

*Review Article*

## **Kedah Water Resources Enactment 2008 for Sustainable Agriculture Development**

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### **ABSTRACT**

The agriculture sector in Malaysia contributes significantly to the country's economic growth and to national development. The series of Malaysia Development Plans (Plans) or 'Rancangan Malaysia', has set out strategies to ensure that productivity and growth of the agricultural industry become a mainstay of the five-year development programmes. The link between sustainable agriculture and sustainable water resources is acknowledged in the plans, and in several policy documents. In Kedah, Malaysia's rice bowl, the Kedah Water Resources Enactment 2008 provides nine key regulatory aspects that can help realise the goals of sustainable agriculture. This paper briefly discusses the enactment, particularly the role it can play in ensuring sustainable development of the agriculture sector through efficient water-resource management.

*Keywords:* Sustainable water resources, sustainable agriculture, Kedah Water Resources Enactment 2008

### **INTRODUCTION**

Since the nation's independence in 1957, the agriculture sector has become one of the key contributors to Malaysia's development.

The trends that chart the growth as well as the direction for the development of the sector are encapsulated in the Malaysia Plans. The First Malaysia Plan, spanning a period from 1966 to 1970, took note of the need to expand the sector and made provisions for strategic policy directions for intensive investment and the opening of new agricultural areas. In the Second Malaysia Plan (1971-1975), it was noted that the strategic push enforced in the First Malaysia Plan had helped generate up to one

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third of the Gross Domestic Product (GDP), provided employment and accounted for about 50% of Malaysia's foreign exchange earnings. In the Eleventh Malaysia Plan (2016-2020), it was noted that the sector had contributed RM455 billion to the nation's GDP, with a 2.4% growth per annum during the years of the Tenth Malaysia Plan, 2011 to 2015.

The Eleventh Malaysia Plan, which is currently in implementation, lays further emphasis on transforming and modernising the agro-food and industrial commodity sector so as to ensure that it will yield higher revenue and become a sustainable sector (Eleventh Malaysia Plan, 2015). Seven strategies were proposed in an effort to support the transition of the agriculture sector into an agribusiness sector i.e. improving and increasing the income of agropreneurs; promoting the training and development of agropreneurs, particularly among the youth; strengthening institutional support and extension services; building capacity of agricultural cooperatives and associations along the supply chain; improving market access and logistical support; scaling up access to agricultural financing; and intensifying performance-based incentives and certification programmes (Eleventh Malaysia Plan, 2015).

This echoes the directions put into place in the previous Third National Agricultural Policy spanning the period from 1998 to 2010 (NAP3) that outlined the strategies and approaches, which among others, focussed on optimising productivity as well as securing and enhancing food security (Third

National Agricultural Policy, 1998). With the aspiration of becoming a high income country by the year 2020, the Government has taken the initiative to include the sector in its Economic Transformation Programme (ETP) as the sector has been identified as one of the 12 National Key Economic Areas (NKEAs) given its potential to contribute to the nation's Gross National Income (GNI) (PEMANDU, 2013).

Following on from this, the National Agro-Food Policy (2011-2020) has been adopted to replace the NAP3, focussing on ensuring food availability, security and safety; competitiveness and sustainability of the agrofood industry; and income increase of agropreneurs (National Agro-Food Policy, 2011). Measures relating to the export of agricultural commodities have been further strengthened with the adoption of the National Commodity Policy 2011-2020, with strategic directions set to increase the development of the plantation and commodities industry towards meeting the aspirations of achieving Vision 2020 (Economic Planning Unit, 2013).

The sustainability of the sector is dependent on many factors, one of which is the availability and secure supply of water. Water-resource management is a critical aspect in the Eleventh Malaysia Plan 2016-2020, and both water resources and agriculture have been given specific focus, particularly to aid efforts to mitigate the impact of climate variability and change (Eleventh Malaysia Plan, 2015). This is echoed in the National Agro Food Policy 2011-2020, which recognises the

importance of improving irrigation and drainage infrastructure to help manage water resources efficiently to support the productivity of crop yields and secure food supply through measures such as the introduction of paddy seed varieties that use less water (National Agro Food Policy, 2011).

A dedicated National Water Resources Policy adopted in 2012 ('2012 Policy') also sets out policy direction and strategic thrusts to ensure sustainable use of water resources. The 2012 Policy emphasises the need to ensure the security and sustainability of water resources, which is made a national priority to ensure adequate and safe water for all. The 2012 Policy takes on a complementary two-pronged approach i.e. the sustainable use, conservation and effective management of water resources enabled by a mechanism of shared partnership involving all stakeholders. The sixth policy thrust of the 2012 Policy makes specific mention of the need for conservation and protection of water resources setting out specific targets, where priority use and users are determined at the outset before an allocation and management plan is developed based on demand priority and resource availability (National Water Resource Policy, 2012).

The state of Kedah, in the north of Peninsular Malaysia, is given focus in this paper, as it is historically known as the country's 'Rice Bowl' or 'Jelapang Padi', with paddy farming areas making up 14.4% of the state's agricultural area (Kedah Structure Plan 2020, 2011). Areas under the Muda Scheme, the Department of Irrigation

and Drainage irrigation scheme in the district of Yan and west of Kubang Pasu will continue to remain as paddy farming areas and will continue to receive further attention to spur optimal production to help meet food security targets (Kedah Structure Plan 2020, 2011). Kedah was also chosen because it has a specific water-resources related enactment that can be used as a means to translate the national policy directions stated earlier.

The Kedah Structure Plan 2020 also sets out policy measures for controlled development so as to ensure that water supply, quality and yield are not affected so as to negatively impact paddy production. This sits well with the Kedah Water Resources Enactment 2008 ('2008 Enactment'), which seeks to provide for controlled use, development and protection of water resources in a more integrated manner. As the agriculture sector is the main growth sector in Kedah, the management of its water resources for multiple and equitable use is critical, and options to translate ideal solutions for sustainable agriculture and water development will have to be made within the remits of the law. This would ensure that proper measures are instituted and a chain of responsibility as well as accountability is established.

The following sections of this paper briefly discuss the role of the Kedah Water Resources Board as established under the said 2008 Enactment and the statutory provisions therein on the role it plays and can play in ensuring sustainable agriculture development through efficient water-resource management. In order to identify

the provisions that fit the options for balance, the basic elements that are essential for sustainable agriculture are looked at, albeit, cursorily.

## **WATER AND SUSTAINABLE AGRICULTURE DEVELOPMENT**

The sustainable development goals of 2015 (SDG 2015) place great emphasis on food security and promotion of sustainable agriculture (United Nations, 2014). At The World Food Summit 1996, food security was defined as the condition in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The FAO (2015) looks at sustainable agriculture as being that which involves increasing and generating adequate crop yield and livestock products without compromising the equal status of people, natural resources and ecosystem services.

There is a strong connection between sustainable agriculture, food systems, and agri-food value chains, as noted by the United Nations, that can help address issues relating to hunger and food insecurity, thus reducing cases of malnourishment. It also has the potential to help balance and meet the growing demand for food, feed, fuel and fibre, as this link will ensure agricultural systems become more productive and less wasteful (United Nations, 2013). In order to sustain food supply for the future, the United Nations (2014) recommended the adoption of ecologically and socially sustainable agriculture through better investments,

enhanced legal frameworks, provision of secure access to information, particularly in land and water management, and better agricultural practices as well as land use planning, which can help build resilience to impact from climate change.

Velten et al. (2015) noted that there are multiple takes on the definition or concept of sustainable agriculture, given that there are various viewpoints grounded on different types and sectors of agriculture. Abubakar and Attanda (2013) suggested that the concept of sustainable agriculture should be closely linked to environmental changes and their impact on society, the environment and economic value. Pretty (2008) proposed that sustainability in agricultural systems encompasses the concepts of resilience and ability to address economic, social and environmental outcomes. Among the key elements identified are the integration of biological and ecological processes into food production processes, minimisation of the use of non-renewable inputs, better use of existing resources, minimisation of human capital costs and also cooperation from various stakeholders in addressing and solving agricultural problems (Pretty, 2008). The United Nations (2013) noted that sustainable agriculture and food security would require specific actions that are comprehensive in application. These actions should take into account the need to increase agricultural productivity and improve efficiency of resource use; increase the income of farmers and employment opportunities; conserve ecosystems and water as well as improve land use management;

improve the access and distribution of food supply; take into consideration value-added aspects of primary commodities and agri-food value chains; and institute measures to ensure resilient food production systems and promotion of food security. These considerations will also require recognition of indigenous and local knowledge in developing agricultural policies.

The need to consider ecological and environmental changes and to ensure sustainability highlights water as the key component in agricultural activity that requires specific focus. The agriculture sector is the biggest consumer of water; several studies have noted that the sector consumes about 70% of water resources (Braimoh, 2013; FAO, 2013; Lal, 2015; UNESCO, 2015). The utilisation of water resources for agriculture is expected to be adequate up to 2050 globally; however, due to the unsustainable use of water resources, there will be water scarcity in many regions (FAO, 2015; Lenton, 2014). Furthermore, various publications have also cautioned that unsustainable agricultural practices can lead to pollution and degradation of the environment, which in turn will have a big impact on the sector (Braimoh, 2013; Lenton, 2014). Other potential impacts will also have to be looked at, including salinisation and waterlogging (Heuperman et al., 2002; Cai et al., 2011) as well as city expansion and urbanisation, which can lead to stress to existing and future availability of water (Cai et al., 2011).

There is also a need to take into account the potential threats and impact from climate

change and extreme climate events; despite assurances of adequacy, the situation could be made worse in light of emerging threats and the ensuing risks (Braimoh, 2013; Bakkes et al., 2009). Extreme climate events have great bearing on the sustainability of the sector. A case in point would be the prolonged drier climate or the 'Big Dry' in the Murray Darling Basin, Australia from 1997 to 2009 that impacted farmers greatly, resulting in a decrease in the yield of crops and deterioration of the environment (Wei et al., 2011).

Braimoh (2013), for example, proposed that agriculture should be pinned to climate-smart agriculture (CSA). CSA looks to address the challenges of food security and climate change, including agriculture, which is a source of greenhouse gas emission (FAO, 2015). Assouline et al. (2015) proposed the use of desalinated water (DS) as an alternative to freshwater for irrigation. The application of treated effluents (TE) for irrigation may have an adverse impact on the quality of soil over the long term (Assouline et al., 2015).

Country examples were also noted, such as Australia, which adopted water trading as one of the measures to help address the problem of water scarcity (Ashton et al., 2009). Furthermore, as in the case of Australia, the prolonged critical drought led farmers to change their water application methods as well as to enhance the irrigation infrastructure (Ashton et al., 2009).

Another option to deal with water scarcity is to put into place measures for water productivity assessment, with a focus

on improving yields, with less water used in securing food supply and maintaining livelihood (Cai et al., 2011). This was also echoed by Chartzoulakis and Bertaki (2015), who described sustainable water management in agriculture as an approach that facilitates meeting water supply and demand both in quality and quantity in time and space, at reasonable cost and without compromising the quality of environment.

The legal and institutional framework plays an important role in sustainable water resource management in agriculture. An institution or an agency should be set up for water resource planning, management, operation and decision making so as to avoid conflict with various authorities (Chartzoulakis & Bertaki, 2015). Tilman et al. (2002) stated that policies for sustainable agriculture should be outlined in a way that gives priority to environmental consideration. The Australian National Water Commission supported the idea of environmental needs becoming a priority for consideration in water allocation as reflected in the National Water Initiative (NWC, 2009).

In order to tackle the conflicting issues between different water users, engagement and consultation between different stakeholders should be included in water resource planning and management (Wei et al., 2011). Lenton (2014) suggested that in developing policies for irrigated agriculture, several issues will need to be addressed such as groundwater resource sustainability; water storage management; use-conflict between agricultural purposes

and environmental needs; and incentives for water-efficient application. In developing any agricultural or food security policies, the need to consider water resources is critical as these policies are strongly interlinked with one another (FAO, 2012). This will enable the issues related to water scarcity to be identified and tackled (FAO, 2012).

Traditionally, water management for agriculture has focussed on the irrigation system and farming (Cai et al., 2011). This segmented approach to management can cause further problems, as water resources need to be managed holistically, taking into account the entire river basin, as the issues do not stem only from agricultural problems, but are interlinked, particularly the hydrological aspects and its people (Cai et al., 2011). Multidisciplinary approaches are required in order to address the issues for sustainable use of water resources (Assouline et al., 2015) even in soil application, which requires comprehensive monitoring strategies of soil health as soil properties, and their application is closely related to irrigated agriculture and sustainable use of water resources.

Due to water scarcity, disputes can arise among users of water resources, making institutional and legal frameworks key in helping to resolve existing and emerging issues (Vaidyanathan & Jairaj, 2009). Salman and Bradlow (2006) noted that water-related legislation is relevant and important in managing water resources. This includes addressing ownership and responsibility (Iyer, 2010). There is also the idea of water resources being a public trust,

where the State acts as public custodian of water resources (Salman & Bradlow, 2006).

In guiding the decisions pertaining to water resources, principles and priorities pertaining to conservation, protection, equitable allocation and sustainable use including development of plans for water resources should be specified (Salman & Bradlow, 2006). Other elements suggested by Salman and Bradlow (2006) for water legislation include the regulation of water use, which relates to the requirement of permits and licences; protection of water resources from non-point and point sources; regulation pertaining to wastewater discharge, land use and procedures for enforcement of water quality standards; regulation of water infrastructure; institutional and financial arrangements; enforcement of the regulations and elements of dispute settlement.

Based on the selected literature referenced here, there are several aspects that will have to be considered in determining the role that can be played by the Kedah Water Resources Board through the 2008 Enactment. There is a need for measures and mechanisms that can look at and address environmental change and its impact on society; environmental and economic value of multiple and related resources; direction of development; and the means to improve land use management. It should also look at establishing assessment measures that will look at the state and condition as well as productivity of the sector.

In addition, the measures and mechanisms should also look at existing,

emerging and potential threats and impact of different hazards or environmental impact, including the impact of climatic hazards. Planning options should also be looked at so as to optimise what is available and ensure its sustainability in addition to addressing potential conflict between use and users.

## **LAW, WATER RESOURCES AND AGRICULTURE IN KEDAH**

There are five key regulatory instruments that are directly related to water resources and agriculture in the state of Kedah. These five instruments have bearing on different aspects of water and agriculture. The Kedah Water Resources Enactment 2008 ('2008 Enactment') serves as the primary legal instrument where water resources is concerned for the State of Kedah. The 2008 Enactment makes provisions for the establishment of a Kedah Water Resources Board ('Board') with a mandate to provide for the integrated management of use, development and protection of water resources in Kedah (State of Kedah Legislative Assembly 2008).

The second instrument that has bearing on water would be the National Land Code 1965 (NLC), which provides a comprehensive administrative framework for dealings related to land, including water resources (see Section 5 of the NLC). The NLC does not set out to control State resources but serves to aid the governing of land resources through processes and procedures enforced through rules and regulations. This is crucial, as if water is understood as it is defined in the NLC's

definition of land, which is provided for in Section 5, then the State Authority, in lieu of a specific regulatory instrument over water resources, can still regulate water resources using the NLC. Section 5 interprets land as:

- (a) The surface of the earth and all substances forming that surface;
- (b) The earth below the surface and all substances therein;
- (c) All vegetation and other natural products, whether or not requiring the periodical application of labour to their production, and whether on or below the surface;
- (d) All things attached to the earth or permanently fastened to anything attached to the earth, whether on or below the surface; and
- (e) Land covered by water.

Section 40 of the NLC vests the State Authority with the entire property of all State land within the territories of the State, including all mineral and rock material not disposed of. This would include water as defined in Section 5 above.

The NLC empowers a State Authority to divide territories, districts or sub districts as well as to vary or alter boundaries, which in turn affects the administration and control of water bodies and resources. Rules in relation to objects and purposes pertaining to land and any dealings related to it can be issued, which includes access to, permission and licences as well as regulation and control of dealings related to a particular land

concerned that also includes any water body on it. Section 58 of the NLC for example, addresses matters pertaining to rights of access to and use of alienated lands, whereby a State Authority may carry out works to facilitate the passage of water. In addition, under Section 62, a State Authority can reserve land for any public purposes; this includes land with water bodies in or on top of it, indicating what cannot be separated from water resources and vice versa. This does seem to mean that water can be understood here to fall within the definition of land.

The Muda Agricultural Development Authority Act 1972 sets out the mandate for the promotion, planning and management of MADA-gazetted areas. In addition, it also makes provision relating to matters pertaining to drainage and irrigation infrastructure; management of water resources for granary areas; and improving the economic and social status of farmers.

MADA areas can only be determined, delineated and gazetted after the Ministry of Agriculture and Agro-Based Industries (MOA) consults with the State government of Kedah and Perlis. Urban development is restricted in MADA areas. This legal instrument applies only in areas that have been gazetted under MADA, but as far as water resources that course through these areas are concerned, the 2008 Enactment prevails.

The Irrigation Areas Act 1953 (revised 1989) provides the mandate related to the declaration of irrigation areas for



paddy cultivation (Sections 3 and 4) and classification of land within an irrigation area (Section 6). Any area that has been declared an irrigation area cannot be used, nor activities planned or developed there except for paddy cultivation purposes (Section 5). Section 7 and Section 8 look at payable water rates and their collection.

Under the Irrigation Areas Act 1953 the power to manage irrigation areas by a Drainage and Irrigation Engineer or an officer appointed by the Ruler in Council or Yang DiPertua Negeri in Council of the particular state (Section 9). The person appointed is obliged to provide reports to the Council or Yang DiPertua Negeri in Council of the particular State on matters related to the area in his charge, furnish annual balance sheets showing the receipts on account of water rates and disclose the expenditure on construction, management, supervision and maintenance of the works in his charge. Similar to MADA areas, as far as water resources are concerned the 2008 Enactment prevails.

Sections 10 to 24 of the Irrigation Areas Act 1953 spell out the powers of the officer appointed, which also includes control of matters related to filling up obnoxious water ways, removal of trees or refuse, damage to irrigation works, obstruction or damage, a penalty for wasting water, passage of water, pollution, use of vehicles as well as tampering with irrigation works. The power of arrest for offences against provisions in a number of sections of the Act is also provided for under the said Act.

Land use planning and development has had a great impact on water resources in Kedah. The Kedah Town and Planning Department holds the mandate to oversee, in as far as land use planning for the whole State is concerned, provided for under the Town and Country Planning Act 1976. There are two levels of land use planning and development that are documented into detailed plans and gazetted by the State Authority. They are the Kedah State Structure Plan 2020, endorsed and gazetted in 2011, which is to be used for the whole State, and several separate city, municipal and district area local plans that translate into actions, policies and strategies in the Structure Plan. These plans help set the direction that will guide physical development but does not in any way control land or water.

There are also special area plans that are prepared to facilitate micro planning and land use control at specific levels in specific areas either within district boundaries or inter-district boundaries. In Kedah, water resources and water bodies as well as overall use, particularly for irrigation areas and conservation of water bodies are given much focus in the Kedah Structure Plan 2020. The policy emphasis of the Structure Plan revolves around three key factors i.e. conservation, sustainable use and protection of environmentally sensitive areas. In the preparation of such plans, be it State, Local or Special Area Plans, public participation is mandatory under the Town and Country Planning Act 1976.

## **SUSTAINABLE AGRICULTURE DEVELOPMENT AND THE KEDAH WATER RESOURCES ENACTMENT 2008**

Water resources in the 2008 Enactment are interpreted to include any river, river basin, ground water or water body, and the term 'water body' is taken to mean "any river, lake, pond, wetland, coastal waters, ground water and other bodies or water whether natural or artificial, including its banks and bed or any part thereof or its surroundings" (Section 3). The preamble states that the 2008 Enactment is intended to provide for the integrated management of the use, development and protection of water resources in the State of Kedah. It serves as the encompassing legal instrument that will serve as the management instrument for water resources in Kedah.

In order to manage water resources in Kedah, a Water Resources Board is established, made up of membership from related government departments, agencies and statutory bodies as well as experts who are appointed by the State Authority. In addressing multiple use of water resources in Kedah, subject to Section 6, the Board functions to ensure, maintain and facilitate the integration of water-resource management in order to support the continuous role of ecosystems and maximise the social, economic and environmental benefits; to regulate the transfer of water resources; to promote coordination and cooperation between various stakeholders; to coordinate the development and exploration of additional water resources; to improve their capacity and expertise as an integrated

water-resource management centre; and to advise the State in terms of water transfer between states.

The Board has the power to approve river basin plans; formulate or review legislation, directives and procedures aimed at promoting or facilitating the implementation of integrated water-resource management ('IWRM'); approve development projects related to IWRM; and divide the State into river basin districts and designate and determine boundaries for proper management by a River Basin Committee. It can also approve guidelines, performance standards, methods and procedures pertaining to management, utilisation and conservation of water resources and issue directives (Section 7).

These functions provide an ideal platform to set out measures towards ensuring sustainable agriculture development in Kedah, as it looks at management from an integrated perspective, grounded in maintaining the balance between the role of ecosystems and the benefits gained from development. It also recognises at the outset that there are multiple stakeholders, and three steps are offered to help bring together the many stakeholders i.e. through a River Basin Committee, the development of plans and promotion of cooperation.

A Water Resources Director is appointed by the Board, with specific functions, which includes preparation of river basin plans for approval of the Board and State Authority. The Director also ensures that each plan contributes to the integrated approach in river basin management; prepares and publishes

annual reports on the state of the water environment; prepares and publishes reports on Board activities and implementation of duties and the function of relevant agencies provided for under the 2008 Enactment; prepares development proposals for IWRM; and looks into the administration and management of the Board. The Director also holds the responsibility of ensuring the flow and exchange of information on projects, plans and activities that have bearing on IWRM and keeps the Board informed and updated on Federal Government initiatives on IWRM that have implications for the State (Section 11). In order to carry out his functions, the Director may issue a directive requiring any person or body to provide assistance or data as well as to make inquiries (Section 11).

The functions and roles of the Board and the Director are useful in setting out the platform for collective action, direction and measures relevant for ensuring sustainable agriculture. In addition, with the delineation of river basin areas, issues pertaining to allocation and measures to address issues that may affect availability and quantity of water required for agriculture, including measures to address threats and risks to agriculture and water resources can be looked into. Nine aspects are considered in determining the best measures to help ensure water-resource sustainability for agriculture.

### **River Basin Committees**

The Board has powers to identify and publish in a gazette delineated river basin districts, with each district having a River Basin

Committee responsible for investigating matters that affect management of the area; assisting the Water Resources Director in the preparation of river basin plans and other related reports; and devising programmes stipulated in the river basin plans (Section 15). In carrying out their functions, committee members are required to consult relevant stakeholders from government agencies and members of the public.

Section 15 of the 2008 Enactment does provide an opportunity, where sustainable water resources and agriculture are concerned, to firstly engage all stakeholders, be they mandate holders, users or beneficiaries of the plan. This will allow for concerted action to ensure that each plan devised is able to balance different needs as well as meet as far as practicable the different expectations of different users and mandate holders. This platform can help ensure that the point of conversation will be centred on the river basin, and that a collaborative approach is taken.

The committee will also have an opportunity to consolidate all relevant indicators and benchmarks that will be brought together from a river basin perspective. This will allow discussions on development of indicators that have bearing on water and agriculture, such as scarcity indicators, particularly during incidences of drought. It can also address issues that may arise in relation to determining appropriate volumetric control, including rate of intake, that will aid effective allocation during rainy and dry seasons, as well as weigh options to

put into effect better storage and recharge of catchment areas.

### **River Basin Plans**

Section 7 of the 2008 Enactment provides the Board with powers to approve river basin plans and development projects related to integrated water-resource management, guidelines and procedures; to advise and assist the State Authority in formulating or reviewing legislations; as well as to designate and divide the State according to its river basin districts. Section 20 makes provisions for the preparation of river basin plans in consultation with relevant agencies that have a stake in the river basin. A platform is also made available in Section 21 for the public to provide comments and objections to any plans to be approved in Section 20. The approved plans will be translated through the mandate of respective key agencies and stakeholders (which includes the private sector and community groups).

The plan should include, as outlined in detail in Section 20, three key components that look at policy implications; state of water, including activities and impacts that have influence, with measures to address them; and measures for conservation, protection, development and use. This would require setting out a statement of objectives; references to related policies and plans; identification of water resources; state of quality and quantity including conditions and development trends; activities that influence quantity and quality with impact assessment; water quality objectives for

each water body; strategies and measures for protection, conservation, development and use including quality improvement; inclusion of indicators; identification of water reserve areas; variation of river reserves; and areas of extraction of sand and rock material. Each plan is subject to comments and objections from the public.

This provides a great opportunity for complementing the existing physical plans, and to an extent, influence existing structural and physical development plans that have been gazetted by the State. The plan can be framed to include six keys aspects that can help ensure water resources and agricultural sustainability i.e.:

- Identify priority use and users according to seasonal weather changes, and anticipated climatic hazard events, such as extreme drought or El Nino;
- Develop use-based allocation, to ensure that the rate of extraction will remain within acceptable thresholds that are set by the River Basin Committee that is specific to different areas and conditions;
- Develop specific measures to address environmental needs to help reduce risks, threats and impact arising from changing climatic conditions or incidences of hazards such as landslides and riverbank erosion;
- Identify and develop specific measures that will allow for adaptation to climatic changes and hazard incidences, taking into account multiple needs, conditions and users (human and environment),

particularly environmental needs, source availability including man-made sources (e.g. recycled rain water or treated wastewater) and rate of recharge;

- Develop specific response and management plans in times of drought, flooding or other hazard events or incidences of environmental impact;
- Explore and set out options for on-site (paddy areas) water storage and capture.

### **Abstraction and Irrigation**

Abstraction of water from any water body will require a license, as per Section 24 of the 2008 Enactment, which will only be granted if it does not pose any threat to or have an undue adverse impact on the quality, quantity or flow of the water, or the water environment or conflict with any river basin plan that has been adopted. The licence for abstraction, however, does not apply for irrigation for paddy cultivation in declared irrigation areas (Irrigation Areas Act 1953) or under the Muda Agricultural Development Authority Act 1972.

Exploration too is regulated, where abstraction or use of drilled ground water or enlargement of existing wells or drilling of land for the purposes of ground water exploration will require a licence (Section 26 of the 2008 Enactment). A copy of the licence is to be transmitted to the Director General of the Minerals and Geosciences Department within 30 days of issuance. The Director General, under the Geological Survey Act 1974, regulates aspects related

to information and methods related to the drilling of wells. Exemption is also given for abstraction for households and subsistence agricultural use from ground water on his premises or from any water body with frontage to the premises owned or occupied by him, provided that the amount abstracted in a day does not exceed 10 m<sup>3</sup> or serve more than 20 persons. In the case of ground water, the amount abstracted in a day must not exceed 2500 L and the abstraction does not require a well to be drilled (Section 27).

Section 28 of the 2008 Enactment provides that no one can divert or disrupt the natural flow of water in a water body or put or cause or permit to be put or to fall or to flow into any water body any object that may interfere with the natural flow of water. Anyone who wishes to do any of the two prohibited acts can only do so if they are permitted by a licence issued by the Water Resources Director.

These sections provide a good opportunity for the Board to develop clear measures that will provide the means:

- to control and gather information pertaining to all manner of abstraction, irrigation and diversion, based on licence application, that in return will allow for better understanding of the rate, frequency and types of use, not just those for agricultural purposes;
- to provide measures to determine the rate of abstraction and scale of diversion;
- to establish measures to set volumetric control and rate of intake;

- to develop strategic policies for abstraction and diversion, taking into account environmental and social factors;
- to explore options for setting quotas during drought seasons or hazard events; and
- to explore options for deficit irrigation.

### **Control of Contaminants and Sewage Discharge**

Part VI of 2008 Enactment addresses aspects related to protection of water resources. In Section 29, the discharge of contaminants into any water body or land is prohibited except when a licence has been granted according to the requirement of the provisions. Under Section 31, effluents may be permitted to be discharged if licensed for under the Environmental Quality Act 1974 or the sewage is discharged into a sewerage system in a sewerage services area, with added provisions that the person doing so is required to avoid, remedy or mitigate any adverse effects on the water body or environment arising from the licensed activities. This allows the Board to set the threshold for helping to control elimination or total removal of contaminants or effluent discharges. This also allows the setting of timelines for phasing out discharge.

### **Control of Activities**

The Board is also responsible for certain aspects of control of land use activities in Kedah, as provided for in Section 32, where activities related to water bodies are

regulated on land, particularly earthwork. An application will have to be made to relevant authorities for approval, and an earthwork plan will have to be sent to the Water Resources Director, who will make recommendations on measures relating to erosion mitigation and sedimentation control.

The 2008 Enactment also looks at the protection of special areas, river reserves and water conservation areas. Section 35 makes provisions for the control of activities in water reserves, which involves the removal of natural vegetation or material, felling of trees, erection of structures or buildings, carrying out of agricultural activities or alteration to or interference with a water body. The State Government of Kedah, on advice of the Board shall gazette areas of land or water bodies as water conservation areas and the Director of the Kedah Water Resources Board may direct the occupier or the owner of the premises within those water conservation areas to take measures or action to conserve and protect the area.

Section 39 makes provision for the extraction of sand and other rock material. According to the provisions, no person shall extract sand or rock material unless that extraction is carried out at a sand mining site in an approved river basin management plan or at a site located in an area not covered by a river basin plan, provided that application is accompanied by studies by experts showing that the sedimentation rate is sufficient even though there is an extraction, or removal is required for flood mitigation purposes or for maintenance of navigation channels.

Recreational activities are also controlled under the 2008 Enactment in Section 40, where owners or operators of all recreational or leisure activities on or in water bodies have to take appropriate steps to avoid causing damage to the bed, banks or shore of a water body; or contamination of a water body; or obstruction to navigation; or danger or being a nuisance to any person or property. The Water Resources Director can from time to time issue directives spelling out measures to help avoid or reduce any of the impacts arising from recreational use.

These provisions, when read with the larger river basin management plan, can actually address issues arising from multiple use and users, as well as conflicting interests, particularly during extreme weather conditions. It will allow for measures and procedures to be set out so as to ensure that limits are set and risks to water resources minimised.

### Protection of Special Areas

Two key areas are addressed in the 2008 Enactment, river reserves and water conservation areas. The 2008 Enactment states that river reserves are areas (Section 34):

- within 50 m of the top of the bank of a river, including its estuary, where the river channel is 40 m or more than 40 m in width;
- within 40 m of the top of the bank of a river, including its estuary, where the river channel is 20 m or more than 20 m but less than 40 m in width;

- within 20 m of the top of the bank of a river, including its estuary, where the river channel is 10 m or more than 10 m but less than 20 m in width;
- within 10 m of the top of the bank of a river, including its estuary, where the river channel is 5 m or more than 5 m but less than 10 m in width; or
- within 5 m of the top of the bank of a river, including its estuary, where the river channel is 1 m or more than 1 m but less than 5 m in width.

The Board can recommend to the State Authority to either reduce or increase the distances in respect of specified river reserves in existing built-up areas, particularly for flood mitigation purposes. Section 35 makes provisions for activities within river reserves that require a licence. These activities include removal of natural vegetation, felling of trees or the removal or deposition of any material; erection of a structure or building; operation of a commercial or agricultural activity; and alteration to, obstruction of or interference with any water body. This is to ensure that the activities do not cause a reduction in the volume or flow of water or degradation to the quality of water or the water environment. If they do, the owner or occupier is required to either modify or cease the activity; or modify, relocate or remove the structure or building; or restore the river reserve or water body to the condition in which it was immediately prior to the carrying out of the activity or the erection of the structure or building.

In order to protect water bodies or even land areas so that they are adequately protected from change in flow, contamination or degradation or to ensure they can serve as a water catchment area for an impounding reservoir or water supply intake, the 2008 Enactment in Section 36 makes provisions for the declaration of such areas, setting out:

- the limits of the area and the purpose of declaring such areas as a water conservation area;
- the types or classes of activity or development and the specific measures or work that apply;
- the types of activities that are prohibited;
- the terms, conditions and restrictions that apply to activities, measures undertaken or development within the area respectively; and
- the body empowered to manage the area.

The Water Resources Director also has additional powers in Section 37 to direct owners or occupiers in a water conservation area:

- to take measures to slow down, reduce or prevent water from running off the premises into a water body;
- to plant specific types of vegetation;
- to relocate structures;
- to undertake an activity, including an agricultural activity, in a specific way;
- to take such other measures as the Water Resources Director may specify to

prevent degradation of water resources; and

- to restore the river reserve or water body within the area to the condition in which it was immediately prior to the commencement of the activities or development in the area.

These sections provide the Board with powers that can ensure the development and adoption of special measures to protect and conserve special areas that can help balance the needs of different users and ensure water-resource sustainability. This can be adopted in river basin management plans to ensure that not only are allocation and distribution strategically planned, but conservation measures are put into place and carried out by owners or occupiers of these areas. It does seem to suggest that a partnership can be formed between the authority and the public so as to ensure that water bodies and their land area are protected. This is critical for sustainable agriculture, as it will allow for clear direction and procedures to ensure balance between multiple use and users.

### **Minimising Threats, Impact or Risks in Extreme Events**

Sections 41 to 43 of the 2008 Enactment makes provision for emergency measures in cases of acute contamination, drought and flood. In case of accidents or events resulting in significant undue contamination of any water body, or which gives rise to the risk of such contamination, the person involved has a duty to promptly take such



measures as are necessary to minimise the impact or risk to the environment and to promptly inform the police or the Water Resources Director (Section 41). The Water Resources Director in turn may issue directives setting out actions required to add any threats to public health or safety or to the environment. The power to redress harm is spelt clearly, and this is useful in cases where immediate action is required.

In cases of drought (Section 42), the Board may, by reason of an exceptional shortage of rain, where a serious deficiency of supply of water in any area exists or is threatened, abstract or direct any person to abstract water from any water body or discharge water to a place specified in a specific directive, or prohibit or limit the abstraction by any person of water from any water body or the supplying of water to any person. This provision allows for the establishment of an allocation plan for cases that will need help to ensure recharge of water bodies or minimisation of usage of any water body. This will require a set of strategies for action to be outlined in a river-basin management plan.

Section 43 of the 2008 Enactment sets out measures to control and manage floods that includes the formation, organisation and operation of flood defence committees for river basins; the adoption of mitigative measures to lessen the impact of flooding; and steps necessary for the proper management of flood defence. This sets the premise for an opportunity to develop a comprehensive plan to address events that

give rise to threats and risks to water bodies and their surrounding land area.

### **Licensing**

Section 44 of the 2008 Enactment sets out a detailed description of what is required in licences. Licences require information that states the nature of the relevant activity and all the works and measures necessary to undertake the activity and the measures to control and mitigate any adverse effects of the activity on the water environment. The Water Resources Director can also request information on the use of the best available techniques pertaining to measures that are proposed or should it not include such techniques, the applicant will have to include information on the efficiency and effectiveness of the alternative techniques.

What is critical here is that Section 45 mandates that the Water Resources Director publish details of any significant activity requiring a licence in at least two local newspapers, and objections are invited from the public. This form of public engagement is positive, as it allows for better feedback and to an extent, is a platform for informed consideration. Depending on the objective lodged, the Water Resources Director may require an applicant to also conduct a public forum. Significant activities are defined as (Section 45):

- any activity that in the opinion of the Water Resources Director is likely to have a significant impact on the quality, quantity or flow of water or on the environment;

- water abstraction at a rate of more than 100 m<sup>3</sup> per day from ground water or from a river of less than 5 m in width or any other maximum rate stipulated in directives under this Enactment;
  - water abstraction at a rate of more than 500 m<sup>3</sup> per day from a river of 5 m or more in width, or any other maximum rate stipulated in directives under this Enactment;
  - waste water discharge at a rate of more than 10 m<sup>3</sup> per day or any other maximum rate stipulated in directives under this Enactment;
  - river works and structures that may obstruct navigation; or
  - any other activity prescribed by the Board as significant.
- legislation laying down environmental quality standards have been changed;
  - new techniques have become available that make it possible to reduce the environmental impact of the activity significantly;
  - the operational safety of the process requires other techniques to be used; or
  - reconsideration is required by other legislation.

### CONCLUSION

As agricultural activities are heavily dependent upon water resources, the need to restructure water-resources management and changes of agricultural practices are required. Present agricultural practices require a large quantity of water and can be the main polluter of water resources. The concept of sustainable agriculture can increase productivity and yields of agricultural products without compromising the need to sustain ecosystem functions as well as to conserve water resources, both in quantity and quality. In terms of resolving disputes among water users for multiple use and for better decision making, a regulatory framework is the best option for managing water resources.

The Kedah Water Resources Enactment 2008 provides the regulatory means that can help push the sustainable agriculture agenda through sustainable use of water resources. What is critical is the formation of a River Basin Committee to bring together all key stakeholders and the

It can be said that licence issuance is not merely an administrative process, particularly for significant activities, where the public has a role to play. In cases where planned development is underway with activities that may impact a water body, a public forum may result, and in the spirit of sustainable agriculture, public engagement is one of the tenets that has been pushed forward for consideration.

Licences are also subject to variation (Section 51) if there has been a significant change in circumstances, which include the following:

- new information on adverse effects on human health or the environment caused by contamination is obtained, or

development and adoption of a river basin plan that includes directions and measures related to priority use and users; allocation, abstraction and extraction; ways to reduce environmental risks, threats and impacts and incorporate environmental needs in decision making, planning and licensing; adoption of measures to address and allow for adaptation to climatic changes and hazard incidences; addressing environmental needs, particularly environmental flow and recharge of water bodies; and development of specific management and response plans to address droughts, floods, environmental impacts and other hazard events.

The plans could also look at the adoption of measures as well as long-term strategies for water storage and capture, recharge and water-resource augmentation, focusing on water resources security. An allocation plan for multiple use of water resources would also be beneficial, particularly in times of crisis. The 2008 Enactment also makes room for public engagement, which would allow for better resource planning and agriculture development, and this should be capitalised on to ensure informed planning and development of the agricultural sector in Kedah. Examples drawn from this can perhaps be considered in other states in Malaysia that have specific enactments for water regulation.

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#### REFERENCES

- Abubakar, M. S., & Attanda, M. L. (2013). The concept of sustainable agriculture: challenges and prospects. *IOP Conference Series: Materials Science and Engineering*, 53(1), 1–6.
- ACT 172. (1976). *Town and Country Planning Act*. Retrieved October 16, 2016, from <http://www.lawnet.com.my/LawNet/Public/LawLibrary/SubDocumentDetails.aspx?DocumentID=18014&LibraryID=2>
- ACT 386. (1953). *Irrigation Areas Act*. Retrieved October 23, 2016, from <http://www.lawnet.com.my/LawNet/Public/LawLibrary/SubDocumentDetails.aspx?DocumentID=18027&LibraryID=2>
- ACT 56. (1965). *National Land Code*. Retrieved October 15, 2016, from <http://www.lawnet.com.my/LawNet/Public/LawLibrary/SubDocumentDetails.aspx?LibraryID=24&OrderID=nlc>
- ACT 70. (1972). *Muda Agricultural Development Authority Act*. Retrieved October 15, 2016, from <http://www.lawnet.com.my/LawNet/Public/LawLibrary/SubDocumentDetails.aspx?DocumentID=17948&LibraryID=2>
- Ashton, D., Oliver, M., Hooper, S., Mackinnon, D., & Mallawaarachchi, T. (2009). *Irrigated agriculture in the Murray-Darling Basin: A farm level analysis by region and industry*. Retrieved from [www.abare.gov.au](http://www.abare.gov.au) 007
- Assouline, S., Russo, D., Silber, A., & Or, D. (2015). Balancing water scarcity and quality for sustainable irrigated agriculture. *Water Resources Research*, 51(5), 3419–3436.
- Bakkes, J., Biggs, O., Hoff, H., & Petersson, G. (2009). *Getting into the right lane for 2050: A primer for EU debate*. Retrieved from <http://www.rivm.nl/bibliotheek/rapporten/500150001.pdf>

- Braimoh, A. (2013). Global agriculture needs smart science and policies. *Agriculture and Food Security*, 2(6), 1–2.
- Cai, X., Molden, D., Mainuddin, M., Sharma, B., Ahmad, M. U. D., & Karimi, P. (2011). Producing more food with less water in a changing world: Assessment of water productivity in 10 major river basins. *Water International*, 36(1), 42–62.
- Chartzoulakis, K., & Bertaki, M. (2015). The effects of irrigation and drainage on rural and urban landscapes, Patras, Greece. *Agriculture and Agricultural Science Procedia*, 4, 88–98.
- ENACTMENT NO. 2. (2008). *Kedah Water Resources Enactment*. Retrieved October 16, 2016, from <http://www.lawnet.com.my/LawNet/Public/eGazette/Download.aspx?ID=12402&LibraryID=327>
- EPU. (1966). *First Malaysian plan 1966-1970*. Putrajaya, Malaysia: Economic Planning Unit.
- EPU. (1971). *Second Malaysia plan 1971-1975*. Putrajaya, Malaysia: Economic Planning Unit.
- EPU. (2013). *Agriculture*. Economic Planning Unit. Retrieved March 24, 2017, from [http://www.epu.gov.my/en/faq?jsessionid=CDBCA6F582D0A5BFA45BBB99A3548DE8?p\\_p\\_id=56\\_INSTANCE\\_xU3W&p\\_p\\_lifecycle=0&p\\_p\\_state=normal&p\\_p\\_mode=view&p\\_p\\_col\\_id=column-4&p\\_p\\_col\\_count=1&page=2](http://www.epu.gov.my/en/faq?jsessionid=CDBCA6F582D0A5BFA45BBB99A3548DE8?p_p_id=56_INSTANCE_xU3W&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-4&p_p_col_count=1&page=2)
- EPU. (2015). *Eleventh Malaysia plan 2016-2020*. Putrajaya, Malaysia: Economic Planning Unit.
- FAO. (2012). *Coping with water scarcity: An action framework for agriculture and food security*. Rome, Italy: FAO.
- FAO. (2013). *FAO statistical yearbook 2013*. Retrieved from the FAO website: <http://www.fao.org/docrep/018/i3107e/i3107e00.htm>
- FAO. (2015). *About climate-smart agriculture*. Retrieved from <http://www.fao.org/climatechange/climatesmart/en/>
- FAO. (2015). *Towards a water and food secure future: Critical perspectives for policy-makers*. Rome, Italy: FAO.
- Heuperman, A. F., Kapoor, A. S., & Denecke, H. W. (2002). *Biodrainage – Principles, experiences and applications*. Retrieved from [ftp://ftp.fao.org/agl/aglw/ESPIM/CD-ROM/documents/6F\\_e.pdf](ftp://ftp.fao.org/agl/aglw/ESPIM/CD-ROM/documents/6F_e.pdf)
- Iyer, R. R. (2010). Governance of water: The legal questions. *South Asian Survey*, 17(1), 147–157.
- KTCPD. (2011). *Kedah state structure plan 2002-2020*. Town and Country Planning Department, Alor Setar, Kedah: Kedah.
- Lal, R. (2015). Research and development priorities in water security. *Agronomy Journal*, 107(4), 1567–1572.
- Lenton, R. (2014). Irrigation in the twenty-first century: Reflections on science, policy and society. *Irrigation and Drainage*, 63(2), 154–157.
- MAAI. (1998). *Third National Agricultural Policy 1998-2010*. Putrajaya, Malaysia: Ministry of Agriculture and Agro-Based Industry.
- MAAI. (2011). *National agro-food policy 2011-2020*. Putrajaya, Malaysia: Ministry of Agriculture and Agro-Based Industry.
- MNRE. (2012). *National water resources policy*. Putrajaya, Malaysia: Ministry of Natural Resources and Environment.
- NWC. (2009). *Australian water reform 2009: Second biennial assessment of progress in implementation of the national water initiative*. National Water Commission. Canberra, Australia: Author.
- PEMANDU. (2013). *About ETP*. Retrieved October 16, 2016, from [http://etp.pemandu.gov.my/About\\_ETP-@-Overview\\_of\\_ETP.aspx](http://etp.pemandu.gov.my/About_ETP-@-Overview_of_ETP.aspx).

- Pretty, J. (2008). Agricultural sustainability: Concepts, principles and evidence. *Philosophical Transaction of the Royal Society B*, 363(1491), 447–465.
- Salman, M. A. S., & Bradlow, D. D. (2006). *Regulatory frameworks for water resources management: A comparative study*. Washington, DC: The World Bank.
- Tilman, D., Cassman, K. G., Matson, P. A., Naylor, R., & Polasky, S. (2002). Agricultural sustainability and intensive production practices. *Nature*, 418(6898), 671–677.
- UN. (2013). *TST issues brief: Sustainable agriculture. United Nations*. Retrieved from <https://sustainabledevelopment.un.org/index.php?page=view&type=111&nr=1802&menu=35>
- UN. (2014). *Report of the open working group of the general assembly on sustainable development goals. General Assembly Official Records. Sixty-eighth session (A/68/970)*. New York: United Nations. Retrieved October 15, 2016, from [http://www.un.org/ga/search/view\\_doc.asp?symbol=A/68/970](http://www.un.org/ga/search/view_doc.asp?symbol=A/68/970)
- UN. (2015). *Sustainable development goals*. United Nations. Retrieved from <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>
- UNESCO. (2015). *World water assessment programme (WWAP). Food and agriculture*. Retrieved from <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/facts-and-figures/food-and-agriculture/>.
- Vaidyanathan, A., & Jairaj, B. (2009). Legal aspects of water resource management. In R. R. Iyer (Ed.), *Water and the laws in India* (pp. 3–13). New Delhi: Sage Publications.
- Velten, S., Leventon, J., Jager, N., & Newig, J. (2015). What is sustainable agriculture? A systematic review. *Sustainability*, 7(6), 7833–7865. doi:10.3390/su7067833.
- Wei, Y., Langford, J., Willett, I. R., Barlow, S., & Lyle, C. (2011). Is irrigated agriculture in the Murray Darling Basin well prepared to deal with reductions in water availability? *Global Environmental Change*, 21(3), 906–916.
- WFS. (1996). *Rome declaration on world food security and world food summit plan of action*. World Food Summit. Retrieved from <http://www.fao.org/docrep/003/w3613e/w3613e00.HTM>

