Drought management in Vietnam

DMIAT: Drought Monitoring and Impact Assessment Toolbox

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2009-2010 drought event Vietnam

> Approx 100 million USD in crop damage; 1.3 million people did not have access to clean water
> Salinity intrusion Mekong River Delta
> Drought Management Programme (DMP)
> Priorities (among others):
  – drought monitoring
  – impact assessment
Drought Monitoring and Impact Assessment Toolbox (DMIAT)

1. **Meteorological** drought: degree of “dryness” in terms of accumulated rainfall deficit
2. **Agricultural** drought: impacts upon crop production through insufficient soil moisture
3. **Hydrological** drought: shortages in surface water and groundwater
4. **Socio-economic** drought: last phase where people and the environment experience the negative impact of drought

DMIAT integrates the four types in drought progression and mainly uses open-access data sources. DMIAT combines three main types of tools to support policy making:
- Remote sensing
- Models
- Decision trees

DMIAT is based on a generalized framework, local specific refinements are always necessary.

DMIAT was applied for the Greater Mekong area to characterize the 2009/2010 drought period and construct general drought risk maps.
1. Meteorological drought monitoring

- Meteorological drought indices:
  - Precipitation anomaly (TRMM)
  - Standardized precipitation index

<table>
<thead>
<tr>
<th>SPI value</th>
<th>Drought category</th>
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</thead>
<tbody>
<tr>
<td>0 to -0.99</td>
<td>Mild drought</td>
</tr>
<tr>
<td>-1.00 to -1.49</td>
<td>Moderate drought</td>
</tr>
<tr>
<td>-1.50 to -1.99</td>
<td>Severe drought</td>
</tr>
<tr>
<td>&lt; -2.00</td>
<td>Extreme drought</td>
</tr>
</tbody>
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2. Agricultural drought monitoring:

- Agricultural drought indices:
  - Normalized Difference Vegetation Index (NDVI - MODIS)
  - Soil moisture deficit (ASCAT)

*Average soil moisture for May (l), soil moisture in May 2010 (m), and soil moisture anomaly for May 2010 (r).*
3. Hydrological drought monitoring

- Hydrological drought indices:
  - Changes in river discharge
  - Changes in reservoir storage
  - Declining groundwater levels

Follow-up for Red River Basin. Demonstration Project: Operational system integrating DMIAT, but focus on hydrological flows and water available in reservoirs.

4. Drought risk = Vulnerability x Hazard

- Population density
- Distance to river
- GDP
- Land use

- Dry season precipitation (mean and variability)
- Dry season vegetation growth (mean and variability)
- Soil water holding capacity

Outputs: Hazard Index maps, Vulnerability Index maps, Drought Risk maps
4. Socio-economic drought risk mapping

Current status

- Infrastructure moved from Ministry of Natural Resources and Environment to NAWAPI (National Center for Water Resources Planning and Investigation)
- Focus more on blue water (large storage reservoirs for irrigation, etc)
- Enhanced monitoring allowed timely response of the 2016 event:
  - But still a major impact:

   ![Drought Impact Graphics]

   **Drought Impact** at the peak of the crisis

   **WATER STRESS**  **FOOD INSECURITY**  **INCOME LOSSES**

   - 2,000,000 people affected
   - 1,000,000 women and girls
   - 520,000 children

   **US$674,000,000 estimated total economic loss**

   - 660,000 ha of crops affected

   The losses of 1.75 million people have been impacted.
A few recommendations towards 2030

- Focus on agricultural drought monitoring, including salinity
- Post-event drought evaluation of 2016 event
- Drought mitigation action plan
- In-depth analysis on drought risk, impact and vulnerabilities – identifying hotspots and most vulnerable communities

Thank you
Questions?

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Socio-economic drought risk mapping

- $DRI = DHI \times DVI$
- $DHI = (HI_1 + HI_2 + HI_3 + HI_4) / 4$
  
  in which:
  
  $HI_1 =$ Mean total dry season rainfall (2000-2013)
  
  $HI_2 =$ CV of total dry season rainfall (2000-2013)
  
  $HI_3 =$ Mean dry season NDVI (2000-2013)
  
  $HI_4 =$ CV of dry season NDVI (2000-2013)

- In each of the indices, scaling is applied between 0 (minimum of values, no hazard/vulnerability) and 1 (maximum of values, full hazard/vulnerability)