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Systematic Review on Urban Ecosystem Services in South-East Asia: Asean Countries

Przegląd usług pełnionych przez ekosystemy miejskie w Azji Południowo-Wschodniej

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Abstract
Urban ecosystem services refer to all the benefits of nature especially to the urban community and economy for maintaining human well-being. This concept links to the economic, community and environmental aspects and shows how nature conservation is important for human and economic principles. However, the view of urban ecosystem services assessment based on essential categories with current urban development is provided. So, this paper reviews the aim to analyze the types and assessing the categories of urban ecosystem services and the methodological used in ASEAN countries. Furthermore, understanding studies about urban ecosystem services are important in long-term studies for monitoring purpose. As a result, 8 out of 10 ASEAN countries excluding Laos and Brunei have studied urban ecosystem services. In this context, the result also shows the most studies specify the significance of the ecosystem services given by the urban as regulating (waste absorption, climate regulation, water purification, flood regulation, and disease control) and followed by cultural (tranquility, social relations, and recreation). Thus, exploring urban ecosystem interaction in current ASEAN countries may have added benefits in terms of improving the urban ecosystem services to streamline the urban area planning. Finally, we conclude that all the ASEAN countries should play an important role to make sure the countries maintain sustainable and more livable with the right policies and guidelines like can fit in Paris Agreement especially in Climate Strategies and plans.

Key words: urban ecology, urbanization, Paris Agreement, sustainable development; environmental management

Streszczenie
Usługi ekosystemów miejskich odnoszą się do wszystkich korzyści płynących z natury, zwłaszcza dla społeczności miejskiej i gospodarki, wspomagając utrzymanie ludzkiego dobrostanu. Ta koncepcja łączy się z aspektami ekonomicznymi, społecznymi i środowiskowymi oraz pokazuje, jak ważna jest ochrona przyrody dla ludzi i ekonomii. Dokonano oceny usług ekosystemów miejskich w oparciu o podstawowe kategorie przy obecnym rozwoju miast. Dokonano przeglądu celów analizy rodzajów i oceny kategorii usług ekosystemów miejskich oraz metodologii stosowanych w krajach ASEAN. Należy podkreślić, że zrozumienie badań dotyczących usług ekosystemów miejskich jest ważne w długoterminowej perspektywie, do celów monitorowania. Okazuje się, że 8 na 10 krajów ASEAN, z wyjątkiem Laosu i Brunei, zbadało usługi ekosystemów miejskich. Większość badań określa znaczenie usług ekosystemowych świadczonych przez miasto jako regulujących (pochłanianie odpadów, regulacja klimatu, oczyszczanie wody, regulacja przeciwpowodziowa i kontrola chorób), a następnie kulturowych (spokój, relacje społeczne i rekreacja). W związku z tym badanie interakcji ekosystemów miejskich w obecnych krajach ASEAN może przynieść dodatkowe korzyści w postaci poprawy usług ekosystemów miejskich w celu usprawnienia planowania obszarów miejskich. Wszystkie kraje ASEAN powinny odgrywać ważną rolę w zapewnieniu, że kraje te wspierają zrównoważony rozwój i będą bardziej przyjazne do życia dzięki odpowiednim politykom i wytycznym, takim jak mogą zmieścić się w Porozumieniu Paryskim, zwłaszcza w strategiach i planach klimatycznych.

Słowa kluczowe: ekologia miejska, urbanizacja, Porozumienie Paryskie, zrównoważony rozwój, zarządzanie środowiskiem

1. Introduction

The Millennium Ecosystem Assessment (MEA) (2005) defines ecosystem services as the benefits people obtain from the ecosystem and its surroundings. Ecosystem services are the goods given to humans throughout the conversions of environments such as water and vegetation into a flow of necessary services and goods such as food and clean air (Constanza et al., 1997). Urban ecosystems indicate an area with constructed infrastructure that deals with a substantial percentage of land area (surface) including green and blue spaces e.g., parks, urban allotments, urban forests, wetlands, and ponds (Gomez-Baggethun et al., 2013). In other words, urban ecosystem services can be defined as all-natural areas in the city including green and blue space. From a point of view, urban ecosystem services that are either directly produced by ecological structures within urban areas or peri-urban regions (McGranahan et al., 2005; Gutman, 2007; Jansson, 2013). For example, Singapore as an important country for urban ecosystem services study was experiencing rapid urban development and a 100% urban population (Friess, 2016).

The ecosystem service concept can be adapted to urban ecosystems because the services are for various inhabitants which were important and needed (Tratalos et al., 2007; Ahern J., 2007). In this case, urban planning and activities often associated with the development potential of ecosystem services. Furthermore, urban ecosystem services were also interconnected with biodiversity aspects in an area. In this context, if the ecosystem has been declined in quality, for example, loss of biodiversity, then the ecosystem services will also decrease. This is because an urban ecosystem will be worthless if it were unable to provide any basic benefits and humans needs. Schewenius et al. (2014) argue that the elements of a sustainable city require a consolidate social-ecological approach in policymaking, city governance, management, and planning. They introduced the Urban Ecosystem Services (URBES), Biodiversity Project and the Scientific Foundation of Biodiversity Outlook (CBO) that contribute as a new social-ecological to urban durability and the practice and research of ecosystem services. To incorporate ecosystem services and biodiversity in urban design, development and governance appliance, these projects were functional as tools in the context of planners and decision-makers.

Elmqvist et al. (2015) conducted a study related with urban ecosystem services and found that the ecological investment in urban areas, including the ecosystem's preservation and conservation such as urban forests and urban rivers, not only affected in ecology but lead to social impact as well as the impact on modern and traditional economies. Investing in recovery, care and empowerment of urban ES and green infrastructure gave an ecological and social desire, besides in the form of economic diversity. The findings were also useful in land-use matters in urban areas as well as it provided many benefit in urban landscape management, architects, legislators and also in the private sector. Therefore, the urban ecosystem services are very important for each country, especially in South-East Asia (ASEAN) to ensure the cities are habitable, livable and sustainable for current and future generations.

ASEAN is the most suitable region to study habitable, livable and sustainability of the ecosystem. Investopedia (2017) defined ASEAN or The Association of Southeast Asian nations as an organization with 10 countries that inspired the development of economic, cultural and political in the province. Furthermore, ASEAN was formed in 1967 to stop the spreading of communism ideology and to calm the tensions between its members and formally it comprises 10 countries including Singapore, Brunei Darussalam, Malaysia, Indonesia, Cambodia, Vietnam, Myanmar, Philippines, Laos, and Thailand (Heather 2006). Hence, recent studies propose that exploring the cultural priority and perceptions toward UES can be practical to recognize many pertinent services to the people

Therefore, the United Nations (UN) has developed the Sustainable Development Goals (SDGs) to carry immediate action to battle climate change and its effect while verifying that nobody left behind (UN, 2015b). Hence, it is important to learn the united response of UES to human interests and activities, besides the relationship between environmental and development to achieve the targets and goals. European Union (2015) stated that to bear more aspiring and more competent in biodiversity conservation policies, the concept of development should be done immediately by the conservationists. From another point of view, we still need to be emphasized and informed to all the goals and targets of urban ecosystem services in the ASEAN region especially with the world policies and agreement. For example, The Paris Agreement (December 2015) aims to take action about climate change under the United Nations Framework Convention on Climate Change (UNFCCC) specify that parties will follow efforts to control temperature rise (1.5°C) by pre-industrial extent by 2050 (Scarano, 2017). Therefore, the agreement is suitable to use for the ASEAN Countries and enables the countries to keep sustainable especially with climate strategies and plans.

Several scientific studies identify, classify and provide knowledge on the evaluation of UES that relevant and importance to the countries such as ASEAN e.g., Yen, et al., 2017; Vollmer et al., 2016; Challcharoenwattana and Pharino, 2016; Clark and Nicholas, 2013; But, the number of studies in evaluating the ASEAN perspectives on specific urban ecosystem services were still in small numbers.

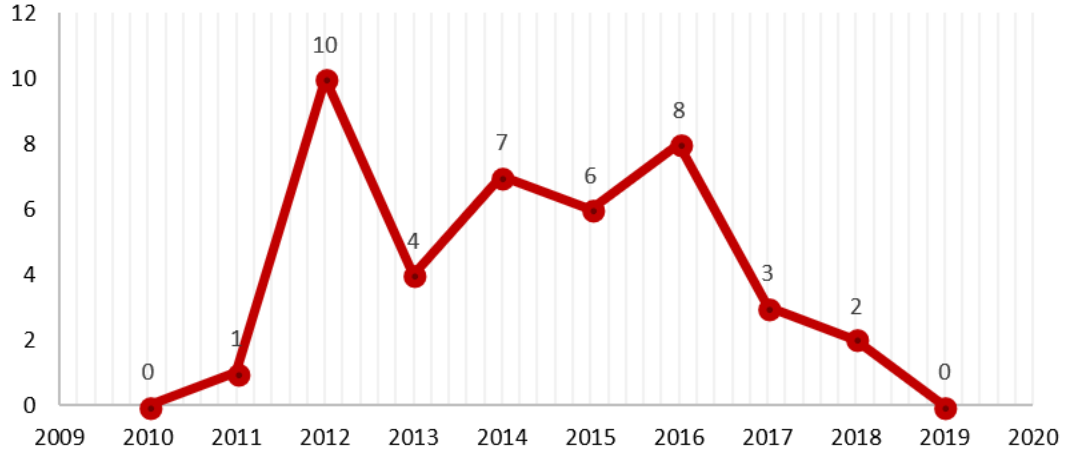

Figure 1(a). The Number of ASEAN's Urban Ecosystem Services Papers Between 2010-2019

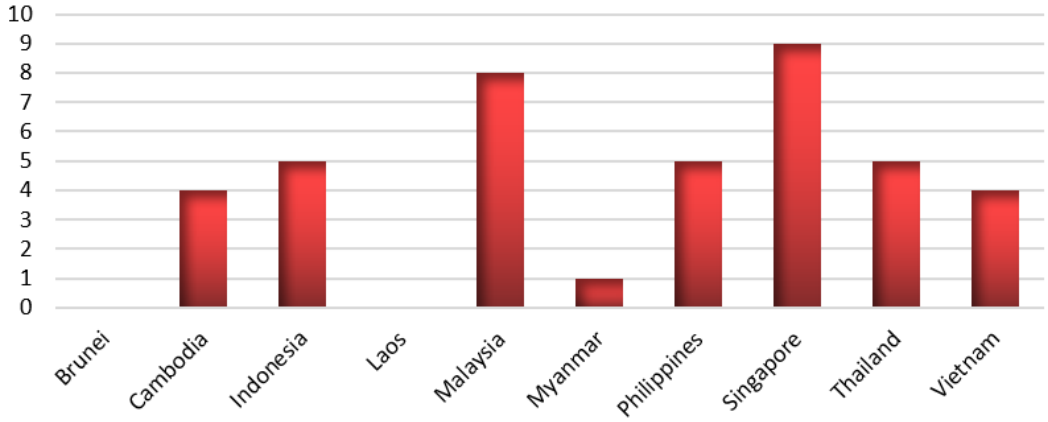

Figure 1(b). Urban ES in the Context of Geographic Dimension

Therefore, we will proceed with a review and overview of current research and this research purpose and aims to fill the research gap in understanding the ASEAN's urban ecosystem services. We hoped the study will complement the existing policy and help to design a better conservation plan for urban ecosystem services in ASEAN countries. Then, we also discuss the methodology and approach that we used and also the results based on the study, discussion, and conclusions. Hence, we conclude this study by a brief overview role to make sure the ASEAN countries maintain sustainable and more livable with the right guideline in the present and future.

2. Methodology

The methodology for this study was based on the scientific articles published in the SCOPUS database. SCOPUS is a digital platform that provides much-related research from superiority data and all-embracing content as a systematic tool to detect, analyzing and conceptualizing a research study. Firstly, a publication of certain periods from 1960 to January of 2019 in the *TOPIC* part with the *phrase ecosystem service* was searched and resulting in the identification of 37,634 articles. Next, we proceed of find all the publications in particular terms that were: (i) ecosystem AND services AND urban, (ii) urban AND ecosystem AND service, (iii) urban AND ecosystem AND valuation, (iv) urban AND ecosystem AND services, (v) urban AND ASEAN AND region which yield 898 of open access articles and the terms generally cover the search of urban ecosystem services. We then coordinate a comprehensive review of all the 898 papers and thus the topic of each paper was analyzed for significance and relevant aspects. We removed irrelevant studies that aren't focusing on the urban ecosystem services such as the papers about the non-ASEAN region and the papers about the ecosystem's business (Abas et al. 2020).

As a result, the final and ultimate sample from the structured review comprised of 41 urban ecosystem services for ASEAN papers. Then we only analyzed the abstract that was used in developing our review. Point of view, it highlighted issues such as the classifying and valuing of UES, benefits, and advantage of reinstating ES in urban areas, a long period case study of UES and the assessment and evaluation of ES for urban livable and resilience as listed in the supplemental material (Table 1). Furthermore, these methodologies were adapted from Yang et al. (2018) which made a study on ecosystem services based on

Table 1. Overview of results for UES in ASEAN

UES CATEGORY	UES TYPE	Represented Countries and References
Provisioning	Food	Philippines (Clark & Nicholas, 2013).
	Water	Singapore (Vincent et al., 2014).
	Timber	Springate-Baginski et al. 2014 have done their study on valuing timber in Myanmar.
	Medicines and health	Only a country discussed on medicines and health which was Singapore.
Regulating	Waste absorption	Thailand and Indonesia (Challcharoenwattana et al., 2016; Suwarno et al., 2014).
	Disease control	Thailand (Koyadun et al., 2012).
	Climate regulation	Thailand, Vietnam, Singapore, and Cambodia (Silva at al., 2012; Davies et al., 2015; Li & Norford, 2016).
	Flood regulation	Vietnam and Cambodia (Ziegler et al., 2012; Depietri et al,. 2012).
	Water purification	Indonesia, Malaysia, and Philippines (Vollmer et al., 2016; Yule et al., 2015; Mahazar et al., 2013; Bueno et al., 2016).
	Attenuation of extreme weather events	Indonesia (Achmada et al., 2015).
Cultural	Tranquility, calm, relaxation	Philippines, Indonesia, Cambodia, Philippines, and Singapore. (Lizuka et al., 2017; Arifin & Nakagoshi, 2011; Yen et al., 2016; Yen et al., 2017; el-Baghdadi & Desha, 2016; Tan & Ismail, 2014).
	Social relations, sense of place	Vietnam and Singapore (Mohri et al., 2013; Newman, 2014).
	Recreation, tourism, aesthetic and educational functions	Malaysia and Thailand (Baharuddin et al., 2014; Karuppannan et al., 2014; Nath & Han, 2015; Intasen et al., 2016).
	Cultural, intellectual, spiritual inspiration	Singapore (Thiagarajah et al., 2015).
Supporting	Photosynthesis and primary production	Thailand and Malaysia (Islam & Siwar, 2012; Vivithkeyoonvonga & Jourdain, 2016).
	Soil formation	Philippines (Estoque & Murayama, 2015; Pham et al., 2014).
	Maintaining Biodiversity & sustainability	Malaysia, Indonesia, Singapore, and Philippines (Shay-Wei & Han-Hwa, 2016; Saadatian et al., 2012; Arifin & Nakagoshi, 2011; Fries, 2017; Karuppannan et al., 2014; Uy & Shaw, 2013).
	Hydrological cycle	Indonesia (Danielaini et al., 2018).
	Biogeochemical cycle	Singapore (Fries et al., 2016).

gendered outlooks and perspectives. Then, the articles were analyzed using the assessment criteria which was developed based on issues that unique to urban systems such as the country of the case study, the specific UES were explored and the valuation techniques or indicators were applied in the studies. Furthermore, we concede that this methodology gives particular limitations and restraints, such as the focal point on irrelevant findings, most of the previous studies on urban ecosystem services were implemented in Europe, plus there were several of publications that are not in open access. So, we chose to use the ResearchGate as an alternative to searching for the scientific and relevant publications and also to search the papers that were not in Scopus.

3. Results

3.1. The Temporal Dimension of ASEAN's Urban Ecosystem Services

Figure 1(a) displays the temporal dimension of the 41 unique studies. Point of view, the studies were published after 2010 and the finding began in 2005 as section of the MEA or Millennium Ecosystem Assessment. This study considered the significance of conservation, protection, preservation, and restoration in the urban area, making this study the previous paper in context the 41 papers analyzed and reviewed. Furthermore, the figure shows a fluctuating number of papers that the researchers keep focusing on ASEAN's urban ecosystem services. For instance, the highest number of papers was in the year 2012, then in 2016, followed by 2014 and 2015 and the lowest number of papers was in 2011 which only one paper published. Hence, we need to understand that this figure only displays results from 2010 until January 2019, because this review paper was written around February 2019 and there were few papers also had been published after February 2019.

Figure 1(b) displays the geographic dimension of the studies related to ASEAN. Furthermore, Figure 2 shows that 22% of the studies were represented in Singapore, 20% of studies in Malaysia, 12% studies in Indonesia, Philippines, and Thailand, except Laos and Brunei that no research has been conducted. Elmqvist et al. (2015) explained that urban ecosystem services are normally classified by a high potency of demand precisely to a very sizable number of urgent local recipient, compared for the sample to ecosystem services produced in rural areas. Point of

view, ASEAN countries where many various ecosystems tend to apply their country into anything that can give benefits to the urban such as green spaces, urban forests and blue spaces including lakes and ponds. Furthermore, the ASEAN countries such as Singapore generally developing their country based on their urban ecosystem's framework. Henderson (2012) explained that the government in cities has critics, yet Singapore's competency, safety, economic successes besides security are impractical to contradict.

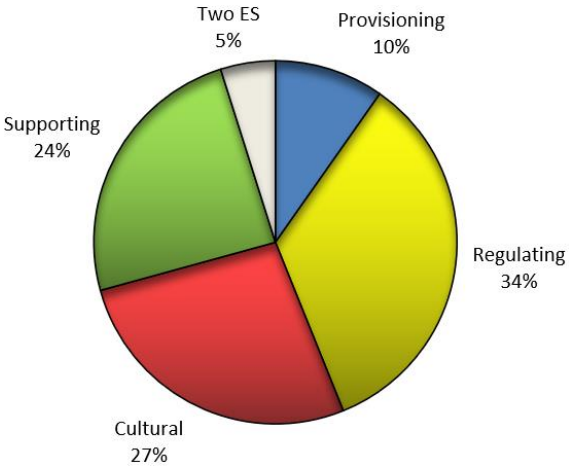

Figure 2(a). Urban ES Analyzed Based on the Categories

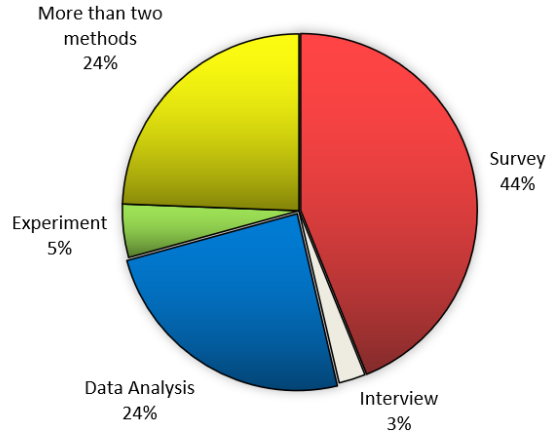

Figure 2(b). Urban ES Paper in the Context of Methods Applied

3.2. The Contextual Aspects of ASEAN's Urban Ecosystem Services

Point of view, we will discuss the category and the number of urban ecosystem services analyzed and the kind of methods used for all 41 unique papers. Fig. 2(a) displays the number of urban ecosystem services classified and analyzed. Hence, most of the studies that we reviewed focus on single urban ecosystem services (41 in total). There were only 2 papers (5%) out of 41 studies that concentrated on two categories of urban ecosystem services. For the single studies on urban ecosystem services, the majority of them (39 papers) were analyzed. Point of view, out of 41 studies which concentrated on single ecosystem services, 14 papers of them examined regulating urban ecosystem services including water purification, climate and also flood regulation, followed by the studies on cultural (11 papers) urban ecosystem services including recreational and green space, then supporting ecosystem services including maintaining biodiversity, habitat restoration, and nutrient cycling, with 10 papers and provisioning urban ecosystem services including timber and food with 4 papers. Besides that, Fig. 2(b) displays the main methods applied in each study and paper. Based on this, the survey method was the most common used with 18 papers followed by data analysis method and more than two methods which 10 in total respectively. While the other 2 papers used the experimental method and the interview method has only a paper in this review.

41 papers have been analyzed and categorized based on various types of ecosystem services. So, Table 1 shows all the primary categories of ecosystem services in the initial column and the varying types of services reviewed in the next column. Then, the next column gives a brief outline of the represented ASEAN countries with references. Point of view, the main focus based on the content to prepare an overall illustration in the context of intersects between the urban ecosystem and the ecosystem services towards the Paris Agreement that has been joined by countries including the ASEAN countries. The Paris Agreement that has been introduced at the Convention, involves all countries and nations into a regular cause to deal with aspiring efforts to take action on climate change and adapt to its impacts with increased support to help developing countries as a beginning (Paris Agreement, 2015). Hence, the following parts indicated a detailed explanation of each study related to the categories of urban ecosystem services and its linkage among ASEAN's region.

3.3.1. Provisioning

Provisioning services include all the substance outputs that ecosystems have been provided. For example, water, food, medicinal plants, water and other resources (Haase et al., 2014). Furthermore, it's has been analyzed, in all the 41 Urban ES ASEAN papers, hence we found that the usual studies made for this subject are: Water supply, food and Medicine/Health.

3.3.1.1 Food.

Generally, every country in the world has its unique food and privileges that may not be the same as other countries. Based on this, the study on the Philippines has concluded that the connection between consuming food as a cultural plus social practice, besides the universal implications of food utilization has less explored (Chakraborty et al., 2016).

3.3.1.2. Water Supply

Traditionally, water and supplies are very important to all users especially to humans that can get the

source either naturally or vice versa. In this context, the urban ASEAN countries such as Singapore are using freshwater only for a necessary purpose and the country needs to keep finding many alternatives to increase water supply specially to fulfil the human needs. The search for freshwater from other optional resources including water reclamation and also sea water desalination indicates energy consumptive technologies, for example, reverse osmosis (Vincent et al., 2014). Thus, water supply is very important especially in the urban ecosystem circle either in the past, present and also in the future.

3.3.1.3. Timber

Timber can be defined as a type of wood then divided into two categories which are hardwoods and softwoods. Myanmar had conducted a study that related to valuing and assessing the forest process and policies. Hence, the export of timber commerce has been played a critical role in deciding the policy of forest section besides truly has utilized as an important influence on all national politics consequently the beginning of the colonial era and rolling nowadays (Springate-Baginski et al., 2014).

3.3.1.4. Medicine/Health

Generally, medicines and health are important and for addressing health problems and to measure the human health level that they can be improved for a better quality of life. Singapore has studied that urban people are better in various ways in linkages with nature every day, yet there have some urban green spaces that generate health goods and health risks. Hence, social and cultural have different responses that differ from urban green spaces and urban nature (Douglas, 2012).

3.3.2. Regulating

Regulating services maintains and conserves all functions including disease control, flood regulation and the quality of air (Haase et al., 2014). It obtained benefits from the urban ecosystem services processes such as waste absorption, disease control, climate regulation, flood regulation, water purification and attenuation of extreme weather events. so, this review paper will focus on those indicators.

3.3.2.1. Waste Absorption

Thailand had conducted a study about waste which was to measure the WTP or the willingness to pay among the community to recycle services in different types of settlements. Based on that study, Challcharoenwattana et al. (2016) found that the monthly analysis of WTPs rises nonlinearly around 0.73 USD in the slightest urbanized regions, then the urbanized regions around ~1.96 USD) and the most urbanized regions around ~1.65 USD. Besides that, Suwarno et al., 2014, in their research on waste in Indonesia estimated that nutrients including phosphorus (P) and nitrogen (N) sewage inputs to almost every Indonesian water body such as rivers from 1970 till 2050 and on future progression will be related with four outlines of MEA.

3.3.2.2. Disease Control

Countries like the Philippines and Thailand have conducted and focused on the ways their urban sesector can prepare to regulate the disease and disaster in their countries. For example, Koyadun et al. (2012) have highlighted the association in urban regions (Chachoengsao province, Thailand) among various aspects including the ecologic of household-level and also the sociodemographic determinants of individual-level and the dengue transmission. Hence, it also recommends many programs that focus to control the dengue in an urban ecosystem or somewhere else principally through an economic crisis when there was a small financial plan and budget for such agendas (Koyadun et al., 2012).

3.3.2.3. Climate Regulation

Three countries especially Thailand, Vietnam, and Singapore have done their study on climate regulation. Which were Silva et al., 2012; Sa, 2017; Thiagarajah et al., 2016. The studied were related to urban climate vulnerability and then a system approach as a regulation aspect to assembly climate change (challenges) in urban areas. In Cambodia, a certain disease that has been focused on was water-borne in adopting for climate change and extreme events of weather including diarrheal illness (Davies et al., 2015). So, the studies are important to be used in analyzed urban systems in certain countries related to global issues (climate change).

3.3.2.4. Flood Regulation

The researchers from Vietnam and Cambodia have done their study on flood regulation (Depietri et al., 2012; Irvine et al., 2015). From a point of view, a phenomenon of floods including flash floods is one of the phenomena that so dangerous that the incident is unpredictably risky that would hit the main city. For example, landslides and flash floods have killed 15 victims in the north of Vietnam's mountainous in June 2018 and also hit the city in Cambodia in July 2018. Hence, the parties should take action and precautions to reduce the surface flash flooding with the technologies that are more eco-friendly and give low side effects (Irvine et al., 2015). Besides evaluating how to differ each city has tried to organize related ecosystem services while also to tie the conclusions of policy-relevant (Depietri et al., 2011).

3.3.2.6 Water Purification

Three countries which were Malaysia, Indonesia, and the Philippines have done their study on water purification (Vincent et al., 2015; Vollmer et al., 2016). Water purification is a process to remove unnecessary materials including solid and gases from the water. Water purification is very important in-

cluding related to rivers and forests so that the water is safe for use by various parties, especially the human community in urban cities and keep urban ecosystem services benefited.

3.3.2.6. Attenuation of Extreme Weather Events
Countries like Indonesia have conducted a study related to urban that can give services to reduce extreme events like hurricanes, storms, and tsunami. So, consequently, with that event, Banda Aceh, Indonesia in the context of urban development was express after the tragedy of tsunami (2004) and also give analytical challenges in the planning of sustainable and systematic development time by time.

3.3.3 Cultural
Point of view, cultural services including the direct uses of non-material (Sarukhan and White, 2003) also causes bad qualifications and consolidation in management terms (de Groot et., 2005). With this point, we conducted a few regular focusing on analyzing the 41 UES studies in ASEAN.

3.3.3.1. Tranquility, Calm, Relaxation
There were 7 research done on tranquillity, calm, and relaxation such as landscapes and its services in Thailand, Myanmar, Malaysia, Philippines, and Indonesia involving (Intasen et al., 2016; Khaing, 2015; Bak et al., 2016; Barau & Qureshi, 2015; Kanniah, 2017; Lizuka et al., 2017; Arifin & Nakagoshi, 2011). Hence, it showed the most relevant urban ecosystem service.

3.3.3.2. Recreation, Tourism, Aesthetic and Educational Functions
The studies analyzed that urban ES in ASEAN was more supportive of recreational interests and activities including the need for urban green areas and spaces. Furthermore, ASEAN is initially popular along its urban landscape and green area's uniqueness. Hence, many interests and activities can be implemented and estimated that would enticing communities around the world. So, these UES provided more benefits and goods for the higher parties by raising the annual earnings/incomes (Baharuddin et al., 2014; Karuppannan et al., 2014; Nath & Han, 2015; Intasen et al., 2016).

3.3.3.3. Cultural, Intellectual, Spiritual Inspiration
Point of view, cultural ES including concern on many aspects such as people and location, then it usually would transform from a rural location to urban location (Thiagarajah et al., 2015).

3.3.4. Supporting
Point of view, to give the space and maintain flora and fauna diversity and also the habitat of organisms, the support from the UES is important (Haase et al. 2014). These services showed in most studies compared to other services and out of 41 UES in ASEAN papers, it provided habitat restoration and biodiversity maintenance.

3.3.4.1. Photosynthesis and Primary Production
Two countries (Thailand and Malaysia) have studied primary production which more to the agriculture sector as an attraction for the urban ES. (Vivithkeyoonvonga & Jourdain, 2016; Pham et al., 2016; Islam & Siwar, 2012). The urban agriculture in Malaysia become an important tool to sustain all the development that can produce any food and others especially in urban areas (Islam & Siwar, 2012) and also to provide the product of foods that can maintain the social welfare and policy-makers (Vivithkeyoonvonga & Jourdain, 2016).

3.3.4.2. Soil Formation
Thailand and the Philippines have studied on soil formation and land change and its services. Point of view, it is important to study the loss and to predict the implications of urbanization that connected to urban growth in rural and urban agriculture (Pham et al., 2014). Thus, they run research to understand the changes of land functions and soil formation of agricultural land in Hanoi.

3.3.4.3. Maintaining Biodiversity & Sustainability
Four countries in ASEAN (Malaysia, Indonesia, Singapore, and the Philippines) have conducted and analyzed the benefits provided from the urban ecosystem services in the aspect of habitat and maintaining biodiversity/sustainability. (Shay-Wei & Han-Hwa, 2016; Saadatian et al., 2012; Arifin & Nakagoshi, 2011; Fries, 2017; Karuppannan et al., 2014; Uy & Shaw, 2013). Based on this, maintaining biodiversity is essential for achieving sustainable development in each country. For example, based on the results, we recommend the importance of community health's actions with the encouragement and support of Malaysia's green space (Karuppannan et al., 2014).

3.3.4.4. Hydrological Cycle
Only one country has done the study on hydrological and its services in urban ES that is Indonesia. The several elements including urban physical and social landscapes will determine various cycles such as water availability and stormwater process (Danielaini et al., 2018).

3.3.4.5. Biogeochemical Cycle
Only one country (Singapore) has done the study about biogeochemical which was *carbon and its services in that country*. Understanding about regulating UES including carbon deposits using many tools to estimates the carbon stocks of mangrove in Singapore (Fries et al., 2016).

4. Discussion

4.1. Filling the Gap in The Context of UES (in ASEAN)

Overall, we will make a summary of all aspects related to the ASEAN studies including the limitations and the concerns of current studies related to urban ecosystem services. Furthermore, we also attempt to focus on filling the research gap with all the papers that we have analyzed. For the problem and limitation aspects, most of the previous research and studies on urban ecosystem services were handle in large continents especially in Europe, so the studies in ASEAN countries are limited including there are several countries with no study about UES, for example, Brunei Darussalam. Thus, for future research, we suggest the researchers in ASEAN or other conduct studies primarily in less or zero study countries related to urban ecosystem services especially in valuing each category of urban ecosystem services. Based on this, the attempt to generate a liveable and sustainable city that complete with all the good infrastructures, social activities and interests, green landscapes, human security, social safety and protection, residents, public health, education, and social work; shows the sustain process and usually need enhancement (Kartini, 2016). Brunei is one of the countries that has its uniqueness to do a study because the majority of the population that lives around the capital and it is also a vibrant and livable city. Besides, Brunei has its water village known as the 'Venice of Asia' or 'Venice of the East' that place around 39,000 people and most of the houses there have access to basic human living and needs. So, this country is quite interesting to study especially related to urban ecosystem services such as the UES valuation of the water village. Furthermore, oil and natural gas industries are the biggest sector and the important income/source of Brunei's development since a few centuries ago (Mclellan & Deterding, 2016). Hence, the research on urban ecosystem services in ASEAN countries should be carried out continuously as each country has a unique and livable city including Brunei Darussalam and Laos.

Besides, we have found that the most common studies are related to monetary approaches. These ecosystem services will typically be measured using a monetary-based approach (Mononen et al., 2016). For instance, the existing studies mostly focusing on valuing and measuring the understand and demand/request of community concerning the eco-friendly spaces in urban, examining demand for urban river rehabilitation and the cost of water purification, the water independence (energy price), next the cultural ecosystem services values that related with historical and contemporary, WTP for waste recycle and WTP for water quality restoration in ASEAN region. View the point, the non-monetary studies still less in number and maybe no researcher focused on that aspect. This is an issue that needs to be highlighted and noted because the non-monetary ecosystem services are also important in the urban ecosystem cycle although they are not directly involved in the area. Furthermore, the ES valuation including non-monetary approach is important to the prevalence of methodological procedures to extract the value of ES such as the component assessments in terms of ES supply, without generating on a constant framework (Kelemen et al., 2014; Chan et al., 2012a; Kenter, 2014).

Thus, maintaining and increasing the providing of various ES, are relevant and significant in both perspectives of human living and economics such as non-marketed and non-monetary services (Rodríguez-Loinaz et al., 2015). For example, Malaysia's natural resources are indispensable for economic growth, but this growth has also been a significant cost among humans, social and physical surroundings. So, as the efforts to achieve the Sustainable Development Goals (SDGs) that comprise 17 goals, Malaysia needs to perform a variety of systematic strategies to achieve these goals as well as a real connection among the urban ecosystem, then its services such as SDG's goals. To fill the research gap, an expanding body of presently appearing literature efforts to explain the human request and demand on non-monetary assessment methodology of ES (Langemeyer, 2015). Consequently, it is important to understand the reaction and response of UES to daily human activities and we should begin by putting more effort into valuing urban ecosystem services by non-monetary approaches for maintaining the livelihood of the urban and the sustainability in present and for the better future.

4.2. Urban Ecosystem Services in ASEAN: Committing to Paris Agreement Towards Livable City

The associated of urban planning and urbanization activities with development capability was often studied in UES. Urban ecosystem services are usually connected with biodiversity aspects and if the ecosystem experiences had a reduction in quality, such as losing an amount of biodiversity, then the ecosystem services will also decrease in quality. Consequently, in efforts and steps to enhance the quality of UES and to ensure the city to be more livable and habitable, all countries have taken various efforts including ratifying and committing to multilateral environmental agreements between various countries. For instance, the ASEAN's countries have committed to multi-lateral Paris Agreements (2015) to build up the universal response to combat climate change by maintaining a global temperature increase, less than 2°C in the context of pre-industrial levels, besides to follow the efforts and steps to control the temperature rise uniformly to 1.5°C (Paris Agreement 2015). So, climate change is a universal, global and complex issue because it can suffocate the harmony and dynamics of the city which involve many dimensions such as economy, social, politics

and ethical issues. The hazards and risk of comprehensive scales climate change become a focus issue that will be facing in all countries (Henderson et al., 2018).

Hence, the agreement such as the Paris Agreement among the countries especially ASEAN's countries should be noted on all aspects that have been agreed upon in 2015. Out of total (10 members of ASEAN countries), nine of them have approved the Paris Agreement, except for Myanmar and is expected to be involved in the future (Wijaya & Idris, 2017). Depend on this, every country, especially the ASEAN countries that mostly involved in the Paris Agreements, should have a specific solution in reducing climate change issues which can bring various impacts to humans, non-humans and others. For example, Malaysia has its targets which are 45 percent reduction by 2030, with 10 percent conditional on having a switch technology and also financial support especially from the developed countries (Mustafa, 2017). Besides that, based on this paper's results, there were few countries which were Thailand, Vietnam, Singapore, and Cambodia that have done their study on climate regulation to protect their urban ecosystem in each country including to solve and decrease the global climate change time by time. From Malaysia, challenges as one of the developing countries, the implementation of policy to reduce greenhouse gasses emissions will way point of view a lot of technologies, economic, social and institutional (Mustafa, 2017). It is necessary to ensure that a city is primarily sustainable, livable and secure especially in ASEAN, without having to sacrifice a different and various natural resource and its UES. So, SDG's goals as planned will be achieved if all countries comply with the Paris Agreements and the standard of urban ecosystem services allow to enhance in the future.

5. Conclusion

It is important to highlight the urban ecosystem services that can be changed with rapid development especially in the ASEAN city. Then, this study has given an overview of urban ecosystem services that related to a variety of benefits provided by the environment especially to the community and economy for maintaining human well-being in ASEAN. Furthermore, we have conducted these studies with the latest year of publications from 2010 to 2019. These papers also analyzed several aspects, for example, the types of urban ecosystem services have been reviewed and also the method applied. Overall, based on the result and our studies on the literature review had most of the papers discussed on the significance of the urban ecosystem services provided by classified them, including regulating (water purification, climate regulation, disease regulation, flood regulation, and waste absorption) then followed by cultural (tranquillity, social relations, and recreation). For future research, we suggest the researchers in ASEAN or others conduct studies primarily in less or zero study countries related to urban ecosystem services especially in valuing each category of urban ecosystem services Finally, we conclude that all the ASEAN countries should play an important role to make sure the countries were sustainable and more livable with the right policies and guideline like can fit in Paris Agreement especially in Climate Strategies and plans.

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