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# Fenomena Jerebu di Asia Tenggara: Punca dan Penyelesaian

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*Jerebu menjejaskan kesihatan awam, mutu alam sekitar dan aktiviti ekonomi*
*Foto: Berita Harian (20 Oktober 2015)*

## Pengenalan

Jerebu merupakan satu fenomena pengurangan jarak penglihatan di udara yang berpunca daripada serakan cahaya boleh nampak oleh zarahan terampai, gas atau wap air di atmosfera. Pengurangan cahaya boleh nampak ini menyebabkan suasana kabur yang menyukarkan pandangan penglihatan daripada jarak tertentu. Fenomena jerebu di rantau Asia Tenggara termasuk di Malaysia sering dikaitkan dengan pengurangan jarak penglihatan. Ianya disebabkan kepekatan zarahan terampai yang amat tinggi di atmosfera yang diakibatkan oleh pembakaran biojisim. Fenomena ini sering berlaku pada musim kering di mana pembakaran biojisim oleh faktor semulajadi dan antropogenik sukar dikawal seterusnya menyebabkan kehadiran zarahan terampai yang tinggi di udara.

Sejak beberapa dekad yang lalu, fenomena jerebu seolah-olah telah menjadi acara tahunan di seluruh Asia Tenggara termasuk di Malaysia. Pada musim panas dan arah angin bergerak dari barat daya, zarahan terampai hasil pembakaran biojisim telah menyebabkan suasana berjerebu yang teruk di kawasan pantai barat Semenanjung Malaysia serta Sabah dan Sarawak. Hal ini adalah disebabkan oleh pergerakan angin rentas sempadan yang membawa zarahan daripada kawasan pembakaran di Sumatera dan Kalimantan, Indonesia. Cuaca yang panas ini juga menyebabkan pembakaran yang drastik berlaku di beberapa kawasan di Malaysia yang meningkatkan lagi jumlah zarahan terampai di udara Malaysia. Alihan arah angin monsun yang berlaku pada bulan Oktober dan kedatangan musim hujan akhirnya mengurangkan fenomena jerebu ini.

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# DARI MEJA PENGARAH
## *FROM THE DIRECTOR*

Assalamualaikum warahmatullah dan salam sejahtera. Sekalung tahniah kepada barisan Jawatankuasa Penyunting Salam LESTARI kerana berjaya menerbitkan keluaran No. 37 untuk tahun ini.

Bagi keluaran No. 37 ini, isu bencana dipilih sebagai tema utama. Sebanyak tiga makalah sumbangan Felo LESTARI dan satu lagi sumbangan daripada Fakulti Perubatan, Pusat Perubatan UKM terkandung di dalam keluaran ini. Isu pencemaran udara akibat aktiviti manusia telah menyebabkan insiden jerebu yang melanda saban tahun di Malaysia dan beberapa buah negara jiran lain. Pembukaan hutan bagi tujuan aktiviti pertanian dilakukan menerusi kaedah pembakaran merupakan penyumbang utama kejadian jerebu di Malaysia. Makalah kedua mengenai keperluan Sistem Sokongan Pembuatan Keputusan (DSS) dalam pengurusan banjir di lembangan sungai. Manakala makalah ketiga membincangkan impak banjir berskala besar terhadap kesihatan awam juga terdapat dalam keluaran ini. Selain daripada penyakit bawaan air, mangsa-mangsa banjir turut berhadapan gangguan psikologi dan trauma kesan daripada kehilangan nyawa dan kemusnahan harta benda. Makalah ketiga pula membincangkan mengenai cadangan pendekatan bukan berstruktur dalam pengurusan banjir kilat di kawasan perbandaran. Kelebihan pendekatan ini yang dapat menjimatkan kos pembinaan dan baik pulih akibat banjir boleh digembeling bersama dengan pendekatan berstruktur yang mendominasi pengurusan banjir masa kini.

Dalam keluaran ini juga, Sidang Penyunting Salam LESTARI turut mendedikasikan penulisan pemergian

Allahyarham Profesor Madya Dr. Shaharudin Idrus, Felo Kanan LESTARI yang telah pulang ke rahmatullah pada tanggal 29hb Januari 2017 akibat serangan jantung. Khidmat sumbangan Allahyarham di LESTARI selama lebih 17 tahun dicatatkan dalam ruang belasungkawa. Kehilangan Allahyarham memberi kesan mendalam terhadap keseluruhan warga LESTARI.

LESTARI turut kehilangan seorang warga akademik apabila kontrak Profesor Emeritus Chamhuri Siwar sebagai Felo Utama di LESTARI telah tamat pada 11hb April 2017. Kepakaran beliau dalam bidang ekonomi pembangunan khususnya kajian kemiskinan dan pembangunan luar bandar telah menyumbang secara signifikan kepada kecemerlangan LESTARI.

Semoga penerbitan Salam LESTARI No. 37 memberi pengetahuan dan maklumat bermakna kepada semua pembaca.

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*Assalamualaikum warahmatullah and salam sejahtera. My sincere congratulations to the Editorial Board of Salam LESTARI for the successful publication of the 37th issue of Salam LESTARI this year.*

*For the 37th Issue, disaster has been chosen as the main theme. There are three articles contributed by LESTARI Fellows and one article contributed by the Faculty of Medicine, UKM Medical Centre in this Issue. The first article highlighted the issue of air pollution that was caused by human activities, which had led to the frequent occurrences of haze in Malaysia and its neighbouring countries. The clearing of forests for agriculture with the use of the slash-and-burn method was one of the major contributor to the phenomenon of haze in Malaysia. The second article addressed the need for a Decision Support System (DSS) in the management of foods in river basins. The third article discussed the impact of floods at a larger scale onto public health. Apart from water-borne diseases, victims of flood will also undergo psychological disturbance and trauma as a result of the losing and destruction of properties and lives due to the flooding disaster. Last but not least, the fourth article talked about a non-structural proposal for the management of flash floods in rapidly developing urban regions. The cost saved for the construction and restoration of flood mitigation structures after a flood is one of the advantages of a non-structural approach to the management of floods, and could be used together with structural approaches that dominated current management of floods.*

*The Editorial Board would like to dedicate this Issue to Allahyarham Associate Professor Dr. Shaharuddin Idrus, Senior Fellow of LESTARI who had returned to be with God on the 29th of January, 2017 due to a heart attack. Allahyarham Associate Profesor Dr. Shaharuddin Idrus' service and contribution to LESTARI for 17 years were published in the Obituary. Allahyarham's passing will be a great lost to LESTARI and will be deeply missed by all LESTARIans.*

*LESTARI has one academician less when the contract of Emeritus Professor Chamhuri Siwar as the Principal Fellow of LESTARI had come to an end on the 11th of April, 2017. Emeritus Professor Chamhuri Siwar's expertise in the field of development economics, specialising in poverty and rural development had contributed significantly to the excellent reputation that LESTARI acquired since its inception.*

*It is my hope that with the publication of the 37th Issue of Salam LESTARI, the information and knowledge provided therein would be meaningful to all readers.*

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**Faktor-faktor Penyumbang Kejadian Jerebu**

Fenomena jerebu di Malaysia dan rantau Asia Tenggara terutamanya berpunca daripada pembakaran hutan dalam kawasan tanah gambut di Sumatera dan Kalimantan. Kebakaran sering terjadi disebabkan cuaca panas yang berpanjangan dan keadaan kestabilan atmosfera yang tinggi. Pembakaran biojisim ini menghasilkan habuk, abu, debu dan asap merentasi sempadan. Aliran angin lintang yang membawa bersama zarah terampai secara besar-besaran.

**(i) Pembakaran Hutan dan Pembukaan Tanah Pertanian**

Pembakaran hutan merupakan kaedah tradisi bagi membuka tanah pertanian di rantau Asia Tenggara. Ia dipergiatkan lagi untuk memenuhi keperluan pembangunan dan pembinaan kawasan penempatan. Kaedah pembakaran hutan ini biasa melibatkan proses "tebang dan bakar" yang menyumbang penghasilan bahan pencemar udara yang tinggi. Keadaan menjadi bertambah teruk apabila proses pembukaan hutan ini dijalankan di kawasan tanah gambut yang menyebabkan proses pembakaran mengambil masa yang lama untuk dipadamkan. Kawasan-kawasan yang cenderung dengan pembakaran seperti di Sumatera dan Kalimantan, Indonesia, aktiviti pertanian dijalankan oleh petani kecil-kecilan dan juga syarikat perladangan besar.

**(ii) Pembakaran Kawasan Tanah Gambut**

Di Asia Tenggara, tanah gambut menyumbang peratusan yang tinggi bagi kawasan rendah, persekitaran pantai dan sub- pantai. Keluasan kawasan tanah gambut di Asia Tenggara ialah kira-kira 24.7 juta hektar, di mana 20.7 juta hektar terletak di Indonesia. Tanah gambut merupakan kawasan yang cenderung untuk mengalami pembakaran semasa musim kering disebabkan oleh ruang kosong yang ditinggalkan oleh air tanah yang bergerak ke bahagian bawah. Proses pembakaran yang berlaku mengambil masa yang agak lama untuk dipadamkan disebabkan proses pergerakan pembakaran bawah tanah dalam bentuk pembaraan. Proses peningkatan semula air tanah merupakan faktor penting yang boleh membantu proses pemadaman pembakaran di tanah gambut. Peningkatan air ini akan berlaku apabila tiba musim hujan pada bulan November hingga Disember setiap tahun.

**(iii) Cuaca Panas dan Pergerakan Angin**

Faktor cuaca panas dan penurunan air bawah tanah di kawasan tanah gambut merupakan antara faktor utama pembakaran kecil merebak menjadi pembakaran dalam skala yang besar. Musim panas dikaitkan dengan jumlah hujan yang rendah yang sering berlaku pada antara bulan Jun hingga September dan Januari hingga Mac setiap tahun. Aktiviti pembalakan dan pertanian yang dijalankan pada waktu ini mencetuskan pembakaran biojisim daripada tanah gambut terutamanya di sekitar pantai barat Semenanjung Malaysia, Sumatera, Kalimantan, Sabah dan Sarawak. Cuaca panas menyebabkan pembakaran tercetus dengan mudah dan merebak dengan cepat dari satu kawasan ke kawasan yang lain.

Kedaan kering yang melampau sering berlaku di kawasan Asia Tenggara apabila berlakunya fenomena El Ninõ Southern Oscillation (ENSO). Keadaan ini disebabkan oleh suhu air permukaan yang sejuk di bahagian barat Pasifik termasuk di lautan sekitar Asia Tenggara manakala permukaan air yang panas di bahagian timur lautan Pasifik. Fenomena ini menyebabkan pengurangan jumlah hujan yang amat ketara di rantau Asia Tenggara. Selain itu fenomena Indian Ocean Dipole (IOD) yang berlaku apabila permukaan air yang panas meninggalkan perairan Sumatera ke bahagian Selatan Afrika menyebabkan keadaan yang kering di kawasan Asia Tenggara. Fenomena yang bermula pada awal tahun ini selalunya akan memuncak pada bulan Julai sehingga bulan Oktober. Keadaan kering melampau ini menyebabkan kejadian pembakaran terutamanya di kawasan tanah gambut menjadi lebih kerap dan cepat merebak. Fenomena jerebu yang teruk pada tahun 1997 sehingga 1998 dan jerebu tahun 2015 adalah disebabkan fenomena El Ninõ dan yang berlaku pada waktu tersebut.

**Langkah-langkah Mengurangkan Episod Jerebu**

Dalam usaha mengatasi masalah jerebu yang kini berlaku hampir saban tahun, langkah-langkah awal dalam mengawal dan mengelakkan pembakaran biojisim terutamanya pembakar tanah gambut adalah sangat diperlukan. Langkah-langkah pengawalan pembakaran tanah gambut dan larangan pembakaran terbuka adalah perlu dijalankan terutamanya semasa musim panas bukan sahaja di Indonesia tetapi juga di Malaysia. Penguatkuasaan oleh pihak bertanggungjawab adalah menjadi perkara pokok yang perlu diperkuatkan kerana dasar dan akta berkaitan pembakaran tanah gambut telah diwujudkan di Malaysia dan Indonesia tetapi penguatkuasaan yang lemah menyebabkan masalah jerebu semakin parah. Aktiviti pertanian di kawasan tanah gambut seharusnya dipantau dengan teknik-teknik terkini

bagi mengawasi proses pembakaran terbuka terutama pada musim kering dan panas.

Penggunaan teknologi terkini juga dapat diadaptasi dan dijalankan dengan berkesan dalam mengurangkan impak jerebu seperti pembenihan awan dan proses menjalankan pemadaman api dengan pantas untuk mengelakkan pembakaran kawasan hutan dan tanah gambut yang lebih luas. Antara teknik yang boleh dijalankan dalam meramal serta memberikan amaran awal bagi episod jerebu yang bakal berlaku adalah dengan menganalisa data darjah penglihatan *(visibility)* dan kandungan lembapan di dalam organik dan permukaan bahan bakar yang lebih dikenali sebagai *Drought Code*. Bahan pencemar daripada faktor lokal seperti pelepasan daripada kenderaan bermotor seharusnya dikurangkan semasa fenomena jerebu berlaku. Pendidikan alam sekitar seharusnya dijalankan dengan lebih komprehensif di rantau ini dengan memberi maklumat mengenai elemen-elemen yang bersifat tidak mesra alam sekitar dan impak kemusnahan alam sekitar dan kesihatan manusia. Penguatkuasaan undang undang di peringkat lokal dan antarabangsa seharusnya dilaksanakan dengan lebih berkesan bagi mengawasi masalah pembakaran oleh petani kecil tempatan dan syarikat-syarikat besar yang menguasai sektor industri pertanian seperti perladangan kelapa sawit di kawasan tanah gambut.

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[a] *Professor Dr. Mohd. Talib Latif (PhD) merupakan Timbalan Pengarah dan juga Felo Utama LESTARI.*

# Flood Impact on Public Health

Sharifa Ezat Wan Puteh [a] | *sh_ezat@ppukm.ukm.edu.my*

Flood occurrences in Malaysia has come and disappeared with many devastating effects, from minimal to huge, on the economy, human lives and on human health. Many of these effects are too massive to miss but sometimes, they are too minute and were neglected. This article will discuss the three aspects of human health impact the flood can have on public health.

**Flood and Physical Health Effects**

Flood has an overall devastating impact on health and population health as a whole. Water by itself may lead to physical drowning and death, but also the physical impact on health due to falling debris such as walls, glass, roof tops and water turbulence. This is not uncommon, whereby flood has ravaged houses and farms, caused deaths, near drowning and fatalities secondary to drowning itself. Children who suffers from the lack of supervision; children who may play in or near the water during a flood may cause accidental drowning, sometimes unnoticed by parents. Many holes and burrows become traps during flood where water level has camouflaged holes and drains, as water level has risen to cover these drains and canals. Turbulences during flood water rise or reside, create vacuum areas that may cause difficulty to stay afloat and may result in drowning. The common physical impact secondary to flood is the accidental trapping of bodily organs, which might lead to fracture of bones, cuts and bruising. Extreme cases shows that fallen glass and debris can slice off organs, crush bodies and leads to superficial to deep abrasions and bruising to victims' body. The usual intact human skin is now open, and exposed too many organisms and or virus, that might lead to open blood vessels and may circulate locally and then systematically into the body. In many cases, due to fallen powerlines, direct current and electricity conducted through the victim accidentally may lead to body electrocutions, burn and even death. Toxics and irritants that can cause injury or death when inhaled or ingested or absorbed through the skin may also occur. Damage to public infrastructure affects a far greater proportion of the population than those whose houses or businesses offices, could be directly inundated by the flood. In particular, flood damage to schools, roads, rail networks can have significant impacts on regional but also the national economies. Flooding of urban areas can result in significant loss to private properties including schools, homes, and businesses, and rising insurance claims.

*Minute dust particles that occurs post flood may lead to respiratory problem*
*Photo: Sharifa Ezad (2016)*

Exhaustion may occur post flood due to heavy work related to post flood clean up. Survivors and volunteers are both exposed to these risks during clean up and repair post flood. When the weather permits, the drying flood water and land, may pose as denuded areas that when the wind blows, brings up minute soil dust particles in the air. These are lifted in the wind and are blown across flood affected areas. Minutes dust particles may irritate the lungs and nostrils, and victims may suffer acute and prolonged running nose and cough. Many countries have shown an increase in respiratory and skin infections cases, post flood.

Removal of debris, the slippery conditions, reduced visions (due to rain), mud build up and the clean-up process by themselves pose as health risks to victims and volunteers. In acute post flood phases, power tools and machineries to aid lifting and cleaning may not be readily available to lift debris, to scower for victims. Instead most work must be done manually. These activities pose risk to dehydration and exhaustion especially if no clean water sources are available. Muscle fatigue and soft tissue injuries may occur and pose to multiple physical health effects.

**Flood Effect on Pathological Disease**

Flood consists not only of water. The rise of water also coincides with rising domestic sewage, flooded home septic tanks and garbage around the flood home and housing environment. Sewage, including toxins that have been diluted with flood water are now intermixed with fecal excreta matter, urine and waste that are detrimental to human health. This is compounded with fecal matter from domestic (livestock) animals (e.g. pig farming that may live together/in close proximity with humans). Pathogenic organisms may enter through the body in many ways. The usual method of organisms entering the body is through non-intact skins, but they can also enter the body through the respiratory and gastrointestinal tract so called the 'feco-oral' route. There are many types of organisms present in contaminated stools. There include *Bacteroides species, Salmonella, Shigella, Yersinia, Campylobacter, Aeromonas, Candida, Eschericia coli (a form of coliform), Cryptosporidium, and Entamoeba histolytica.* In reality, many other types of coliform bacteria are present in the human intestines. They are a collection of relatively harmless microorganisms that live in large numbers in the intestines of man, or other warm and cold-blooded animals. They do not cause intestinal illness. Instead, they and aid in the digestion of food. However, certain types of coliforms, e.g. the pathogenic *E.coli*, indicates the presence of fecal coliform bacteria in a contaminated environment. The presence of fecal coliform bacteria in aquatic environments (including flood water) indicates that the water has been contaminated with the fecal material of man and other animals. Fecal coliform bacteria can enter rivers through direct discharge of waste from mammals, birds/chicken, from agricultural, water runoff, and from untreated human sewage.

Human contact with the organism may occur through swimming and drinking contaminated water either through deliberate or accidental activities. There are some waterborne pathogenic diseases secondary to these organisms, they include typhoid fever, dysentery, viral and bacterial gastroenteritis and hepatitis A. These are the detrimental health effects of exposed flood victims that may present with symptoms and signs such as nausea and vomiting, body fever, an enlarged liver, jaundice, diarrhoea, dehydration and hypovolemic shock. In extreme conditions, these can present as acute renal failure and kidney dialyses are required. Safety and hygienic precautions are very useful in the prevention of these illnesses in post flood areas. Measures during flood include double boiling of drinking water, boiling of water used to prepare food, washing hands with soap before eating, chlorinating of water and washing vegetables/ fruits with clean water before consumption.

Garbage disposal are an important precautionary measure to be taken and to be adhered to during flood water rising and after subside. In many cases, garbage and effluents also rise during flood and once water level declines, it will stack up and present as garbage piles. These by itself may cause hazards to human victims of flood. Untreated, garbage pose a risk to health through direct method, i.e. toxins, sharp hazards, sanitary napkins, soiled diapers etc. But also, garbage pile or improper disposal leads to stagnant water, collection of food and debris that leads to other mammals and anthropods breedings (such as dengue and malaria). The usual animals that scavenge these sites include dogs and rodents that may carry rabies and fleas. Rats may abandon their burrows for aim for higher ground, but they can also swim in and underwater. Droppings of rats fecal matter and rats urine contaminants may also harbour spiral shaped bacteria *leptospira*, that may lead to the leptospirosis, a zoonotic bacterial disease. These droppings can fall into stagnant flood water and infect humans and may survive for a few months. Environmental changes can potentially increase rodent (vector) population and enhance transmission to humans. This transmission increased in cases of high population displacement, poor public health control in the first place and contaminated water source supply (for example a nearby pig breeding farm that contaminate the ground or soil water supply).

Leptospirosis is an infectious disease presenting through a broad range of clinical manifestations. These may range from mild flu-like illness (uncomplicated) to very severe haemorrhagic manifestations and multi organ failures (complicated) that warrants intensive care services. Majority of cases will present as mild cases that can present as fever, sore throat, loss of appetite, headaches, nausea and vomiting, myalgia (muscle ache), cough and rashes. These will generally present as treatable and of good prognosis. Many types of antibiotics are available to treat leptospirosis, such as *Ampicillin, Azithromycin, Ceftriaxone, Doxycycline and Penicillin*. Severe cases (much rare), may target organs of body presenting as jaundice, chest pain, shortness of breath, kidney failure, internal bleeding, coma and death unless promptly treated. Extensive treatment and high cost drugs and support for complicated leptospirosis care and can prove to be fatal. An increase in Vector-borne diseases transmissions usually occur post flood. These include cases such as malaria, dengue and dengue haemorrhagic fever, yellow fever, and West Nile Fever that may occur in countries that harbour such diseases.

In the urgent phase of post flood; municipal solid waste services may not be present and segregation of solid waste may be impossible to implement. Thus, to avoid the presence of food and organic waste materials being strewn all over the place and pollute our immediate living environment, one of the easiest ways to dispose waste in a rural residential property post flood is by landfilling all organic matter. In simple term, landfill is considered to be a place to dispose of organic waste material by burying it, sometimes in layers of soil or covering it over with soil. This can be used for wastes (such as leaves, vegetables, food leftovers) that can degenerate and composed naturally; wastes that are not too abundant; there is no toxic in the waste that may leak out into ground water. In addition, these wastes are topped up with soil. This prevent animals from digging out the waste materials; and flies or rodents from infesting the waste. However, this is only used immediate post flood or disaster that prevents proper road communication and the proper discharge of sewage. This is definitely not sustainable to the environment in the long run and modern techniques need to be put in place to prevent soil, and water contamination.

**Flood Effect and Mental Health**

In cases where flood is part of disaster occurrence, the event may lead to mild (can be transient) or severe (and prolonged) effect to the mental health of the population affected. In many cases, many of the mental issues may

*The unmeasurable loss has impact on victim's mental health status*
*Photo: Sharifa Ezat (2016)*

occurs acutely during and post disaster. These need to be handled with tact, by volunteers handling survivors. In many cases, simple physiological first aid, one-to-one counselling and advice to survivors may suffice. Majority of survivors may return to normal functioning of daily activities, evident by their ability to function in their day to day business and maintain the ability to take care of themselves and also their dependents. An example would be of how mothers would be able to take care of themselves, their children or taking care of the elderly who are dependent on them.

Survivors may experience flashbacks of events that has occurred, frightening dreams or a recurrence of nightmares. There are certain survivors that would be more at risk compared to others; they would be the elderly, women and young children. They could be the population who are less empowered, less equipped with survival skills that are needed to increase preparedness towards post flood survival.

In many cases, return of full functioning and capacity occurs days to weeks post disaster. In certain cases, it takes months before they are relieved of the traumatic memories. However in a minority of survivors, the revival of the disaster has a big impact on their psychological status and mental health being. The situation is compounded if they face the loss of lives of immediate family members, and the loss of financial dependence and income.

Living in temporary shelters, such as the 'flood relief centres (be it schools, mosques or shelters) also pose stressful encounters among the flood victims. Many felt that the loss of privacy and living in temporary camps/tents leads to stress, anxiety, lack of sleep and insomnia. Sharing of common facilities with other families and strangers, may lead to difficulty in changing of sanitary towels (especially among women), difficulty in toilet access and mobility in movement among the elderly. These toilets are usually not equipped with proper holding bars to support elderly movement up and down during toilet use.

Examples of flood events that may has a lasting effect among flood victims include post-traumatic stress disorders, depression, anxiety, stress and suicidal intents. The health fraternity needs to identify the risks and incidences of these events among the survivors. Although it is highly unlikely that this occurrence happens in catastrophic mass number, but the affected population, however small the number, needs to be identified and comprehensively treated. In many cases, the physical effects to health are more easily treated that their mental health status as this might be subconsciously hidden.

There are many tools available that can be used to screen for such an event. Among them include the DASS tool (screen for depression, anxiety and stress), Beck's Depression Index (screen for depression), Patient Health Questionnaire (screen for depression) and so on. In many situations, there is no one to screen the survivors and only a basic psychological first aid (PFA) is conducted. This is because, not many people are trained to provide basic PFA let alone a proper mental health screening. In times of duress and distress, priority are to saves lives, to provide emergency care and to estimate loses. Thus this leave a majority of the population affected. These people might not receive the care and help they need. Most of flood volunteers are not trained to provide psychological help, while most of the community and local leaders are not able to identify those who may be affected even among their community members.

**Conclusion**

Flood has and will continue to occur in many parts of the world and in many states in Malaysia too. Many of these environmental changes are not properly monitored and controlled, which will lead to an ever devastating impact to the environment and health. Proper flood management, flood control and its mitigation are the ways forward, and with it the reduction of negative externalities and health impacts to the population.

[a] *Professor Dr. Sharifa Ezat Wan Puteh is a Professor at Pusat Perubatan Universiti Kebangsaan Malaysia (PPUKM).*

# A Decision Support System for an Integrated Flood Disaster Management Decisions in Pahang River Basin

*Mohammad Imam Hasan Reza [a], Lee Yook Heng & Mohd Raihan Taha*

Recent prolonged flood (2014-2015) in Malaysia affected a large number of people's livelihood, socio-economic wealth and country's natural ecosystem along the east coast of Peninsular Malaysia as well as the Pahang River Basin (PRB) area. The government of Malaysia has taken substantial steps to tackle this threat through an integrated and multi-sectoral manner. Thus, this study focuses on several aspects of the flood disaster on the PRB integrating socio-economic, ecological, environmental, and technical viewpoints for an overarching Integrated Flood Disaster Risk Management. The primary aim is to produce a robust and efficient decision-making process while the traditional approach, mainly structural measures, failed to reduce the risk of flood disasters in many river basins like PRB in Malaysia.

Hazard management often requires a significant number of spatial information with various scale formats to assess the hazards and risk (Mansor et al., 2004). The management decision depends on either a few or an array of scattered data of the socio-economic, ecological or environmental data of a region (Innocenti & Albrito, 2011). It is then practically unusual to make a proper decision for a sound management initiative interpreting those data. On the other hand, solely scientific analyses also are not sufficiently addressed the real feature on the socio-economic and human vulnerability and vice versa (Islam et al., 2013). However, using geospatial technology for integrating as many possible socio-economic, ecological or environmental data of a region can produce simplified and visualised information concerning graphical and cartographic presentation (Thomas et al., 2007).

This integrated approach has the enormous ability to make a real feature of a region through classifying into potential hazard zone, vulnerable population zone, environmentally and ecologically sensitive zone and other information in the same map layer for helping the decision process. Disaster management decision based on such integrated analyses can reduce risk regarding life, property or social and economic tangible and intangible capital loss from a hazard prone area. These studies are also necessary to take long-term mitigation plan and disaster preparedness and adaptation plans.

>> bersambung di m/s 12


*Source: (https://www.behance.net/gallery/7545089/Anti-Bottled-Water-Campaign-Poster)*

# SUDUT KREATIVITI DAN INOVASI
*CREATIVITY AND INNOVATION CORNER*

## PEMBANGUNAN *ECOWALL* @ LESTARI, UKM

### PENGENALAN

Pembinaan *Ecowall* ialah satu usaha untuk mewujudkan kaedah tanaman yang mesra alam menggunakan bahan-bahan terbuang dan terpakai. Pembinaan *Ecowall* menggunakan teknik pengurusan sisa yang mudah kerana ianya tidak memerlukan langkah-langkah yang rumit dan boleh dipraktikkan oleh pelbagai peringkat umur. Teknik tanaman ini mampu menjimatkan ruang secara maksimum dan tidak memerlukan penggunaan tanah lapang serta menjimatkan kos. Melalui inovasi tanaman *Ecowall* ini, ia dapat mendisiplinkan masyarakat khususnya warga UKM tentang kepentingan menjaga alam sekitar secara bijak dan kreatif dengan menggunakan sumber sedia ada.

**Langkah-langkah:**

1. Bahan dan peralatan yang diperlukan ialah:

   i. Botol mineral 500ml (kitar semula)
   ii. Pisau kecil dan gunting
   iii. Tali pancing / tali tangsi
   iv. Sarung tangan plastik (jika perlu)
   v. Tanah yang dicampurkan dengan baja kompos
   vi. Benih bunga

2. Buat lakaran di atas botol secara melintang dan potong mengikut ukuran yang telah ditandakan.

3. Masukkan tanah baja kompos ke dalam botol dan tanam benih pokok mengikut kesesuaian ruang botol.

4. Ikatkan tali pancing/tangsi pada kiri kanan botol seperti di dalam gambar.

5. Ikatkan tali tangsi yang telah diikat pada botol ke palang besi yang telah disediakan pada dinding.
   (Pemilihan dinding di lobi LESTARI adalah kerana persekitaran yang sesuai bagi menampilkan konsep hijau)

6. Inilah hasilnya setelah semua botol yang telah ditanam anak benih diikat pada palang besi di dinding mengikut susunan yang teratur. Penyiraman hendaklah dilakukan berkala bagi mengekalkan kesuburan anak pokok yang ditanam.


*Sumbangan : Norazmi Abd. Kadir & Muhammad Wafiy Adlan*

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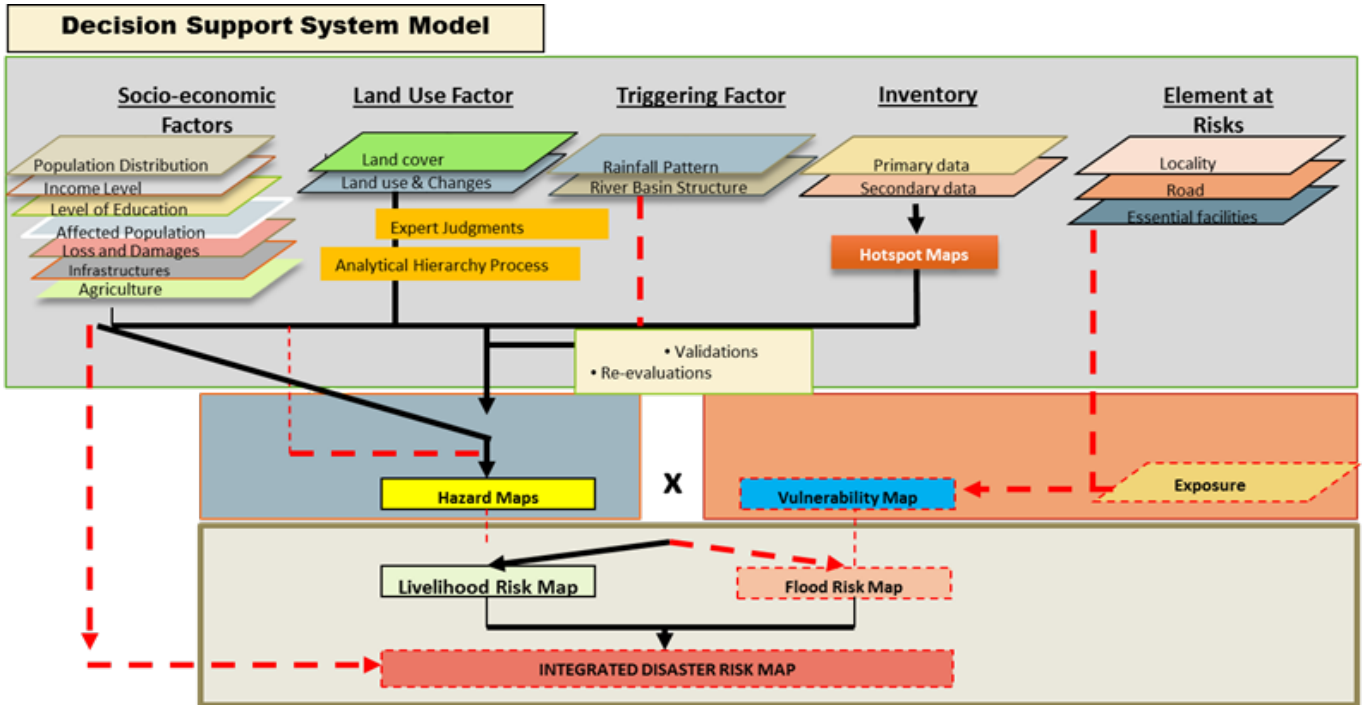


*Figure 1. A Decision Support System Model showing different components and associated layers that are essential for integrating into this system to identifying and visualizing flood disaster risks of the Pahang River Basin.*

### The Proposed Decision Support System (DSS)

In general, a DSS can be characterized as an interactive computer-based system, which helps policy makers utilize data and models to solve unstructured problems (Muhamad et al., 2013; Kou et al., 2011). An effective DSS have some essential characteristics (Sprague & Watson, 1989), those are as follows:

1. process a complicated input into a clear output that is useable by the decision makers;
2. integrate the models or analytic techniques with available and traditional data sources;
3. visualize into features and spatially explicit maps or diagrams that simplify the perspectives, which is easy to be used by nontechnical users and also a various of stakeholders; and
4. emphasizes the measurability, flexibility and adaptability to accommodate all sorts of changes.

Figure 1 represents the proposed DSS Model for a straightforward and easy-to-use decision-supporting outputs for the robust flood disaster risk management of the Pahang River Basin. It has four essential components: (i) socio-economic factors; (ii) land use factors; (iii) triggering factors; and (iv) element-at-risks factors. Every factor has different criteria which have been used as the input layers. Each criterion layer has several sub-criteria. These criteria layers have been selected through land-based original studies. They may be found in the data, graph or other datasets which were then developed into GIS compatible data layers. These criteria and sub-criteria have been judged by the experts and later weighted through the Analytical Hierarchy Process (Saaty & Vargas, 2000). Based on these importance values, GIS has calculated increasing flood risks, and they will be accounted on the spatial position in the GIS layers. Finally, a flood disaster risk map that visualizes the whole study area with differentiated and classified multi-criteria risk zones has been produced.

### Significant Findings

It revealed from the study that, the main reason for the flood was the highly intense rainfall. However, many other causes made the flood more severe and triggered elongated inundation in various places of the river basin. Among them, rapid land use change, deterioration of the ecological integrity of the river system, spreading of commercial agriculture and developments in the highland areas are noteworthy. Flood affected population along this river catchment area have been experiencing multiple vulnerabilities, including socio-economic, health and ecological nature (Figure 2). Ecosystem destruction and deforestation, particularly wetlands degradation, is a proximate cause of such disaster. Many types of wetlands disappeared in the Temerloh area between 1988 and 1996. Whereas, they are drastically degraded in Pekan, and Kuantan, the capital and coastal district of Pahang along Kuantan River Basin, between 2000 and 2010.

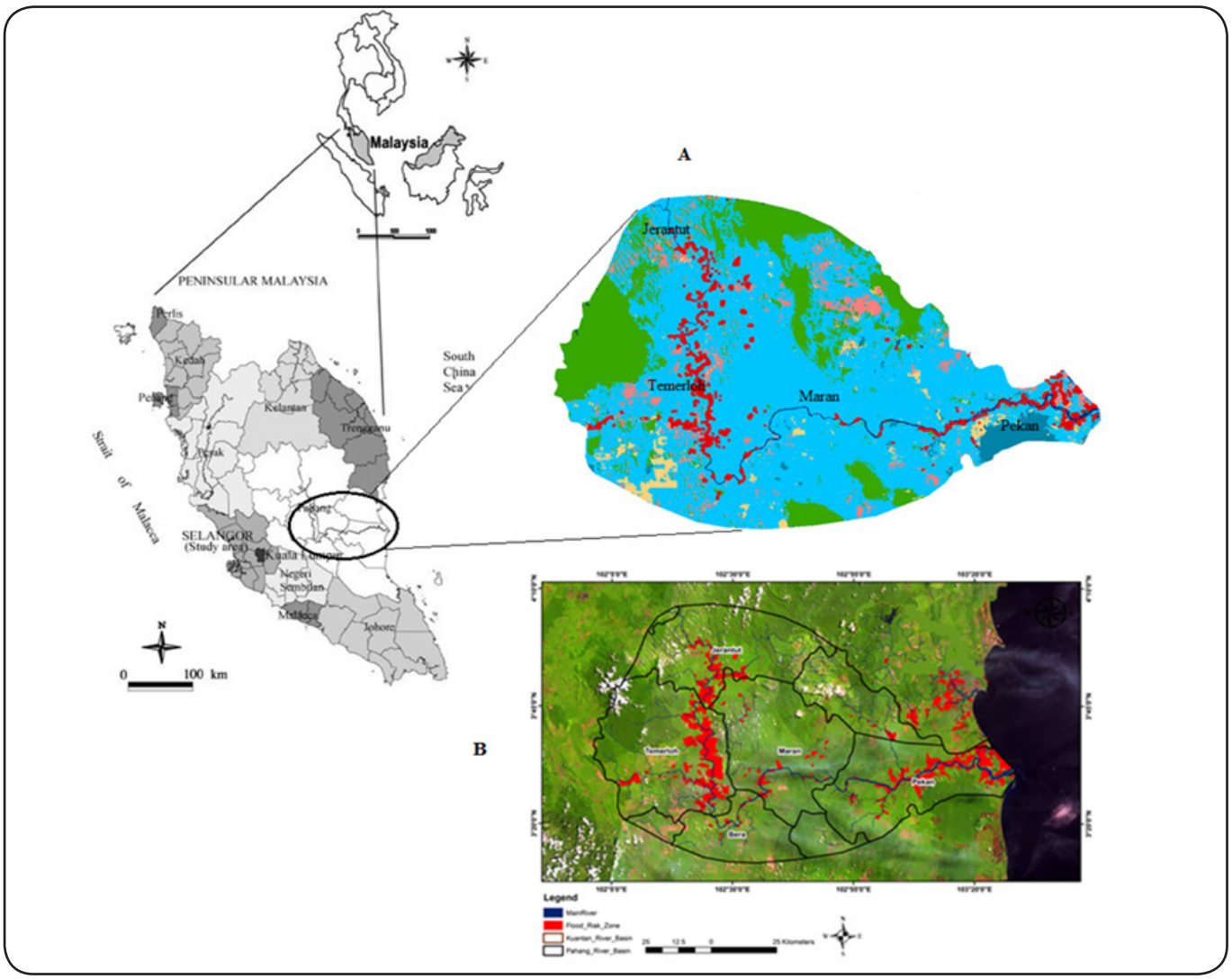


*Figure 2. Geographical distribution of study area, the Pahang River Basin. Decision support system delineated the flood affected communities (A) and the flood risk zones (B), marked as red coloured areas on the maps.*

The disappearance of these wetland ecosystems may be the main reason for prolonged floods around the many places in the PRB. Findings show that the preparedness of the flood and awareness programmes of the existing disaster management initiatives are inadequate.

Based on these findings, an integrated flood disaster risk map is produced (Figure 2). It is also identified that, the preparedness of the flood and awareness programmes of the existing disaster management initiatives is inadequate. Nevertheless, this study also tried out the attitudes and resilience of the stakeholders. It identified the community and different stakeholders from the Village to Mukim levels who are willing to work with the holistic approach for facing potential disasters.

Based on the findings of this research, it is proposed that the remnant wetland ecosystems must be preserved and therefore any kind of further evolution of these landscapes should be declared as prohibited. Necessary legal measures need to be adopted at once. The ecosystem approach of the entire river catchment area or the region must be taken into account while the government take action for structural solution as part of the flood disaster management of this water catchment area. The development and extensive commercial agricultural sprawl should be controlled so they are not contributing to the sandy sediment to the flow and causing the river shallow. It is also recommended for the scientifically designed and effective awareness and resilience building programmes for the communities whereby the government may get valuable help from the academia. We assume, this integrated multi-metric and multi-aspect decision supporting guidelines and spatially explicit maps, are able to support effective and long-term flood disaster management strategies in the Pahang River Basin area.

## REFERENCES

Innocenti, D., Albrito, P. (2011). Reducing the risks posed by natural hazards and climate change: the need for participatory dialogue between the scientific community and policy makers. Environmental Science & Policy 14: 730-733.

Islam, M. S., Swapan, M. S. H., Haque, S. M. (2013). Disaster risk index: How far should it take account of local attributes? International Journal of Disaster Risk Reduction 3: 76-87.

Kou, G., Shi, Y., Wang, S. (2011). Multiple criteria decision making and decision support systems. Decision Support System 51: 247-249.

Mansor, S., Abu Shariah, M., Setiawan, I., Jabar, F. (2004). Spatial technology for natural risk management. Disaster Preventiaon and Management 13 (5): 364-373.

Muhamad, N., Lim, C., Reza, M. I. H., Pereira, J. J. (2013). Geological Input for Decision Support System to Manage the Risk of Disasters: A Case Study of Universiti Kebangsaan Malaysia. Bulletin of the Geological Society of Malaysia 59: 73-84.

Saaty, T. L., Vargas, L. G. (2000). Models, Methods, Concepts and Applications of the Analytic Hierarchy Process, Boston: Kluwer Academic Publishers.

Sprague, J. R. H., Watson, H. J. (1989). Decision Support System, putting theory into practice (2nd ed.). UK. Prentice-Hall International Edition.

Thomas, D. S. K., Kaivang, E., Kemec, S. (2007). The role of geographic information system/remote sensing in disaster management. Handbook of Disaster Research & Handbook of Sociology and Social Research, pp. 83-96.



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# Pendekatan Bukan Struktur Dalam Menangani Banjir Kilat Di Kawasan Perbandaran


*Tanot Unjah [a] & Norashikin Samsuri*


### Pengenalan

Perangkaan oleh World Disaster Report (2015) melaporkan Asia adalah antara benua yang paling kerap mengalami musibah bencana. Sepanjang tempoh tahun 2000-2010, sejumlah lapan daripada 12 bencana besar yang terjadi di dunia berlaku di Asia. Banjir merupakan bencana yang dijangka meningkat pada masa mendatang ini dan fakta ini disokong oleh kajian terdahulu (seperti Noji 2000; Jonkman & Kelman 2005) Negara-negara Asia berhadapan impak bencana banjir dan hampir 50 peratus membawa kepada kematian sepanjang tempoh suku terakhir abad ke-20.

### Banjir Kilat

Banjir kilat merupakan fenomena yang biasa dan lebih kerap berlaku di kawasan bandar. Banjir kilat merujuk kepada aliran air yang banyak dan berkelajuan tinggi atau kenaikan paras air yang berlaku secara tiba-tiba dalam jangka masa yang singkat selepas hujan lebat dalam tempoh yang panjang (Jonkman & Kelman 2005). Kenaikan paras air ini berpunca daripada hujan lebat, ribut petir, taufan, ribut tropika atau pencairan ais, aliran salji, kepingan ais atau medan salji. Banjir kilat juga boleh disebabkan oleh empangan yang pecah atau air sungai yang melimpahi tebing biasanya oleh hujan yang berlaku dalam tempoh kurang daripada enam jam. Di kawasan tanah rendah, banjir kilat berpunca oleh tanah yang tepu air selepas hujan lebat dalam tempoh yang panjang sehingga aliran air melimpah dan mengalir di permukaan. Limpahan sungai ini turut membawa bersama batuan, tanah dan debris.

### Banjir Kilat di Kawasan Perbandaran

Impak banjir kilat adalah di kawasan perbandaran adalah lebih besar dan melibatkan banyak kerosakan kerana aliran air banyak dengan kelajuan tinggi atau kenaikan paras air yang cepat dan secara tiba-tiba sehingga tidak memberikan peluang kepada mangsa-mangsa untuk melakukan persediaan berpindah. Reka bentuk dan permukaan bandar menyebabkan larian air permukaan berlaku lebih cepat berbanding dengan kawasan luar bandar walaupun kuantiti air yang sama menyebabkan kawasan bandar cepat dan mudah ditenggelami air. Banjir kilat memberi impak besar daripada segi kerosakan struktur, kehilangan nyawa

dan harta benda, pencemaran bahan makanan, air; gangguan kepada aktiviti sosio-ekonomi termasuk pengangkutan dan komunikasi.

Di Malaysia, banjir kilat di kawasan perbandaran menjadi insiden yang biasa kepada komuniti bandar khususnya Kuala Lumpur. Kebelakangan ini bandar-bandar baru seperti Klang, Selangor, Kajang Selangor, Seremban Negeri Sembilan, Muar, Johor Bahru, Skudai dan Segamat di Johor telah mencatatkan kejadian banjir kilat yang kerap dan memerlukan pendekatan yang bersesuaian bagi mengurangkan impaknya dalam jangka masa panjang.

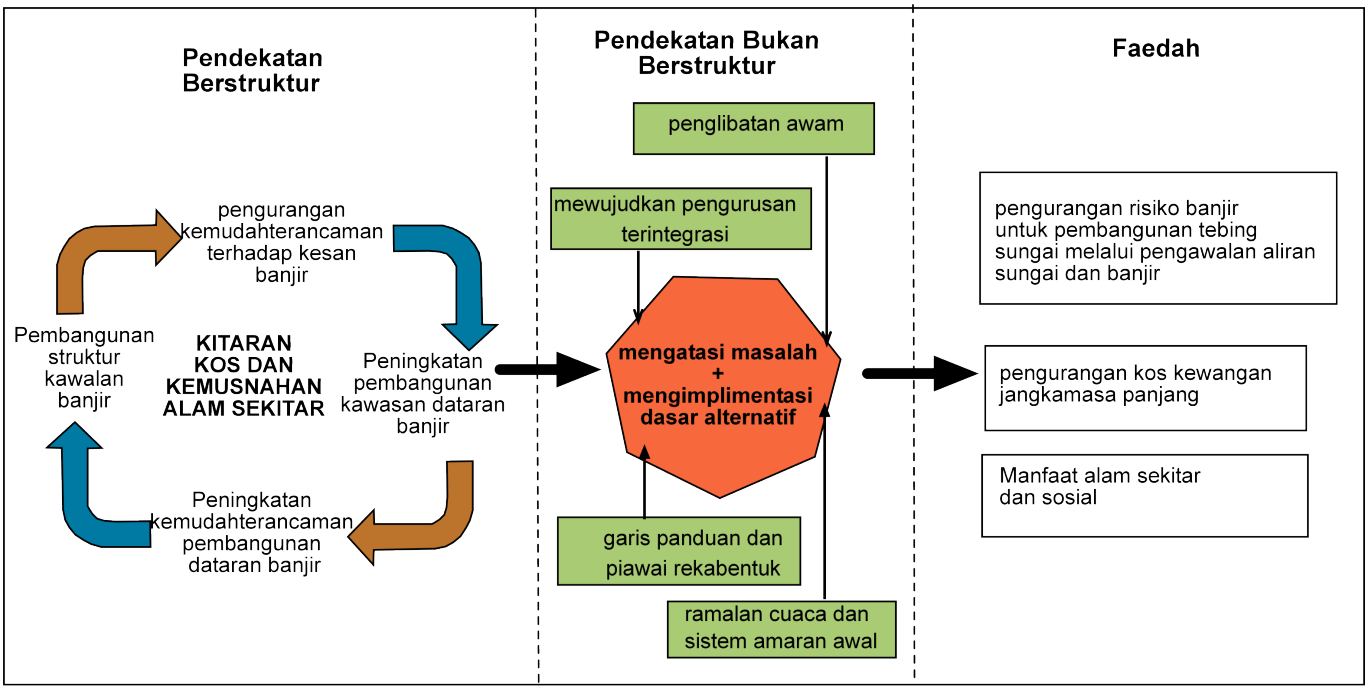
**Menangani Banjir Kilat**

Usaha menangani banjir kilat di kawasan perbandaran telah disyorkan selepas kejadian banjir kilat buruk di Kuala Lumpur pada tahun 1971. Terdapat dua pendekatan utama yang dicadangkan iaitu pendekatan berstruktur dan pendekatan bukan struktur (Chua, 2004). Pendekatan berstruktur adalah usaha menangani masalah banjir kilat semasa yang melibatkan pengukuhan tebing sungai, pembinaan empangan dan takungan berkala, pengubahsuaian saliran, pengubahsuaian penyerapan dan pelencongan aliran air. Pendekatan ini melibatkan binaan kejuruteraan yang besar dan kompleks. Manakala pendekatan bukan berstruktur pula melibatkan kaedah seperti peramalan dan amaran banjir dan perancangan untuk kecemasan, kawalan guna tanah, pemindahan atau pengambilan semula tanah, insuran banjir dan penyebaran maklumat kepada penduduk setempat dan pihak awam.

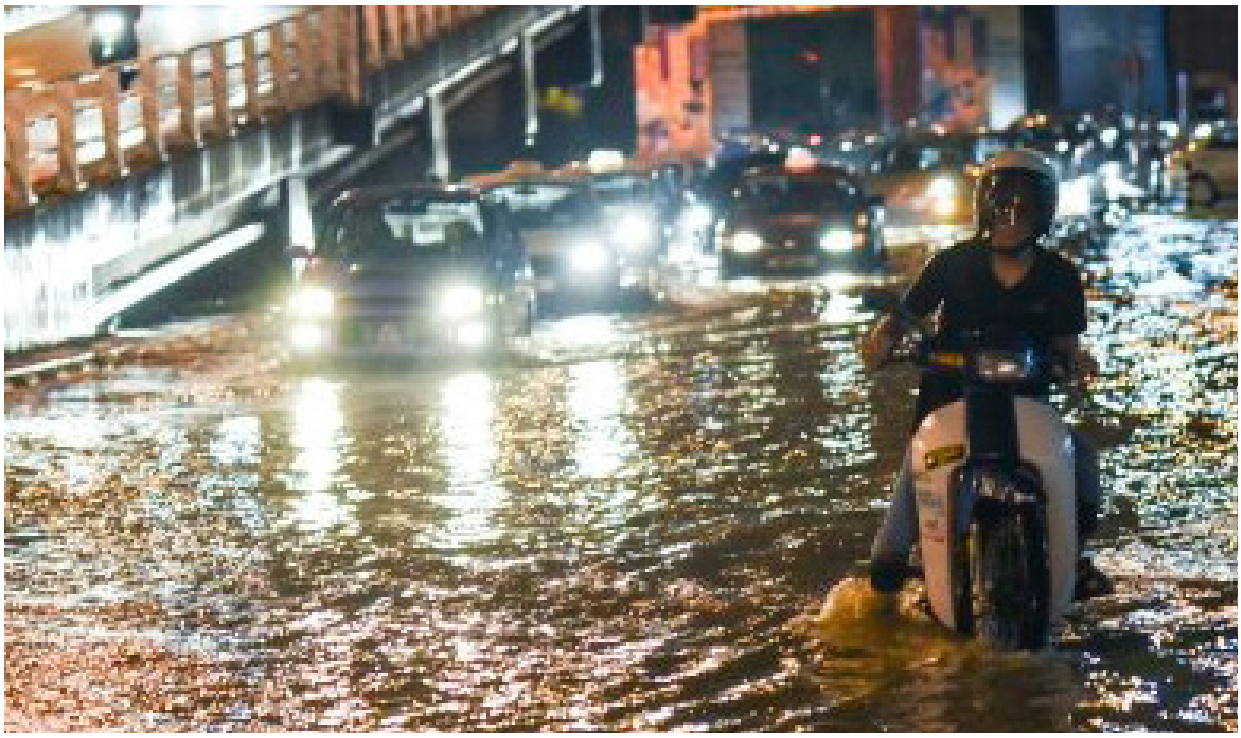
Gabungan pendekatan berstruktur dan bukan berstruktur adalah penting dalam menangani banjir dan keseimbangan kedua-dua pendekatan ini perlu dicapai mengikut kesesuaian kawasan. Pendekatan bukan berstruktur merupakan pendekatan yang tidak melibatkan pembangunan secara fizikal tetapi lebih kepada penggunaan pengetahuan, praktik, atau persetujuan untuk mengurangkan risiko dan impak khusnya melalui pelaksanaan dasar dan undang-undang, peningkatan kesedaran awam dan pendidikan.

**Menangani Banjir Kilat Melalui Pendekatan Bukan Struktur**

Menangani Isu banjir kilat secara khusus di Malaysia lebih tertumpu kepada penyelesaian banjir kilat di Kuala Lumpur berbanding kawasan perbandaran lain yang mungkin telah dilaksanakan oleh pihak perbandaran masing-masing. Antara pendekatan semasa yang bersifat berstruktur adalah pengukuhan sungai utama iaitu Gombak dan Klang, pemesongan aliran air dengan mewujudkan terowong *smart* dan pembinaan tapak pengumpulan air hujan bagi mengurangkan aliran air di hulu sungai. Usaha ini telah sedikit sebanyak menyumbang kepada pengurangan kesan banjir. Pendekatan struktur ini memerlukan kos yang tinggi dan memerlukan jangka masa panjang untuk melaksanakannya.




*Rajah 1: Langkah pengurusan banjir bukan berstruktur*
*Sumber: Ubahsuai daripada Lyle (2001); Chia Chong Wing (2004)*



*Kejadian banjir kilat di kawasan perbandaran menjejaskan infrastruktur kemudahan awam dan harta benda mangsa.*
*Foto: Berita Harian (13 Mei 2016)*

Sehingga kini pendekatan bukan berstruktur lebih cenderung kepada usaha-usaha memetakan kawasan berpotensi banjir, pengenalpastian komuniti dan punca banjir kilat, pembersihan sungai Gombak dan Klang, pengenalpastian keperluan dan pengukuhan sistem amaran awal serta pengenalpastian tahap kesiapsiagaan penduduk Kuala Lumpur menangani banjir.

**Langkah ke Hadapan**

Usaha menangani banjir kilat di kawasan perbandaran adalah sesuatu yang kritikal dan perlu pertimbangan tinggi oleh pihak berkepentingan. Penekanan terhadap pendekatan bukan berstruktur berpotensi mengurangkan kos pengurusan banjir kilat dalam jangka masa panjang. Melalui usaha pengenalpastian kawasan potensi banjir, kawasan tadahan dan takungan semulajadi, pengekalan kawasan teres banjir atau pembangunan dengan pendekatan khusus kawasan berkenaan, penggubalan dasar yang menyokong pelaksaanaannya di peringkat perbandaran adalah antara langkah-langkah awal ini

Di samping itu, kawasan yang menunjukkan tanda-tanda awal banjir kilat, selain pendekatan berstruktur pendekatan bukan berstruktur yang melibatkan pemahaman, pendidikan dan penglibatan komuniti setempat adalah penting. Bagi mewujudkan bandar yang selamat didiami dan memberikan kesejahteraan kepada penduduknya banjir kilat di kawasan perbandaran merupakan isu yang perlu diberi perhatian dan diatasi sebelum menjadi bencana besar. Adalah lebih baik memadam api semasa ia kecil daripada membiarkan ia besar dan berusaha memadamkannya.

**Rujukan**


Chua Chong Wing. 2004. Managing Flood problems in Malaysia. Bulletin Ingenieur. 38-43

Jonkman SN & Kelman I 2005. An analysis of the causes and circumstances of flood disaster deaths. Disasters. 29(1):75-97. 2.

Noji E. Public Health Issues in Disasters. Critical Care Medicine. 2000; 33(1):S29S33. 3.

Lyle, Tamsin Sara. 2001. Non structural flood management solution for Lower Frazer Valley British Columbia. M.R.M Thesis. Simon Fraser University. Canada



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# JASAMU DIKENANG:
# Penghargaan dan Terima Kasih kepada Profesor Emeritus Chamhuri Siwar

*Profesor Emeritus Chamhuri Siwar telah memulakan perkhidmatan di Institut Alam Sekitar dan Pembangunan (LESTARI) Universiti Kebangsaan Malaysia pada tahun 1999 atas jemputan mantan Pengarah LESTARI pada ketika itu Profesor Emeritus Dr. Ibrahim Komoo. Menyorot latar belakang perkhidmatannya, Profesor Emeritus Chamhuri memulakan khidmat sebagai pensyarah di UKM pada tahun 1974 di Fakulti Ekonomi (sekarang Fakulti Ekonomi dan Pengurusan) sebagai tutor. Dilantik ke jawatan Profesor Madya pada tahun 1988 dan Profesor pada tahun 1994. Pada Majlis Konvokesyen Ke-37, beliau telah dianugerahkan gelaran Profesor Emeritus. Daripada segi pengalaman pentadbiran, beliau pernah menggalas jawatan sebagai Ketua Jabatan Ekonomi Pertanian dan Sumber, Fakulti Ekonomi. Selepas berpindah perkhidmatan ke LESTARI, beliau diberi amanah untuk mengetuai Kumpulan Teras Sosio-ekonomi.*

*Minat beliau yang mendalam terhadap penyelidikan terserlah menerusi penglibatannya sama ada menerusi pembiayaian dalam negara dan juga luar negara. Bidang penyelidikan yang merupakan kepakaran dan minat beliau ialah kemiskinan, pembangunan luar bandar, pembangunan pertanian dan pembangunan lestari. Beliau juga merupakan tenaga akademik yang aktif dalam menerbitkan makalah-makalah ilmiah seperti buku, bab dalam buku, kertas jurnal, monograf.*

*Kesarjanaan Profesor Emeritus Chamhuri Siwar telah menarik pelajar-pelajar tempatan dan luar negara untuk berguru dengan beliau. Beliau telah berjaya melahirkan kira-kira 40 graduan Ijazah Doktor Falsafah (PhD) dan 20 graduan sarjana. Khidmat kepakaran beliau turut menjadi rujukan di kalangan pihak-pihak berkepentingan seperti Unit Perancang Ekonomi, Jabatan Perdana Menteri, Kementerian Pertanian dan Industri Asas Tani, Kementerian Kemajuan Luar Bandar dan Wilayah, Kementerian Kesejahteraan Bandar, Kementerian Pendidikan Tinggi Yayasan Basmi Kemiskinan. Profesor Emeritus Chamhuri juga membina rangkaian penyelidikan antarabangsa, antaranya United Nations Development Programme (UNDP), dan Asian Development Bank (ADB).*

*Seluruh warga LESTARI mengucapkan jutaan penghargaan dan terima kasih kepada beliau sepanjang kira-kira 18 tahun perkhidmatan di LESTARI dan 30 tahun di UKM. Semoga Allah S.W.T memberi kesihatan baik dan kesejahteraan berpanjangan kepada Profesor Emeritus Chamhuri Siwar. Selamat beristirehat dan menikmati masa berharga bersama keluarga.*

*Disediakan oleh: Rospidah Ghazali*

# AKTIVITI LESTARI JANUARI - JUN 2017

*LESTARI'S ACTIVITIES JANUARY - JUNE*

Lunching Ceremony - "Malaysia - Window - To - Cambridge @ UKM" (19 January 2017, Bilik Majlis, UKM)

Universiti Kebangsaan Malaysia Workshop on Disaster Resilient Cities: Risk Assesment and Forecasting for Geophysical and Atmospheric Hazards (9-10 March 2017, Hotel Istana, Kuala Lumpur)

Research Methodology: Questionnaire Design Series 1/2017 (15 March 2017, LESTARI, UKM)

Training of Trainers - Program Lestari Rakyat 2017 (24-26 Mac 2017, Terengganu)

Wacana Kelestarian bertajuk "Planetary Boundaries and Sustainability" oleh Prof. Emeritus Dr. Mohd Nordin Hasan (3 Mei 2017, LESTARI, UKM)

Konvesyen Kampus Lestari (22-24 Mei 2017, Fakulti Sains dan Teknologi, UKM)

# BELASUNGKAWA

## Prof. Madya Dr. Shaharudin Bin Idrus (1968-2017)

"***Dari Allah kita datang, kepada Allah jua kita kembali***"


Pada 29 Januari 2017 bersamaan 1 Jamadilawal 1438 Hijriah, kira-kira jam 2.40 petang, Institut Alam Sekitar dan Pembangunan (LESTARI), Universiti Kebangsaan Malaysia (UKM) telah kehilangan seorang warga yang turut merupakan sahabat, Prof. Madya Dr. Shaharudin Bin Idrus. Allahyarham Dr. Shaharudin yang dilahirkan pada tanggal 5hb Oktober 1968 di Kampung Batu 8 Behrang Ulu, Tanjung Malim, Perak telah menghembuskan nafas terakhir akibat serangan jantung. Jenazah telah dikebumikan di kampung halaman Allahyarham pada hari yang sama.

Menyelusuri latar belakang pendidikan, Allahyarham menerima pendidikan awal di Sekolah Kebangsaan Behrang Ulu, Tanjung Malim dan kemudiannya meneruskan alam persekolahan di Sekolah Menengah Khir Johari Tanjung Malim, Perak sehingga tamat Tingkatan Enam Atas. Allahyarham melanjutkan pengajian di UKM dan memperolehi Ijazah Sarjana Muda Sains Pembangunan (1992); Sarjana Pengurusan Persekitaran (1996); dan Doktor Falsafah (PhD) dalam bidang Geografi dari Universiti Sains Malaysia (2014). Allahyarham memulakan perkhidmatan di LESTARI pada 19 April 1999 dengan jawatan terakhir sebagai Felo Kanan/ Profesor Madya. Allahyarham juga menyandang jawatan Ketua Hal Ehwal Jaringan Masyarakat dan Industri, LESTARI. Dikenali sebagai seorang yang amat komited dan berdedikasi dalam menjalankan tugas, Allahyarham memiliki kepakaran dalam bidang kajian ekosistem dan kelestarian bandar, daya huni bandar dan perumahan, Sistem Maklumat Geografi (GIS) dan pendidikan alam sekitar. Allahyarham juga merupakan antara penggerak utama dalam mempelopori konsep *extended mega-urban region* bersama-sama Profesor Emeritus Dato' Dr. Abdul Samad Hadi, Profesor Madya Dr. Ahmad Fariz Mohamed dan Allahyarham Prof Madya Abdul Hadi Harman Shah. Menurut Profesor Emeritus Dr. Terry Mc Gee, (University of British Columbia), Allahyarham merupakan ahli akademik yang dibentuk dan dilatih secara tempatan namun mempunyai pandangan dan pengalaman global. Sepanjang perkhidmatan di LESTARI, Allahyarham telah melibatkan diri dengan lebih 40 projek penyelidikan sama ada sebagai ketua projek atau penyelidik bersama. Antara penyelidikan termasuklah:

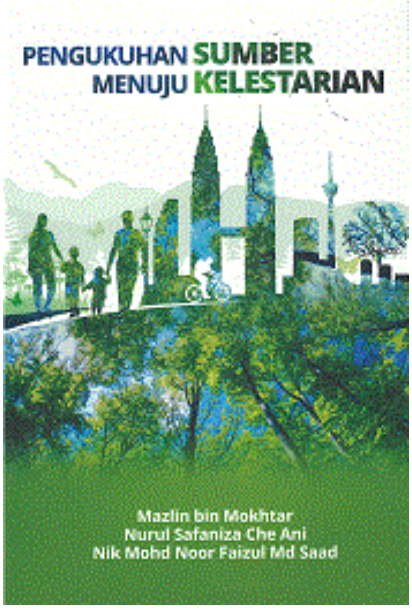
- *Accessibility to Goods and Services in Shaping a Livable City in the Linggi to Bernam Mega-Urban Region: Case Seremban Municipality (2012-2014);*
- *Development of a Grounded Socio-spatial Urbanization Theory for Malaysia's Secondary City Region (2012-2014);*
- *An Investigation into the Forms and Processes of Counter-Urbanization for Livable City: Case of Seremban Municipality in the Extended Mega-Urban Region (2011 - 2014);*
- *Developing Metabolism Concept for Urban Sustainability (2007 - 2008);*
- *Membina Indeks Kesedaran Dan Komitmen Untuk Membudayakan Penghijauan (Developing Awareness and Commitment Index for a Green Culture) (2013-2015);*
- Pemindahan Ilmu Transdisiplin untuk Kelestarian dan Dayahuni (Transdiciplinarity Knowledge Transfer for Sustainability and Livability) (2012 – 2014; and
- Meneroka Konsep Metabolisme Perumahan dalam Kejiranan Besar (Urban Neighbourhood) (2010 – 2014)

Allahyarham telah menerbit kira-kira 170 penerbitan yang meliputi buku, monograf, jurnal, laporan teknikal dan akhbar. Allahyarham turut aktif membina jaringan bersama dengan pihak kerajaan, industri dan korporat. Allahyarham meninggalkan seorang isteri Hasnah Hj. Zain dan empat orang anak Mohd Ikhwanul Haqieqie (21 tahun), Mohd Ikhwanul Fiqrie (19 tahun), Mohd Ikhwanul Zikrie (17 tahun) dan Nurul Ainul Syafiqah (16 tahun). Sesungguhnya warga LESTARI dan UKM amat merasai kehilangan seorang ahli akademik yang berwawasan dan insan yang berperibadi tinggi. Semoga roh Allahyarham ditempatkan di kalangan orang-orang yang beriman. AL-FATIHAH

*Disediakan oleh: Nik Mohd. Noor Faizul Md. Saad*

# PENERBITAN TERKINI
*CURRENT PUBLICATION*

## PENGUKUHAN SUMBER MENUJU KELESTARIAN




*Buku Pengukuhan Sumber Menuju Kelestarian diterbitkan bertujuan berkongsi pengalaman dan analisis kepada data serta informasi mengenai sebuah institut penyelidikan di Universiti Kebangsaan Malaysia (UKM) iaitu Institut Alam Sekitar dan Pembangunan (LESTARI). LESTARI kini berusia 22 tahun pada tahun 2016, bertanggungjawab dalam menjalankan penyelidikan dan pembangunan multi-inter- dan trans-disiplin dalam bidang alam sekitar dan pembangunan lestari yang diharap memberi impak positif kepada pelbagai pihak berkepentingan di Malaysia dan dunia. Buku ini menyentuh aspek governan, sumber manusia, kewangan, penyelidikan dan pembangunan, ilmu dan teknologi, jaringan, jangkauan, khidmat nasihat, pembangunan keupayaan insan, penerbitan, dan infrastruktur untuk menjadi pusat rujukan di peringkat kebangsaan dan antarabangsa. Buku ini diharap berguna sebagai rujukan kepada warga pentadbir, profesional, pegawai, pensyarah, mahasiswa/siswi dan masyarakat umum, termasuk para profesional di sektor swasta, industri dan non-governmental organization (NGO) demi mencapai matlamat Wawasan 2020 dan Sustainable Development Goals (SDGs).*

*Editor: Mazlin Mokhtar, Nurul Safaniza Che Ani & Nik Mohd Noor Faizul Md Saad*