Malaysia’s Adaptation of Climate Change through Integrated Water Resources Management

By

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The Regional Humid Tropics Hydrology and Water Resources Centre for Southeast Asia and The Pacific
Category 2 under the auspices of UNESCO
OUTLINE

- Introduction
- Climate change effect
- Adaptation Strategies
Malaysia’s Adaptation of Climate Change through Integrated Water Resources Management

Introduction
MALAYSIA

- North East Monsoon (Nov-Jan)
- South West Monsoon
  (Apr - May for Peninsular Malaysia)
  (May-July for East Malaysia)
- Temperature: 21°C - 32°C
- Humidity: 80%
- Rainfall: 2,420 mm - 3,830 mm
Observed Climatic Change

• Temperature
  • Increase in mean surface temperature: 0.6°C to 1.2°C, 1969-2009 (Met)

• Rainfall
  • Increased rainfall intensity -> 1-hour rainfall intensity (2000-2007) increase by 17% compared to 1970s values (NAHRIM)

• Sea Level Rise
  • 4.6 cm to 11.9 cm, satellite altimetry data (1993-2010)

Source: NAHRIM (2013)
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Climate Change Effect
WATER

Flood

Drought
## Drought

<table>
<thead>
<tr>
<th>No.</th>
<th>Year</th>
<th>Location</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1990</td>
<td>Melaka, Johor</td>
<td>Water Crisis in Melaka (Durian Tunggal Dam)</td>
</tr>
<tr>
<td>2.</td>
<td>1998</td>
<td>Kuala Lumpur, Selangor, Pulau Pinang, Melaka, Kedah, Kelantan, Sabah &amp; Sarawak</td>
<td>El-Nino Phenomena</td>
</tr>
<tr>
<td>3.</td>
<td>2005</td>
<td>Negeri Sembilan</td>
<td>Water Crisis Negeri Sembilan</td>
</tr>
<tr>
<td>4.</td>
<td>2010</td>
<td>Sabah, Johor, Kedah, Perlis</td>
<td>El-Nino Phenomena</td>
</tr>
<tr>
<td>5.</td>
<td>2014</td>
<td>Selangor, Kuala Lumpur, Johor, Kelantan, Perak</td>
<td>Dry and Drought Weather</td>
</tr>
<tr>
<td>6.</td>
<td>2016</td>
<td>Perlis, Kedah, Pulau Pinang, Johor, Perak, Kelantan</td>
<td>El-Nino Phenomena</td>
</tr>
</tbody>
</table>
North East Monsoon
14 Dis 2014 – 10 Jan 2015

- 6 State: Kelantan, Terengganu, Pahang, Perak, Perlis dan Johor
- >15 days
- More than 11,500 km²
- 1 – 12 meter depth
FLOOD IN SG KELANTAN (2014)
Rainfall Status in Kelantan

<table>
<thead>
<tr>
<th>District</th>
<th>Average Total Rainfall (mm)</th>
<th>Return Period (years)</th>
<th>Comparison of Average Rainfall for December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gua Musang</td>
<td>1,015</td>
<td>&gt; 200</td>
<td>2 fold</td>
</tr>
<tr>
<td>Kuala Krai</td>
<td>814</td>
<td>13</td>
<td>1.6 fold</td>
</tr>
<tr>
<td>Jeli</td>
<td>1,130</td>
<td>&gt; 300</td>
<td>2.2 fold</td>
</tr>
<tr>
<td>Tanah Merah</td>
<td>1,067</td>
<td>&gt; 200</td>
<td>2.1 fold</td>
</tr>
<tr>
<td>Kota Bharu</td>
<td>742</td>
<td>12</td>
<td>1.5 fold</td>
</tr>
</tbody>
</table>

Rainfall within 10 days for Kelantan indicates that Jeli recorded the highest average of rainfall for a returned period of more than 100 years and is 2.2 times the ratio of the average rainfall for the month of December as compared to the other districts.
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Adaptation Strategies
Hydrological Procedure No. 1 (Revised and Updated 2015)

The Region Created using Clustering Approach (NAHRIM, 2010)
## CCF in Rainfall Design

<table>
<thead>
<tr>
<th>State</th>
<th>No</th>
<th>Station Name</th>
<th>Climate Change Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Return Period, T</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Kelantan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Balai Polis Bertam</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Dabong</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Gua Musang</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>JPS Kuala Krai</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>JPS Machang</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Kg. Aring</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Kg. Jeli Tanah Merah</td>
<td>1.12</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Kg. Lalok</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Setor JPS Kota Bharu</td>
<td>1.10</td>
</tr>
</tbody>
</table>
Blue Ocean Strategies

- break down silos among the ministries, agencies and the private sector in order to ensure all can work together and make the best use of their resources.
- save costs through sharing ideas and expertise.
- government departments and agencies to work closely with one another to ensure that all programs and initiatives truly benefit the people.
National Blue Ocean Strategy

Federal Government

- Central Agency
- DID
- MET Malaysia
- MAMPU
- KETHA
- JPBD

State Government

- STATE DEPT
- WATER BODY

- DATA COLLECTION
- BILL
- POLICY
- REGULATOR
- IMPLEMENTATION
Launched on 24 March 2012
- 5 Working Group

Bill of Law
- Water Resources
- Land & Water is state matter

IWRM (IRBM/ILBM/IFM/ISMP/ICZM)

ENABLING ENVIRONMENT

MANAGEMENT INSTRUMENTS

INSTITUTIONAL SETUP

FFWSP
- Phase 1 by 2018
- Control center

NAWABS
- Phase 1 by 2019

NWRC No.11
- Intra/Interbasin
- Groundwater exploration
- Rainfall harvesting

NWRC

REBRANDING
DID → DWR
NATIONAL FLOOD FORECASTING & WARNING PROGRAM

DETECTION
- Cloud detection
- Rain forecast
- Rain gauge
- Water level & discharge
- Soil moisture & evaporation

FORECAST
- Rainfall analysis
- Run-off analysis
- Flooding Area
- 2D Modelling

FLOOD FORECASTING & WARNING SYSTEM

WARNING AND DISSEMINATION
Real time information & forecast
- 40 River Basin
- 1st phase : 3
- 2nd phase : 37
NATIONAL WATER BALANCE SYSTEM (NAWABS)

Considering water resources is the key driver to the nation’s economy with multitude of stakeholders, therefore ensuring the security and sustainability of water resources under these challenging situation and compounded by uncertainties from climate change impact requires that water resources is managed in a more effective and efficient manner. It is with this objective that the Federal Government is looking at developing a water balance model management tool for key river basins as part of its strategy to improve water resources management.

The system shall be able to provide and improve the seasonal forecast of 3 months from Met Malaysia available system or dataset. The system shall also improve and analyse the climate change projection data by NAHRIM. The system shall expected to be as an early drought warning system for the catchment and shall be design to link with the current and future InfoKemarau® and is expected to enhance the drought analysis for that river basin;
Proposal of Solution

NATIONAL WATER BALANCE SYSTEM (NAWABS)

INTER-BASIN WATER TRANSFER
GROUND WATER EXPLORATION
INCREASE POND/DAM STORAGE
SURFACE STORAGE
RAINWATER HARVESTING
RECYCLING SEWAGE WATER
DESALINATION
LOW HEAD BARRAGE

WATER ACCOUNTING
OPTION AVAILABLE FOR WATER RESOURCES
WATER AVAILABILITY
WATER PRIORITIZATION AND DEMAND MANAGEMENT OPTIONS
WATER ALLOCATION
WATER STORING AND RELEASING DURING HIGH & LOW FLOW
WATER QUALITY (SALINITY, SEDIMENT TRANSPORT AND TURBIDITY)
WATER RESOURCES INDEX (WRJ) AND DROUGHT INDEX (DI)
WATER AUDITING

FF: 2 months in advance
Warning 2 weeks in advance

OPERATION MODE
OPTION 1
OPTION 2
OPTION 3
OPTION 4

SURFACE FLOW
SURFACE FLOW + STORAGE PONDS
SURFACE FLOW + STORAGE PONDS + GROUNDWATER
SURFACE FLOW + INTERBASIN CHANNELING + GROUNDWATER
To prepare a Storm Water Management Master Plan for the people, economic development and sustainable environment
Integrated Shoreline Management Plan (ISMP)

1. To develop *Decision Support System*” (DSS) for the state government.

2. Coastal Zone Management sensitive to user needs, environment natural coastal processes.
Launched on 24 March 2012
- 5 Working Group

Water Resources
- Land & Water is state matter
- Security & Safety is Federal matter

NWRC No.11
- Intra/Interbasin
- Groundwater exploration
- Rainfall harvesting

Bill of Law

IWRM (IRBM/ILBM/IFM/ISMP/ICZM)

ENABLING ENVIRONMENT

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- Phase 1 by 2018
- Control center

NAWABS
- Phase 1 by 2019

REBRANDING

DID \(\rightarrow\) DWR
Thank You

Terima kasih