft and wrapping for traditional food (i.e., Kutupat and Nasi Lemak). They also use the tender shoots of Tenggek Burung (*Euodia redlevi*) as a salad in their meals.

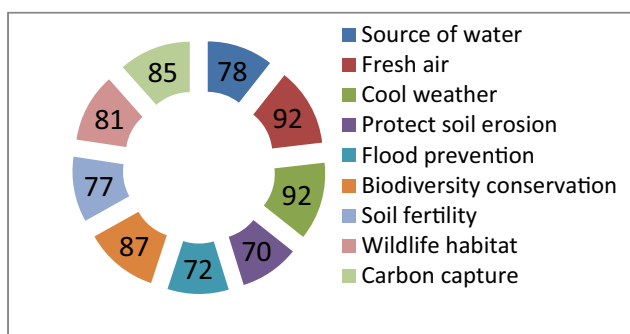
Apart from the direct benefits, the respondents reported the indirect or environmental values of the PSF. More than 80% of the respondents reported environmental values of PSF that included flood prevention, biodiversity conservation, fresh air, soil fertility, perennial water source, and reduced storm damages (Fig. 3). They said the PSF is not only a source of water, but it also acts as water reservoir to protect villages from flooding. They commented that the PSF looks like a sponge that holds water and reduces the incidence of flash flooding during the rainy season. The PSF also provide suitable habitat for wildlife. Yule (2010) reported that peat swamps affect the hydrology of the surrounding ecosystems due to their large water storage capacity, which slows the passage of floodwaters in the wet seasons and maintains stream base flow during the dry season. The respondents also reported several health and cultural benefits including pure environment (92%), place for relaxation (76%), and agro-tourism (84%). Ninan and Inoue (2013) reported that the recreational benefits provided by forests are considerable and the consumer surpluses obtained by visitors from forest-related recreational activities such as viewing wildlife, enjoying scenic beauty, and nature walks were significant. It was found

that majority of the respondents belonged to 18–30 years old having secondary education and living in 1–2 km away from the PSF reported higher responses for both environmental (data not shown in Table 1), and health and cultural values (Table 1a). However, their responses were not significantly different from other groups.

The manager of homestay agro-tourism commented that in response to a government initiative in the mid-1990s to promote and increase tourism in Malaysia, a cooperative (Koperasi Homestay Sungai Sireh Tanjung Karang Berhad) launched agro-tourism homestay at Sungai Sireh village. The aim was to provide tourists with the opportunity to experience rural Malaysian life in a *kampung* (traditional village) and in turn preserve the local cultural heritage and improve the local economy. Currently this agro-tourism homestay has been expanded to four villages involving 60 households who have a clean separate unit consisting of 3–4 rooms along with their house. Each house usually consists of 2–3 units where one unit is exclusively assigned for tourists and family members of the owner use other unit(s). The owner does not stay in the separate unit allocated for tourists. These units meet a set of regulations able to maintain required facilities recommended by the department of fire, police, and board of tourism. These owners are required to go through training once every three months and renew their agro-tourism homestay license every two years. The tourists stay with welcoming families in the designated homestay units where they can experience the Malaysian culture and food and have activities ranging from agricultural site visitations to recreation activities such as kayaking, boating, fishing, and local cultural events. The programme has been managed jointly by the Koperasi Homestay Sungai Sireh Tanjung Karang Berhad, Syafeez Maju Enterprise, and De Seri Niaga

Enterprise, both of which were formed by the villagers themselves. Thousands of tourists, both domestic and foreign visit and use the facilities every year (Table 2).

The 60 households were clustered into four groups and each group of 15 families received tourists the first week of every month. The four groups were created to distribute a relatively equal number of tourists to each family weekly. For example, the first group received tourists in the first week of a month, the second group in the second week of the month and so on. In next month the second group received tourists in the first week and so on. This distribution of tourists is usually done by the Koperasi Homestay Sungai Sireh Tanjung Karang Berhad. Each participating family received 45% of the total revenue earned. Each family had a monthly net income of USD 116–139 from this agro-tourism homestay. On top of the extra income they received from agro-tourism, some households started selling food such as homemade sweets and snacks (e.g., chips) to the tourists who preferred taking a food item as a souvenir. During high tourist season, all of the villages were brightened with festivities and weddings to



**Fig. 3** Respondents' opinion on the various environmental benefits of the PSF. Data labels indicate the percentage of respondents

**Table 1** Variation of responses (percentage) on health and cultural values, demerits of PSF conversion, and WTC in respect to the selected attributes of respondents

## a. Variation of responses on health and cultural values of PSF

Respondents' attribute	Pure environment	Place for relaxation	Agro-tourism
Age (years)			
18–30	83	75	75
30–45	17	17	17
> 45	-	8	8
Education			
Secondary	42	42	42
Diploma	17	8	17
Graduate	33	33	33
Post graduate	8	17	8
House to PSF distance (km)			
1–2	58	58	58
2–4	42	42	42
> 4	-	-	-

## b. Variation of responses on demerits of PSF conversion

Respondents' attribute	Deforestation	Biodiversity loss	Flooding	Loss of wildlife habitat	Reduce income	Water scarcity	Loss of NTFPs
Age (years)							
18–30	75	75	75	75	58	75	58
30–45	8	8	8	8	8	8	8
> 45	17	17	17	17	33	17	33
Education							
Secondary	42	42	33	50	42	42	42
Diploma	17	8	17	25	17	17	8
Graduate	33	17	42	17	25	33	17
Post graduate	8	33	8	8	8	8	8
House to PSF distance (km)							
1–2	75	68	68	68	50	68	50
2–4	17	33	33	33	33	33	33
> 4	8	8	8	8	17	8	8

## c. Variation of responses on WTC

Respondents' attribute	Join in CBFM	Patrolling and fire protection	Tree planting	Cash donation	Supplying seedlings	Awareness creation
Age (years)						
18–30	67	75	75	33	42	67
30–45	17	17	17	17	17	17
> 45	17	8	8	17	17	17
Education						
Secondary	42	50	42	42	42	42
Diploma	33	25	17	17	17	33
Graduate	17	17	25	-	-	25
Post graduate	8	8	8	8	17	-
House to PSF distance (km)						
1–2	50	50	58	33	33	58
2–4	33	42	33	33	33	33
> 4	17	8	8	-	8	8

**Table 2** Tourist arrival at Sungai Sireh agro-tourism homestay in the last five years (Source: Sungai Sireh Agro-Tourism Homestay Office, 2016)

Year	Tourist arrival		
	Domestic	Foreign	Total
2011	8467	541	9008
2012	6234	397	6631
2013	4784	709	5493
2014	5785	761	6546
2015	8075	924	8999
5-year total	33,345	3332	36,677

showcase their unique culture to visitors. The nearby police station provides regular patrols of the villages and so there were no incidences of crime. Villagers commented that because of the presence of PSF they could establish agro-tourism as a destination in their locality, invite tourists to their villages, and generate a stream of income. The respondents also reported that students from various academic institutions visit the PSF for education and research purposes and they feel proud of being a part of these novel activities. However, villagers were concerned with the fluctuation of tourist arrivals and so they commented that further government support would be necessary to ensure sustainable tourist flow in their homestay.

### Conversion of PSF

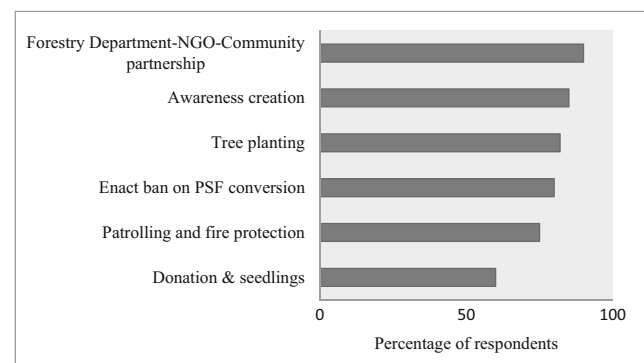
With PSF degradation in mind we asked the respondents about the merits and demerits of forest conversion and those responsible for degradation. Even though they mentioned that the demerits of PSF conversion such as deforestation (90%), biodiversity loss (90%), flooding (88%), destruction of wildlife habitat (85%), reduction of income sources (58%), water scarcity (86%), and non-availability of non-timber forest products (72%), they also claimed that PSF conversion provided them with a parcel of land for agriculture (50%), housing (24%), and palm oil (60%). Among the respondents who were 18–30 years old, mostly had secondary education, and living in 1–2 km away from the PSF reported higher responses for the demerits of PSF conversion (Table 1b). However, their responses were not significantly different. Similar findings were also reported by researchers in Malaysia, Indonesia, and elsewhere (Medrilzam et al. 2017; Miettinen et al. 2016; Uda et al. 2017). The respondents felt that the government agencies and large and small-scale palm oil companies were equally responsible for PSF degradation. They also mentioned

that the villagers themselves cleared the PSF for growing rice, vegetable, fruits, palm oil, and house building. It was reported that all of the regional PSF are threatened either legally or illegally with logging, drainage, agricultural conversion (mostly to palm oil and rice), fire, fragmentation of habitats, and reclamation for residential centres and industries (Miettinen and Liew 2010; Yule 2010).

### PSF Conservation and Willingness to Contribute

The respondents proposed that the government should enact a ban (80%) on PSF conversion for palm oil plantations, rice cultivation, housing development, and horticulture practices (Fig. 4). They emphasized on building community based forestry management in collaboration with non-government organisations (90%) for PSF management. Further, respondents stressed creating awareness among the communities on the importance of PSF conservation through education. They sincerely wanted to contribute to PSF conservation through participation in community-based management (74%), patrolling and fire protection (75%), tree planting (82%), donation in cash and supplying seedlings (60%), and joining in the awareness creation programme (85%). During group discussions, the villagers also commented that they would like to contribute to the PSF conservation fund if the GEC and the SSFD initiated such a fund. These responses however, were not significantly different for selected attributes of the respondents (Table 1c).

The application of WTC approach to explore peoples' preferences on involvement in forest conservation had encouraged them to voice their choices. Based on this study the application of WTC was found useful for generating a number of preferences towards forest conservation compared to asking people for payment under the concept of WTP. Lankiaa et al. (2014) and Yogo (2014) applied this WTC approach in the

**Fig. 4** Respondents' opinion and willingness to contribute to PSF conservation

management of recreational quality and environmental goods. However, they only considered the WTC for labor. This study identified at least six preferences where local people were WTC for the conservation and protection of the PSF. For local communities, monetary contribution for forest conservation is always not possible because majority of them are usually economically disadvantaged. Moreover, they also claim that forests are natural resources, and so they do not want to pay money for their conservation. As they obtain both direct and indirect benefits from forests, they rather prefer to take part in forest protection activities (e.g., patrolling, fire prevention), planting programme, awareness creation, and in the forest management team. These contributions are generally voluntary. In general forest conservation consists of a number of activities where local communities can involve through participatory management instead of paying (hypothetical) money for forest conservation by using WTP approach.

### PSF Rehabilitation Project and Participation of Local People

In order to sustain essential environmental services researchers urged (e.g., Miettinen et al. 2017) considering a range of measures including actively protecting, and rehabilitating all remaining PSF in SE Asian regions. As such, the PSF rehabilitation project in the RMFR was a worthy initiative to protect, and restore the degraded forests. It was a pioneer project on community-based PSF management approach that was being implemented in the NSPSF. Since 2008 the GEC, in collaboration with the SSFD and local communities, has been implementing this project. The main activities include monthly tree planting, forest patrolling, fire monitoring and prevention, awareness creation among villagers, community development through a small scale nursery (small to medium scale business), and agro-tourism promotion. The GEC in collaboration with the SSFD initiated an innovative way of reforestation through inviting corporate agencies, academic institutions, NGOs, and other concerned stakeholders to participate in a monthly tree planting programme. It circulates its invitation through a social media platform (Facebook), and interested agencies confirm their participation by online registration. Participation is on a first-come first serve basis and 100 participants can register in an event for planting 400–600 native tree seedlings in one hectare of degraded PSF land. Lampela et al. (2017) suggested that to reforest degraded PSF ecosystems, the main focus should be on the native species. The planting cost, including seedlings and land preparation is usually arranged through sponsors such as international funders, and local corporate agencies. The GEC staff members reported that replanting started in 2008, and by 2014 about 310 ha of degraded area was replanted with native species.

However, in 2011 when the planted seedlings in compartment<sup>1</sup> 99 were 5–6 m tall, a 250 ha area was burned by fire.

In a few planting sites established in 2012 through 2014 we found a survival rate of 85% with a spacing of 3 × 5 m and a mean height of the seedlings to be 1.6 m. The staff members of the GEC commented that they usually performed replanting if seedlings died. Currently the programme has an 80%<sup>+</sup> survival rate for the seedlings. The planted species were mahang (*Macaranga pruinosa*) and tenggek burung (*Euodia redlevi*) and these plants are the common pioneer species usually planted in degraded peatland areas. They also planted meranti tembaga (*Shorea leprosula*), mersawa paya (*Anisoptera marginata*), merbau (*Intsia palembanica*), and ramin (*Gonystylus* sp.).

In compartment 73, the SSFD and the GEC jointly established a “Centre of Excellence for PSF” where they only managed the watershed to maintain the water level in peatland by blocking the canals to raise the water level, facilitating natural regeneration along with reforestation. Hydrological restoration (water table) is urgently needed to take care of the degraded PSF in order to rehabilitate the ecological functions of these peatland forests, and to support their sustainability (Astiani et al. 2017). Local people actively participated in canal blocking activities. It was observed that these areas were regenerating naturally with diversified tree species, and the streams and surrounding forest areas were full of water. Some of the regenerating species include mahang, tenggek burung, meranti tembaga, ramin, mengkirai (*Trema orientalis*), terentang (*Camposperma coriaceum*), bekak (*Aglaia rubiginosa*), kelat paya (*Syzygium cerinum*), and mengkuang (*Pandanus odoratissimus*).

In 2011 the GEC in collaboration with the SSFD established a community based organization called “FNPSF” with 40 members, 10 from each of the four villages. Currently there are 90 members. The organisation was registered with the Registry of Societies (ROS) in 2012 so that it could work without any legal barriers. In Malaysia, a NGO or a social organisation or a club is required to register with the ROS in order to be legitimate, obtain grants, and own assets. The main purpose of the FNPSF was to create awareness among villagers about the importance of PSF. It collaborates with the SSFD and the GEC, works on reforestation, fire control, and daily forest patrolling. Villagers and the GEC staff members reported that since the creation of the FNPSF, awareness creation and continuous motivation was probably responsible for no fire in 2015. Further, they formed four patrol teams consisting of four members in each team, in four villages. They patrol daily their respective fire-prone areas to point out any fire incidence. The FNPSF in collaboration with the GEC established the Junior Peatland Forest Ranger

<sup>1</sup> A compartment is the smallest forest management unit (e.g., land area) with recognizable boundary, usually homogeneous in size and species composition. The RMFR has 101 forest compartments (Selangor State Forestry Department 2014)



Programme to create awareness among school students about the importance of PSF, and their protection. Initiated in 2014, this programme has been extended to 12 primary schools in North Selangor. It introduced environmental knowledge in the school programme, involved students in various outreach events (e.g., planting event), and created awareness for the responsibility, and the role of local youth for environmental protection and conservation for the future generations.

The FNPSF also works on community development. With the rehabilitation project four farmers were trained on tree nursery raising and with that knowledge they established nurseries at their homesteads. They collect wildings (naturally growing seedlings) from palm oil plantations and raised them in polybags on their own homesteads. These saplings were then used for the monthly planting programme and they reported to have an annual income of USD 6977 by selling these saplings.

Discussions at group meetings reveal that local peoples' participation in rehabilitation project was found ad-hoc basis aiming mainly at rehabilitation of the degraded RMFR. They had no real participation on programme decision making. They were unsure how long the project would continue, and the GEC and the SSFD would require their participation. They urged to incorporate their participation as an institutional requirement of the SSFD for sustainable management of the RMFR.

## Conclusions and Implications

Findings show that the villagers have benefited directly (resources support), and indirectly (services) because of the PSF. Even though the direct benefits including timber, medicinal plants, and fish are not so great, the indirect benefits include source of water, flash flood mitigation, biodiversity, and environmental protection are of great importance to the local people. The villagers are mostly dependent on the PSF's water for their agricultural practices and domestic use. They are well aware of the possible negative impacts of PSF conversion on their lives, and have been collaborating with the GEC and the SSFD for the conservation, and rehabilitation of degraded PSF. Researchers (e.g., Macura et al. 2011; Paletto et al. 2013; Abram et al. 2014) suggested that understanding peoples' perceptions of the services provided by natural systems can provide insight into the interplay of the linkages between humans and their environment, which in turn can contribute towards identifying ways to reduce future impacts on society from environmental change. Sustenance of the inter-linkages of society and environment, participation of the local community in environmental management efforts seems essential. Community participation is today an essential element of sustainable natural resource management (Isager et al. 2002; Macura et al. 2011; Galvani et al. 2016; Nath et al. 2016; Newton et al. 2016).

The intrinsic values and peoples' enthusiasm for the PSF conservation in the study area suggests a community-based

approach for sustainable PSF management is effective. The involvement of local community in the rehabilitation of the degraded RMRF is a successful pioneer initiative in Malaysia. The local community, without any significant economic incentives, has been profoundly engaged in forest conservation and protection. Researchers (e.g., Prospere et al. 2016) reported that participatory management, through the establishment of local forestry management committees, has been successful in swamp forest conservation initiatives in a number of African countries. The commitment of the GEC and the SSFD towards successful collaboration, creation of awareness about the importance of PSF, and motivation and formation of social capital between the local community and external agencies facilitated the effective community participation in the programme. Community based management enhances social capital, which in turn facilitates sustainable management of natural resources (Nath et al. 2016; Orchard et al. 2015; Chinangwa et al. 2016). The formation of the FNPSF was a milestone for capacity building of the community for creating environmental awareness among the younger generation. Apart from organising important environmental events, this organisation initiated several income generating activities including homestead nursery, agro-tourism, and handicraft enterprise in the locality that encouraged local people to participate in environmental conservation.

The societal and environmental values of the PSF warrant that these forests should be conserved for the welfare of society and the environment, and that the participation of the local community in the conservation, and rehabilitation of resources is crucial. This kind of collaboration among community people, NGOs, and state agencies can be promoted in the management of the country's natural resources where the relationships between community and natural environment are interconnected. This is particularly important for natural resources policy makers to understand the importance of the PSF to local communities, and benefits of community based natural resource management. However, it is essential to institutionalize, and incorporate community engagement efforts and collaborations into the national forest conservation policies.

Findings of this study have potential implications in the management of PSF in other parts of Malaysia and elsewhere in the world where local communities are inhabited in and around the PSF or other types of wetlands. Engagement of local communities would create ownership, which empower them to take part effectively in the management of PSF. However, a conducive enabling environment, having proper institutional arrangement, good governance, and provision of incentives, will be required considering the local realities in order to ensure effective participation of local communities. If these happened, then it may lend the hope that the PSF can be managed, and local communities will be benefited sustainably.

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