Every day I supply oxygen for up to 4 people. Don't you think...

Killing me in name of development? How will you live without me?

You have no future without me. "Let me live"
INTERNATIONAL SEMINAR ON ECOHYDROLOGY MANAGEMENT OF PUTRAJAYA LAKE AND WETLAND 2016.

Water Quality Monitoring and Assessment in Putrajaya Lake and Wetland.

Dr. Pauziah Hanum Abdul Ghani
19-20 January 2016
Putrajaya
Content:

1. Water quality issues associated with climate change

2. Potential impacts of climate change on the beneficial uses in Putrajaya Lake water quality

3. Implications for decision making and varying impacts across the lakes
Realms of climate change in lake management

Being lake manager you must manage with knowledge...
Air Temperature

Table shows the simulated annual mean air temperature at every subregion of Malaysia during the historical (1984-1993) and the future (2025-2034 and 2041-2050) periods.

From the table it can be concluded that monthly mean temperature during the future period is higher than that during the historical period. Monthly mean temperature during the future period is higher than during historical period up to 1.4 deg Celsius.

Maximum monthly temperature also increases up to 2.0 deg Celsius.
### Summary of simulated air temperature during the historical and future periods at every subregion of Peninsular Malaysia

<table>
<thead>
<tr>
<th>Subregion Name</th>
<th>West Coast</th>
<th>Klang</th>
<th>Selangor</th>
<th>Terengganu</th>
<th>Kelantan</th>
<th>Pahang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Monthly Air Temp (deg C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historical</td>
<td>28.9</td>
<td>27.7</td>
<td>27.7</td>
<td>28.2</td>
<td>28.0</td>
<td>28.3</td>
</tr>
<tr>
<td>Future</td>
<td>30.7</td>
<td>29.7</td>
<td>29.5</td>
<td>29.9</td>
<td>29.6</td>
<td>29.9</td>
</tr>
<tr>
<td>Increase</td>
<td>1.8</td>
<td>2.0</td>
<td>1.8</td>
<td>1.7</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>% Increase</td>
<td>6.2%</td>
<td>7.2%</td>
<td>6.5%</td>
<td>6.0%</td>
<td>5.7%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Mean Monthly Air Temp (deg C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historical</td>
<td>27.3</td>
<td>26.5</td>
<td>26.4</td>
<td>25.5</td>
<td>25.3</td>
<td>26.1</td>
</tr>
<tr>
<td>Future</td>
<td>28.6</td>
<td>27.9</td>
<td>27.8</td>
<td>26.8</td>
<td>26.5</td>
<td>27.4</td>
</tr>
<tr>
<td>Increase</td>
<td>1.3</td>
<td>1.4</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>% Increase</td>
<td>4.7%</td>
<td>5.3%</td>
<td>5.3%</td>
<td>5.1%</td>
<td>4.7%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Minimum Monthly Air Temp (deg C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Historical</td>
<td>24.9</td>
<td>24.8</td>
<td>24.7</td>
<td>21.9</td>
<td>21.0</td>
<td>22.8</td>
</tr>
<tr>
<td>Future</td>
<td>26.2</td>
<td>25.5</td>
<td>25.4</td>
<td>23.1</td>
<td>22.4</td>
<td>24.1</td>
</tr>
<tr>
<td>Increase</td>
<td>1.3</td>
<td>0.7</td>
<td>0.7</td>
<td>1.2</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>% Increase</td>
<td>5.2%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>5.5%</td>
<td>6.7%</td>
<td>5.7%</td>
</tr>
</tbody>
</table>

Source: NAHRIM
Simulated monthly air temperature during the historical and future periods at the subregion of Peninsular Malaysia
The impact is closer than we thought...

Feeling the El Nino heat

Padi farmers worry lower rainfall will affect harvest

By LOSHANA K SHAGAR
and CHONG KAH YUAN
newscdesk@thestar.com.my

PETALING JAYA: The El Nino heatwave is expected to affect local food production, with padi farmers in the north already complaining of 50% less harvest.

Vegetable growers in the lowlands, especially in Johor, have also been warned to look for alternative sources of water.

In Alor Setar, a Kampung Suka Menanti farmer known as Din, 40, said the current heatwave was the worst in his 25 years of farming, adding that the situation was made unbearable due to poor water supply.

Din, who claimed to be among the hundreds of farmers affected, said water level at the river dropped from 2.5m to 1.8m recently.

“The irrigation system supplies the padi field with water from the river, but a recent flood mitigation project has hindered the supply and the scarce rainfall does not help.

“Due to the lack of water, the padi grains have shrivelled in size and we expect the yield this time to be halved,” he said yesterday.

Hamzah Salleh, 62, who farms his padi field in Pantai Johor said the harvest might be late this season due to the lower rainfall since November.

“During normal seasons, padi can be harvested in 90 days, but dry spells may stretch the growth to up to four months and affect our harvest,”

Thirty percent of the country’s rice is imported from countries such as Thailand.

Recently, Science, Technology and Innovation Minister Datuk Seri Wilfred Madius Tangau said Peninsular Malaysia along with Limbang and Miri in Sarawak, would be experiencing hot and dry weather until March.

The weather condition is a result of El Nino, which is also expected to reduce rainfall by about 20% to 60% and cause temperatures to rise between 0.5°C and 2°C.

Cameron Highlands Vegetable Growers Association secretary Chay Ee Mong said farmers in the lowlands might have to start looking at alternative water sources to avoid problems in the next few months.

“For Cameron Highlands, the water sources here are enough.

“Even Perak and Selangor farmers can turn to the former mining areas as an alternative,” he said, adding that they would only be facing problems should the dry season last beyond the predicted period.

Deputy Agriculture and Agro-based Industry Minister Datuk Seri Tajudin Abdul Rahman said they did not expect the drop in local production to be alarming as not all source of supply was local.

“If there’s a drop of, say 10%, we will increase imports by 10% to compensate,” he said, adding that they were monitoring the situation.
Effects of increased air temperature on water quality

Hydrologic factors:
1. Increased water temperature
2. Increased rates of productivity, decomposition and chemical reactions
3. Decreased water volume for dilution of chemical inputs
4. Invasion by temperature-sensitive exotic species
Terrestrial factors

Vegetation changes within lake catchment

<table>
<thead>
<tr>
<th>Terrestrial Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VEGETATION CHANGE</strong></td>
</tr>
<tr>
<td>- Species distribution changes</td>
</tr>
<tr>
<td>- Changes in nutrient leaching rates</td>
</tr>
<tr>
<td>- Invasion by temperature-sensitive exotic species, pests</td>
</tr>
<tr>
<td>- Shifts in nutrient cycling, carbon storage</td>
</tr>
<tr>
<td>- Soil change: increased microbial processing rates in soils</td>
</tr>
<tr>
<td>- Increased leaching of nitrate to surface waters</td>
</tr>
</tbody>
</table>

Source: modified from Murdoch et al., 2000.
The climate change landscape on lake ecosystem

**Airshed Effects:**
- Increase in air temperatures
- Increase in precipitable water in warmer atmosphere
- Change in frequency and intensity of storms

**Watershed Effects:**
- Warmer air temperatures
- More precipitation
- More intense precipitation events
- Increase in evapotranspiration

**Nearshore Effects:**
- More evaporation

**In-lake Effects:**
- Higher evaporative losses from lakes
Key implications on water quality:

- Warmer water temperatures affect physical, chemical, and biological processes
- Taste and odour problems in drinking water may increase
- Periods of thermal stratification may be extended with associated declines in dissolved oxygen
- Changes in mixing depth affect productivity
- Non point source pollution increases with higher intensity precipitation events
- Climate change may make it significantly more costly to meet water quality goals
- Water quality remediation targets may not be met
Low Carbon City Framework (LCCF)

<table>
<thead>
<tr>
<th>Performance Criteria</th>
<th>Preserve Natural Ecology, Water Body and Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN GREENERY AND ENVIRONMENT QUALITY</td>
<td></td>
</tr>
<tr>
<td><strong>Intent</strong></td>
<td>To provide natural restoration of carbon by improving urban biodiversity through preservation and conservation of natural environment and water bodies or wetlands.</td>
</tr>
</tbody>
</table>
| **Description** | Biodiversity is defined as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; including diversity within species, between species and of ecosystems. *(Source: National Physical Plan-2)*

Meanwhile, natural ecology also includes wetlands which provide many benefits to society. They are among the most productive and biodiverse ecosystems in the world - comparable to rain forests and coral reefs. They help improve water quality, including that of drinking water, by intercepting surface runoff and removing or retaining inorganic nutrients, processing organic wastes and reducing suspended sediments before they reach open water.

Natural ecology and water body provide natural restoration of CO₂. Hence, disturbing the ecology and water bodies for development purposes will release CO₂ into the atmosphere. Meanwhile, a large body of water such as a lake or wetland can absorb CO₂ already present in the air and function as a carbon sink.

<table>
<thead>
<tr>
<th>Carbon Emission Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A tropical forest absorbs 5.5 kg of CO₂/year.</td>
</tr>
<tr>
<td>2. 1 hectare of tropical forest absorbs 4.3 tCO₂/year to 6.5 tCO₂/year.</td>
</tr>
<tr>
<td>3. 1 hectare of tropical wetlands absorbs 1.48 tCO₂/year.</td>
</tr>
<tr>
<td>4. 1 tree absorbs approximately 1,000 kg of CO₂ <em>(Source: <a href="http://www.conservationfund.org/gozero">www.conservationfund.org/gozero</a>).</em></td>
</tr>
<tr>
<td>5. 1 acre of trees stores 2,600 kg of carbon/year (where tree cover for urban area is about 204 trees/acre, for forest it is about 480 trees/acre) <em>(Source: coloradotrees.org).</em></td>
</tr>
</tbody>
</table>
Local authorities and related agencies should take the following actions:

- Incorporate green and blue corridors in development
- Identify possible sites for environmental sensitive protection
- Preserve forests, wetland and water bodies
- Enhance urban biodiversity through the enhancement of existing habitats and creation of new habitats
WQI trend in Wetland and Putrajaya lake

**WQI Wetland 2001 - 2015**

- **Class I**
  - 2001: 89.5
  - 2002: 85.9
  - 2003: 88.7
  - 2004: 84.9
  - 2005: 87.2
  - 2006: 85.2
  - 2007: 85.9
  - 2008: 85.1
  - 2009: 88.7
  - 2010: 89.5
  - 2011: 90.7
  - 2012: 87.8
  - 2013: 84.8
  - 2014: 84.9
  - 2015: 84.4

**WQI Lake 2001 - 2015**

- **Class I**
  - 2001: 89.0
  - 2002: 90.0
  - 2003: 92.0
  - 2004: 94.5
  - 2005: 94.3
  - 2006: 94.3
  - 2007: 93.1
  - 2008: 93.9
  - 2009: 92.8
  - 2010: 93.0
  - 2011: 93.9
  - 2012: 93.5
  - 2013: 94.5
  - 2014: 88.7
  - 2015: 90.4
  
**Class II**

**Class III**
Carbon sequestration

The process of capture and long-term storage of atmospheric carbon dioxide (CO$_2$) or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change.

Carbon dioxide is naturally captured from the atmosphere through biological, chemical, or physical processes.

Artificial processes have been devised to produce similar effects including large-scale, artificial capture and sequestration of industrially produced CO2 using subsurface aquifer, reservoirs, ocean, aging oil field, or other techniques.
Schematic diagram showing pathways of carbon cycling mediated by lakes and other waters
Actions needed:

Monitoring and Data acquisition
- strategic /review location station,
- relevancy parameter/indicator
- watershed management process
- point and non point sources

Water quality Standard
- Bases for assessment
- application of Standard
- ecosystem assessment
- loads and loading capacity

Water body and watershed restoration and waste assimilative capacity enhancement
- restoration technique
- riparian wetland restoration
- aquatic interrelationship

Lake management recommendation
- data interpretation
- inform decision
Excess of debt create financial crisis
Excess of CO$_2$ create climate crisis

If we don’t act, the risks will compound, and we’ll lost opportunity to avoid the worst outcome.

When climate related disasters strike, we all pay. It’s an economic armageddon during financial crisis

We need to incentivize behavior change and promote the use of cleaner technologies
Thank you for sharing the session

pauziahhanum@yahoo.com