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Identification of water conservative tree species with high economic value around "Sendang Kalimah Toyyibah"

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Abstract

Spring conservation require serious concern on the economic advantages for the society. Without economic advantages achieved from the conservation activities, the conservation programme should face intense conflict of land utilization. Plantation of economically valuable conservative plant species is one of the proposed solution to overcome the problem. This research aimed to identify the economic value of conservative plant species found in "Sendang Kalimah Toyyibah" surrounding. Research was conducted through field observation involving 4 line transects and 4 square transects at each line with transect size of 20 m x 20 m. Plant identification was conducted for tree strata. Data analysis was including diversity, evenness and importance index of respective plants. Economic valuation was conducted through literature study. The result showed there were 28 plants species availabile in "Sendang Kalimah Toyyibah" surrounding. Among the plant species 22 of the had been identified to provide conservative function, while 6 of them weren't including Banana, Papaya, Melinjo, Pangi, Longan and Stink Bean. Instead of providing conservative function, most plants also provide economic advantages including wood, fruit, flower, bud, leaf, fibre, sugar, peel and bean products while only 3 of them were not identified including Banyan, Manila Tamarind and Amboyna Wood. Plantation of economically valuable conservative plant species is recommended to support the conservation of the spring as well as to provide economic advantage for the society.

Keywords: conservation, economic, plant, "Sendang Kalimah Toyyibah", spring

INTRODUCTION

Water is an important resource for every living creature. The demand of water increases time after time, hence the utilization of water resources should be managed sustainably (Huang et al., 2015). City and urban development had increased the demand of water significantly as well as the agriculture activities (Howe, 2005). Schaible and Aillery (2012) stated that the utilization of water is mostly for agriculture, which accounts for 80 – 90% of total water consumption.

Spring is a unique eosysem. Orendt (2000) mentioned that each spring has unique condition both for biotic and abiotic structures. Spring system is sensitive to changes in landsacpe funcions, such as land use and groundwater levels. According to Chamola and Solanki (2014), the discharge and quality of spring is completely dependent on the aquifer of spring hosts. Hence, the physical and biological structure of spring should be maintained to avoid sudden change of its system. Conservation is needed to maintain the condition of spring ecosystem to avoid the impacts. Conservation of water resources has become major consideration in natural resources management. Water is core resource for any living creature. Hence, water has very important roles in the sustainability of the ecosystem.

In several countries, water pricing is applied to manage the utilization of water for certain purposes such as agriculture, industries and residences (Howe, 2005). Liu et al. (2013) noted there were 3 paradigms should be understood in water conservation, including water use, water use efficieny and water pollution. Water conservation should consider the economic development and ecosystem preservation as well as restoration of degraded ecosystems.

Conservation of spring ecosystem is not only purposed to maintain the sustainability of spring and its water discharge quality and quantity. According to Parwita et al. (2015), conservation plan cound be conducted to achieve economic goal such as for tourism interest. Sustainable resources would support the sustainability of the economic as well. Hence, the conservation could support the livelihood of surrounding society. Further impact of economic development as the part of conservation purposes is it could avert land conversion for other utilization.

Conservation of spring require understanding on its related ecosystem. Upland forest is still claimed as the most appropriate ecosystem to maintain the sustainability of groundwater (Sallata, 2015). According to Ridwan and Pamungkas (2015), spring conservation is related to composition of vegetations around the spring. The availability of spring conservative vegetation would help to maintain the sustainability of the spring. Certain types of vegetation help the infiltration of surface water to the ground as well as protecting the soil from being eroded.

There are various vegetations in spring ecosystem. Each plant species has certain implication on the ecosystem inluding to the water nor soil. For example, according to Ridwan and Pamungkas (2015), *Ficus* sp has the capbility of water conservation since its deep rooting and large canopy systems. While Daswir (2010) also mentioned that even herb plants have implications on water and soil conservation, such as Citronella grass which could hinder soil erosion and maintain the soil nutrient concentration.

“Sendang Kalimah Toyyibah” is one of springs in Semarang Region. The utilization of the spring water is quiet intense. The utilization of “Sendang Kalimah Toyyibah” spring is mostly for tourism purpose. Development of “Sendang Kalimah Toyyibah” surrounding had been conducted to facilitate the visitors which lead to land conversion in the downstream area. While in the upstream (catchment) area, land conversion had also occured for several utilization such as agriculture. Change of land use followed by high tourism visits would alter the risk of spring degradation. Hence, conservation programme should be applied in the management of “Sendang Kalimah Toyyibah” spring.

Conservation of spring could be conducted through physical and biological development. Biologicaly, conservation could be conducted through plantation of conservative vegetations. But, sometimes the application of conservation through plantation alters another problems concerning the economic impact. The impication is the low participation of local society. Hence, plantation of water conservative plant species with economic value could be applied to change public perception that conservation can also provide economic advantages.

Even though some conservative plant species can provide economic advantages, but there is no appropriate information to the public. In order to improve the conservation activities especially in populated springs, plantation of economic valued plant species should be emphasized. Further research is needed to identify the availability and particular economic advantages provided by plant species in the spring surrounding. This research aimed to study the availability and abundance of plants species, to identify the availability of water conservative plants species and to study the economic value of water conservative plants species in “Sendang Kalimah Toyyibah” surrounding.

MATERIAL AND METHODS

Research was conducted through field observation in “Sendang Kalimah Toyyibah” spring. The observation was limited to 200 m radius as spring buffer area. Transects were occupied for sampling purpose, including 4 line transects and 4 square transects at each line. Square transects occupied in this research including size of 20 m x 20 m. Line transects were set according to the flow direction of river available in spring surrounding.

Data collection including the species identification, plant abundance, identification of conservative value and identification of economic value of the plants. Observation data was analyzed descriptively to identify the economic value of conservative plant observed in the research area. Data was processes to analyze the diversity index and evenness index of plant species. Analysis of diveristy, evenness and importance index of tree species is calculated as:

Diversity Index

$$H' = -\sum Pi \ln Pi$$

Notations:

H' = diversity index

P_i = ni / N

n_i = abundance of plant species - i

N = total abundance of plant species

Evenness Index

$$e = \frac{H'}{\log S}$$

Notations:

e = evenness index

H' = diversity index

S = Number of species

Importance Value Index

INP = RA + RD + RF

Notation:

IV = Importance Value Index

RA = relative abundance

RD = relative dominance

RF = relative frequency

RESULTS AND DISCUSSION

According to the observation result, there were 28 tree species were identified in "Sendang Kalimah Toyibah" surrounding. Plant abundance varied among species as well as its importance value. Detailed information of observed plant species in "Sendang Kalimah Toyyibah" surrounding is presented in Table 1

Table 1. Observed plant species, abundance, basal area, frequency and importance value in "Sendang Kalimah Toyyibah" surrounding (stands/1600 m^2)

No.	Scientific Name	Local Name	Abundance	Basal Area	Freq.	IV
1	*Swietenia macrophylla*	Mahoni	33	8.693,14	11	28,97%
2	*Albizzia falcataria*	Sengon	29	6.343,07	12	26,70%
3	*Coffea robusta*	Kopi	20	3.731,36	11	19,23%
4	*Cocos nucifera*	Kelapa	18	6.292,32	7	17,98%
5	*Garcinia mangostana*	Manggis	16	9.907,86	11	23,47%
6	*Musa spp*	Pisang	16	2.275,04	9	14,86%
7	*Durio zibethinus*	Durian	12	7.878,83	6	16,41%
8	*Hibiscus tiliaceus*	Waru	11	1.488,14	7	10,73%
9	*Leucaena glauca*	Lamtoro	10	1.497,57	3	7,47%
10	*Tectona grandis*	Jati	10	4.014,21	4	10,56%
11	*Gigantochloa atraviolacea*	Bambu wulung	9	17.563,26	3	22,18%
12	*Syzygium aromaticum*	Cengkeh	8	1.340,43	4	7,26%
13	*Persea americana*	Alpukat	8	2.733,50	4	8,57%
14	*Artocarpus heterophylla*	Nangka	7	2.000,43	5	8,21%
15	*Carica papaya*	Pepaya	6	1.358,50	5	7,22%
16	*Ceiba pentandra*	Randu	6	4.084,93	6	10,50%
17	*Gnetum gnemon*	Mlinjo	6	3.862,57	5	9,57%
18	*Arenga pinnata*	Aren	5	4.271,93	5	9,56%
19	*Pangium edule*	Kluwek	5	7.021,14	4	11,43%
20	*Dimocarpus logan*	Klengkeng	4	3.752,57	2	6,53%
21	*Parkia speciosa*	Petai	3	368,50	3	3,68%
22	*Ficus benjamina*	Beringin	2	4.331,64	2	6,29%
23	*Mangifera odorata*	Mangga kweni	2	460,43	2	2,65%
24	*Melia azedarach*	Mindi	2	279,71	2	2,48%
25	*Lansium domesticum*	Duku	2	330,79	2	2,53%
26	*Acantocephalus cadamba*	Jabon	2	267,14	2	2,47%

No.	Scientific Name	Local Name	Abundance	Basal Area	Freq.	IV
27	*Pitechelobium dulce*	Asam	1	95,07	1	1,20%
28	*Pterocarpus indicus*	Angsana	1	176,79	1	1,28%
	H'		***1,299***	***Medium***		***300,00%***
	e		***0,390***	***Low***		

Observation result showed there were 28 tree species found in "Sendang Kalimah Toyyibah" surrounding. Among the observed species, Mahogany (*S. macrophylla*) was the most abundant species, while Albizzia (*A. falcataria*) was observed to be the most distributed tree. Observation on the ground coverage of observed trees was addressed to Bamboo (*G. atraviolacea*) to have ground cover dominance. Analysis on the diversity index showed medium value while the evenness was at low value. It showed that there was dominance of plant abundance. Analysis on the importanve value index showed Mahogany (*S. macrophylla*) to have highest importance value followed b Albizzia (*A. falcataria*). Analysis of importance value showed there was no significant dominance certain plant species. The distribution of importance value was quite balanced among low, medium and high value groups.

To maintain the sustainability of "Sendang Kalimah Toyyibah" spring, there must be water conservative plant species in its surrounding. Abundant water conservative plant species would maintain water quality and quantity for the springs. Such role of plant for spring conservation including infiltration, filtration, absorption and holding capacity should be provided by existing plants. Instead of conservative role, several plants also indicated to have economic value. Hence, conservation can also provide economic advantages for the society. Literature study was conducted to identify the conservative roles of plants in "Sendang Kalimah Toyyibah" surrounding as well as its evonomic value. Identified conservative roles and economic values of respective observed plants is presented in Table 2.

Table 2. Conservative values and economic values of plant species observed in "Sendang Kalimah Toyyibah" surrounding

No.	Scientific Name	Common Name	Local Name	Conservative Method				Economic Value		
				Infilt.	Filt.	Absorb.	Hold/Stor.	Wood	Fruit	Other
1	*S. macrophylla*	Mahogany	Mahoni	+	-	+	-	+	-	Coal
2	*A. falcataria*	Albizzia	Sengon	+	+	-	-	+	-	-
3	*C. robusta*	Coffee	Kopi	-	+	-	-	-	+	Peel
4	*C. nucifera*	Coconut	Kelapa	-	-	-	+	+	+	Sugar
5	*G. mangostana*	Mangosteen	Manggis	-	-	-	+	-	+	Peel
6	*Musa spp*[(a)]	Banana	Pisang	-	-	-	-	-	+	Leaf
7	*D. zibethinus*	Durian	Durian	+	-	-	-	-	+	Peel, Bean
8	*H. tiliaceus*	Sea Hibiscus	Waru	-	+	-	+	+	-	Coal
9	*L. glauca*	Ipil-ipil	Lamtoro	+	-	-	-	-	+	Coal
10	*T. grandis*	Teak	Jati	-	-	-	+	+	-	Leaf
11	*G. atraviolacea*	Brown Bamboo	Bambu wulung	+	+	-	+	+	-	Shoot
12	*S. aromaticum*	Clove	Cengkeh	-	+	-	+	-	-	Bud, Leaf
13	*P. americana*	Avocado	Alpukat	-	+	-	+	-	+	Seed, Trunk
14	*A. heterophylla*	Jackfruit	Nangka	-	-	+	-	+	+	Seed
15	*C. papaya*[(a)]	Papaya	Pepaya	-	-	-	-	-	+	Trunk, Leaf, Latex
16	*C. pentandra*	Kapok Tree	Randu	-	-	-	+	+	+	Seed
17	*G. gnemon*[(a)]	Melinjo	Mlinjo	-	-	-	-	-	+	Leaf, Peel, Bark

No.	Scientific Name	Common Name	Local Name	Conservative Method				Economic Value		
				Infilt.	Filt.	Absorb.	Hold/Stor.	Wood	Fruit	Other
18	*A. pinnata*	Sugar Palm	Aren	-	-	+	-	+	+	Sugar, Leaf, Trunk, Fibre
19	*P. edule*[(a)]	Pangi	Kluwek	-	-	-	-	+	+	Leaf
20	*D. longan*[(a)]	Longan	Klengkeng	-	-	-	-	-	+	-
21	*P. speciosa*[(a)]	Stink Bean	Petai	-	-	-	-	-	+	-
22	*F. benjamina*[(b)]	Banyan	Beringin	-	+	-	+	-	-	-
23	*M. odorata*	Mango	Mangga kweni	-	-	+	-	-	+	-
24	*M. azedarach*	Chinaberry	Mindi	+	-	-	+	+	+	-
25	*L. domesticum*	Langsat	Duku	-	+	-	-	-	+	-
26	*A. cadamba*	Kadam	Jabon	-	+	-	-	+	-	-
27	*P. dulce*[(b)]	Manila Tamarind	Asam Londo	-	+	-	-	-	-	-
28	*P. indicus*[(b)]	Amboyna Wood	Angsana	-	+	-	+	-	-	-

Notation: Infilt. = infiltration function; filt. = filtration function; absorb. = absorption function; hold = holding function; wood = economic value froom timber crops; fruit = economic value from fruit crops; other = other economic values (mentioned); (+) = available function / value; (-) = non available function / value; (a) = unidentified conservatin roles; (b) = unidentified economic value

Table 2 showed there were variations of conservative roles of respective plant species observed in "Sendang Kalimah Toyyibah" surrounding. The conservative roles including infiltration, filtration, absorption and holding capcity were all fulfilled by the plants. While economic value including timber production, fruit crops and some other product such as sugar, leaf and flower crops for commercial purpose were also identified. Conservative roles and economic value of respective plant species observed is discussed.

The most abundant plant species found in "Sendang Kalimah Toyyibah" surrounding was Mahogany (*S. macrophylla*) which also had highest importance value. Mahogany has role in water conservation. According to Istomo et al. (2011), Mahogany roots provide soil porosity which favors the infiltratin of water. Mahogany also plays role in groundwater absorption lead by its high stomatal evaporation rate (Sarawa et al., 2014). Economic value of Mahogany including timber as the main product. According to Tukawa et al. (2013), Mahogany wood has high economic value for its hardness and stripes. Instead of for timber source, Mahogany by product can also be utilized for coal production (Pujiarti and Sutapa, 2005). Hence, instead of its ecological function in water filtration, mahogany also has economic adantages. Plantation of Mahogany is recommended for conservation along with economic purposes.

Conservation role of Albizzia tree (*A. falcataria*) are inlcuding infiltration and filtration of water to the ground. According to Yulistyarini and Sofiah (2011), Albizzia is capable to increase soil macroporosity which enhance the potential of water infiltration. While its role on water filtration is explained by Wiegner et al. (2013) which showed that Albizzia is capable to ncrease the availability of dissolved N, decreasing the concentration of organic N, organic carbon and increase the chlorophyll concentration beneath the tree stands. Economic advantages of Albizzia tree is for timber production (Kusumedi and Jariyah, 2010). While according to Parlinah et al. (2015), Albizzia is mostly planted by individual households for future use. Albizzia is usually cropped at the age of 9 years or more.

Conservative value of Coffee (*C. robusta*) is for water filtration. Coffee tree is capable to control the erosion rate and increase surface run off (Subagyono et al., 2003). Instead of its conservative value, Coffee is much planted for rehabilitation purposes in water catchment area as an enrichment because of its economic value (Tjakrawarsa and Handoko, 2013). Economic value of Coffee includes fruit (bean) production. Coffee has high economic advantages since the global market demand increase (Hariyati, 2014). Coffee's by product including bean peel also provide additional economic advantage. According to Pambayun et al. (2013), coffee peel can be utilized to produce active carbon coal.

Coconut (*C. nucifera*) has been utilized in water conservation since its capability as water holder (Lusiana et al., 2008). According to Kumar (2006), Coconut is mostly utililzed in agriculture nor aquaculture. Its capability of water holding is appropriate to support other plants needs of water. Evonomic advantages of Coconut is quite a lot. The main product of Coconut tree is the fruit (Patty, 2011). The fruit is mostly used for food, especially for young fruits. But, old fruit is mostly utilized as raw material for coconut oil. Instead of its fruit, coconut by product also provide additional economic advatages, such as its fibre or usualle called as cocofibre (Indahyani, 2011) and its shell for active carbon coal (Pambayun et al., 2013). Johanes et al. (2015) also mentioned that Coconut ree also utilized to produce coconut sugar which is extracted from its flower buds.

Mangosteen (*G. mangostana*) has good water holding capability. Aprisal (2012) noted that Mangosteen has appropriate canopy and deep rooting which capable to decrease the soil erosivity. Tjakrawarsa and Handoko (2013) mentioned that Mangosteen is much utilized to refine water catchment area. Mangosteen is much found in river basins which indicates its relation to water abundance. Mangosteen has a lot of economic values, mainly for the fruit and additionally its peel. According to Narakusuma et al. (2013), Mangosteen is utilized for powder, juice, cocktail, syrup and peel extrat. While according to Suryadi (2013), Mangosteen peel contain antioxidant compound which is utilized as cosmetics material.

Banana (*Musa* spp.) is an agricultural plants which is mostly planted for commercial purposes. Banana does not support conservation of soil nor water. According to Oluwafemi et al. (2012), Banana alter soil erosion and has high water uptake. Hence, it has low conservative value. Eventhough, it is commercially important comodity and provide has economic value. The economic value of Banana is mainly from its fruit. Prahardini et al. (2010) stated that there are a lot of Banana species found in Indonesia. Banana is processes to many products such as Banana powder and Banana chips.

Conservative role of Durian (*D. zibethinus*) is for water infiltration. Gonzal (2007) stated that Durian has deep rooting system which support its role on water infiltration. While Schroth et al. (2004) stated that Durian tree canopy system is capable to break and infiltrate the rainwater. Durian is much found in the catchment area and river basins (Tjakrawarsa and Handoko, 2013). Instead of its conservative value, Durian has economic value as well (Wijayanto, 2011). According to Haryanti (2014) economic value of Durian is achieved from its fruit. Durian is one of high economic valued fruit. Economic advantage of Durian is mainly achieved from its fruit (Arifin, 2013). According to Prasetyaningrum (2010), instead of its fruit, Durian bean and peel also has economic values. Durian bean can be processed to flour, while its peel can be extracted as dye.

Conservative roles including water filtration and holding are provied by Sea Hibiscus (*H. tiliaceus*). Sea Hibiscus has firm fibrous roots which shows its capability on water filtration and holding (Khasanah et al., 2010). The capability of Sea Hibiscus on water holding is showed by its main habitat which is coastal area, which means that it can hold freshwater to survive (Saraswati et al., 2010). While the filtration capability of Sea Hibiscus is showed by Adnan (2012) including its utilization to refine ex mining area. Economic value of Sea Hibiscus is its timber. According to Suwandhi (2007), Sea Hibiscus wood has quite high economic value. While Cahyono et al. (2008) stated that instead of timber, Sea Hibiscus also provide economic value from coal.

Conservative role of Ipil-ipil (*L. glauca*) including water infiltration. According to Subagyono et al. (2004)), Ipil-ipil is utlized for dry land plantation to enhance infiltration capability of soil. Its capability also includes soil maintenance by providing medium level cover wich hinder soil erosion. The role of Ipil-ipil in water infiltration is defined by its capability to increase soil porosity which enhance drainage pores (Subagyono et al., 2003). Economic advantage of Ipil-ipil is achieved from fruit (bean) crops and coal of its wood. Suryanto and Prasetyawati (2014) stated that Ipil-ipil fruit is utilized as vegetable. While Soelaiman (2013) mentioned that Ipil-ipil coal can be found in such traditional market in Indonesia.

Teak (*T. grandis*) plays important role in maintaining groundwater availability. Maridi et al. (2014) stated that Teak has wide root system which capable of holding huge amount of water. Generally, in dry season Teak sheds its leaves to reduce evapotranspiration rate nearly to none, hence groundwater will not be absorbed / consumed. Economic value of Teak is mainly for the timber. According to Kusumedi and Nawir (2010), Teak is favourite plant species for traditional people for its high economic value of the timber. Tea is planted since it has high hardess level.

Bamboo is well known as water conservative plants. According to Yulistyarini and Sofiah (2011), Bamboo can increase water infiltration to the ground. Bamboo forest is much found in water catchment area and proved to have highest infiltration rate compared to any other trees. Raka et al. (2011) stated that Bamboo can infiltrate to 90% of rainwater and hold it. While Vigiak et al. (2007) stated that instead of its capability to infiltrate water, Bamboo also has a god fltration capability provided by its rooting system. Economic value of Bamboo is achieved from its timber and shoots. Bamboo is much utilized as construction material of building (Hartanti, 2010). Ancient people used to use Bamboo as the main material of house building instead of woods. Instead of its wood, Bamboo shoots is utilized as food material.

Conservative roles of Clove (*S. aromaticum*) are including water filtration and holding. The fltration role of Clove is suggested by Alam et al. (2009) which proved its capability in decreasing the concentration of dissolved Zn and Ni. While Siarudin et al. (2014) stated that Clove plantation along with Coffee and Chocolate could improve the water holding capacity. Clove is mostly utilized for industrial purpose. Economic values of Clove are achieved from its leaves and buds. According to Nuryoto et al. (2011), Clove leaves has been utilized for essential oil extraction which has quite expensive value. While its bud (flower) had been utilized for cigarette production (Towaha, 2012).

A research conducted by Asiagwu et al. (2012-2013) showed Avocado (*P. americana*) capability as biofiltration. According to the research, Avocado is able to remove dye pollutant from waste water. According to Atucha et al. (2013), Avocado also has water holding function. Available water holding capacity of Avocado increases as its growth. The capability of water holding capacity is affected by decreasing soil porosity of Avocado planted land. Avocado is a fruit tree which economic value is mainly achieved from fruit crops (Wahyudi, 2008). But, additional economic advantage was mentioned by Prasetyowati et al. (2010) concerning the extraction of fuel oil from Avocado seed, while Marnoto et al. (2012) also mentioned the potential of Avocado trunk to be utilzed as dye.

Jackfruit (*A. heterophylla*) had been reported to have deep roots which capable of absorbing groundwater to the surface (Sofiah and Fiqa, 2010). It supports the spring surface water availability as the source of spring water. There are a lot of economic value of Jackfruit. According to Qomari and Suhartiningsih (2013), economic value of Jackfruit is mainly achieved from its fruit, but its bean also has potential economic value as flour. The utilization of Jackfruit bean flour had been tested by Wulandari et al. (2014) as the main ingrendient of dodol. While Surono (2015) showed the utilization of Jackfruit wood for furniture creations.

There is no particular report conserning the role of Papaya (*C. papaya*) on water conservation. According to Hamzah and Hamzah (2010), all plant parts of Papaya has economic value, such as trunk, leaves and fruits which contain latex for papain industries. Eventhough, plantation of Papaya in the spring catchment area is not recommended. According to Campostrini and Glenn (2007), Papaya consume a lot of water to maintain its growth. Hence, it can not be used to maintain the sustainability of spring.

Kapok (*C. pentandra*) is expected to have water saving capability. According to Einzmann et al. (2014), Kapok has the mechanism to shed its leaves in dry season. This mechanism purposed to maintain groundwater availability. Kapok has various economic advantages from wood, fruit and its seed. According to Hakim et al. (2009), Kapok tree is planted by local society in many regions in Indonesia. The main product of Kapok tree is kapok fibre (Suhadiyah et al., 2015). Additional economic value of Kapok was showed by Yuniwati (2012) including the utilization of Kapok seed as fuel oil.

Particular role of Melinjo (*G. gnemon*) on groundwater and spring conservation is not reported. But according to Biye (2013), Melinjo has been reported to be found in most tropical rainforest which shows its relation to water availability. There are a lot of advantages of Melinjo. Economic values of Melinjo are achieved from bean, young leaves and peel which can be used as vegetables, while the bark can be used as net (Suena et al., 2010).

Sugar Palm (*A. pinnata*) is known to have deep rooting which is suggested as the source of water (Kali et al., 2015). Groundwater absorption mechanism provided by Sugar Palm provide surface water availability of springs. According to Rompas et al. (2012), Sugar Palm was found to be dominance species in the upstream area of Tondano Watershed. Sugar Palm has a lot of utilization. According to Rachman (2009), Sugar Palm products including sugar from its flower, fruit, leaves, trunk for flour production and fibres for traditional roof, broom, etc.

Specific function of Pangi (*P. edule*) on water conservation is not well reported. Eventhough its availability in spring surrounding had been reported in some research such as Ridwan and Pamungkas (2015); Gunawan and Subiandono (2013). Economic values of Pangi including for vegetable (leaf), cooking ingrendient and preservative (fuit) and construction material (wood) (Arini, 2012).

There is no particular report on the rules of Longan (*D. longan*) on groundwater conservation. But according to Adman (2012), Longan is much utilized for ex mines plantation for soil recovery. Economic advantage of Longan is achieved from its fruit. According to Mardhani (2013), Longan produce fruit which can be consumed and has economic value.

There is no report on the water conservative role of Stink Bean (*P. speciosa*).

According to Marsudi (2011), Stink Bean is used as vegetable. Eventhough the specific role of Stink Bean is not understood, Wibawa et al. (2010) recommend its plantation on the upper watershed.

Banyan (*F. benjamina*) is well known to provide water biofiltration. Yeo and Tan (2011) stated that Banyan tree is resistant to heavy metal pollution and capable of absorbing certain heavy metal. Banyan is also capable on holding groundwater. Kali et al. (2015) explained that the complex rooting system of Banyan physiologically provide conservative roles on soil and groundwater. The holding capacity provided by Banyan is supported by its rooting as well (Retnowati, 2014). There is no record on the utilization of Banyan for economic purpose. But, the availability of Banyan is often related to the existence of water source

The conservative role of Mango (*Magnifera* sp.) includes water absorption. According to Kali et al. (2015), Mango has deep rooting which capable of absorb groundwater for maintain surface water availability. The water absorption is an important factors for spring as groundwater discharge mechanism. The economic value of Mango is achieved from its fruit (Novia et al., 2015).

Several research showed that Chinaberry (*M. azedarach*) has the capability on water infiltration and holding. The research conducted by Xiangrong et al. (2012) showed that plantation of Chinaberry along with Neem (*Azadirachta indica*) significantly affect soil porosity, groundwater holding capacity and infiltration capacity. While Maitre et al. (2000) stated that groundwater consumption by Chinaberry is quite low. Chinaberry has several economic values achieved from its wood and fruit. According to Karyono and Hariyatno (2001), Chinaberry wood has high economic value for its features and shor period harvesting. While Viruly (2014) showed that Chinaberry fruit contain medicinal componds which can be used in pharmacheutical purposes.

Conservative role of Langsat (*L. domesticum*) includes water filtration. A research conducted by Wahyuni et al. (2014) showed that Langsat is capable of absorbing certain heavy metal solution effectively. Eventhough Langsat is capable of filtrating water, but it is not recommended for water conservation since its requirement of water (Wong et al., 2007). According to Gonzal (2007), Langsat is utilized for fruit production and medicine.

Kadam (*A. cadamba*) is indicated as biofilter for polluted water. According to Pandey et al. (2014), Kadam is capable to absorb flouride and accumulate it within leaves. Hence, Kadam is capable to decrease the risk of environment pollution. Kadam is also tolerant to environmental stress such as dust load (Squires, 2016). Economic value of Kadam is for timber production. Dutt and Tyagi (2011) mentioned that Kadam wood is used for pulp and paper making.

Manila Tamarind (*P. dulce*) is identified as recommended species for reforesration and rehabilitation of wasteland. It showed its rule in soil remediation through biofiltration (Giri and Dhanalakshmi, 2015). Manila Tamarind plays important role in nitrogen fixation which improve soil fertility. A research conducted by Zhang et al. (2014) showed that Manila Tamarind is capable to absorb heavy metal solutions as its biofilration capability. Instead of its conservative rule, Manila Tamarind also produce fruit (Ellwanger and Gould, 2011). Eventhough the fruit is consumable, there is no information of commercial purpose of Manila Tamarind plantation reported.

Conservative role of Amboyna Wood (*P. indicus*) includes filtration. According to Evelyne and Ravisankar (2014), Amboyna Wood is able to remediate heavy metal from the soil. Istead of filtration, Amboyna Wood also roles for water holding. Amboyna Wood has small root which shows low groundwater uptake indicated by high soil moisture (Saifuddin and Osman, 2012). There is no report concerning the utilization of Amboyna Wood for economic purposes.

CONCLUTIONS

"Sendang Kalimah Toyyibah" surrounding consisted 28 plant species. Most of the plants species provide conservation function for the spring inluding infiltration, fitration absorption and water holding capacity. There were 6 plants species with unidentified roles on spring conservation including Banana, Papaya, Melinjo, Pangi, Longan and Stink Bean. Most of the conservative plants species also identified to provide economic value such including products as timber, fruit, leaf, coal, flower, bud, fibre, sugar, peel, bean, etc. Among all the identified conservative plant species, only 3 plants species which economic value weren't identified including Banyan, Manila Tamarind and Amboyna Wood. Plantation of economic valued plant species is recommended to provide conservative function as well as economic advantages for the societies

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