Water environment in Vietnam: opportunities and challenges for sustainable management in the context of climate change

Mai Trong Nhuan, Tran Ngoc Anh, Truong Quang Hoc, Pham Van Cu
Vietnam National University, Hanoi
Tran Hong Thai, MONRE
Contents

- Vietnam and global context
- Water Resources of Vietnam
- Water environment: pollution and disasters
- Water resources management in VN
  - Challenges and opportunities for water management in Vietnam
  - Some solutions
I. Vietnamese context

Fast economic growth after Doi Moi
World Second Rice Exporter (more waters, emission of CH4,)
70% of 86 million population living in rural areas of typical water civilization
Urbanization and industrialization are absorbing a lot of agriculture land, waters
VN is considered as one among the most potentially affected by SLR in particular and by CC in general
Extreme Weathers, CC related disasters start to increase in VN, affecting strongly on WR!
II. Global context

• Water is resource and disaster
• Water resource shortage is very serious

• Water resources distribution is not rational!

• Extreme Weathers, CC related disasters start to increase
• Global, regional changing climate impacts strongly on WR

• Globalization, urbanization and industrialization are absorbing a lot of agriculture land, waters...
• Transboundary water utilization is not balanced
<table>
<thead>
<tr>
<th>Global temperature change (relative to pre-industrial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C</td>
</tr>
<tr>
<td><strong>Food</strong></td>
</tr>
<tr>
<td>Falling crop yields in many areas, particularly developing regions</td>
</tr>
<tr>
<td><strong>Water</strong></td>
</tr>
<tr>
<td>Small mountain glaciers disappear – water supplies threatened in several areas</td>
</tr>
<tr>
<td><strong>Ecosystem</strong></td>
</tr>
<tr>
<td>Extensive Damage to Coral Reefs</td>
</tr>
<tr>
<td><strong>Disasters</strong></td>
</tr>
<tr>
<td>Rising intensity of storms, forest fires, droughts, flooding, erosion heat waves…</td>
</tr>
<tr>
<td><strong>Risk and change</strong></td>
</tr>
<tr>
<td>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</td>
</tr>
</tbody>
</table>

Source: Stern Review
CLIMATE CHANGE IMPACTS

CC impacts most severely to water resources
Vietnam is expected to be one of the top 5 most vulnerable to climate change (SLR) countries.
Global environment problems are as follows

1. Global climate change;
2. Biodiversity loss;
3. Stratospheric ozone depletion;
4. Freshwater degradation;
5. Desertification and land degradation;
6. Deforestation and the unsustainable use of forests;
7. Marine environmental and resources degradation;
8. Persistent organic pollutants.
III. Water Resources of Vietnam

Water is an important resource

    Vietnam is a country of water civilization:
    - 70% of the territory is rural area, where people’s life still depends very much on natural resources, especially water and land.
    - Water – energy
    - Water – important ecosystem
    - Water is a life for all
III. Water Resources of Vietnam

- Accidental Topography
- More than 3200Km of coast line
- 2360 River of >10km length
- 7/9 main rivers of Vietnam pass through 2-5 countries
- 17 Main Catchments of >1000Km2 divided into 1556 sub-catchments of 100km2
- Disparity of Population Density between ecologic regions
- Increasing Industrialization
- High frequency of disasters
III. Water Resources of Vietnam

3.1. *Vietnam is a country of the water shortage*
Viet Nam has around 830 billion m³ of the surface water of which, just 310 billion m³ are from the rainfall within the territory, and the remaining of 63% is from the rainfall in neighboring countries. The total potential reserve of underground water resources is estimated at 60 billion m³ per year (excluding water resources in the islands).

Viet Nam has the average amount of 4400 m³ per capita/year (the worldwide average amount is 7400 m³ per capita/year, reaching 10,600 m³ per capita/year if water resources flowing to the territory is added).

In accordance with evaluative criteria of the International Water Resources Association, the countries, those have the amount of water below 4000 m³ per capita/year, are categorized as the countries suffering from the water shortage. Therefore, Viet Nam is one of the countries which **have been suffered from the water shortage** in the present as well as in the near future.
III. Water Resources of Vietnam

3.2. Water resource and water environment in Vietnam (cont.)

Viet Nam has about 2,378 rivers over 10 km of length which have a perennial flow, and 15 basins with an area of more than 2,500 km² of which 10 river basins are of over 10,000 km² in area. These account for 80% of the total area of Vietnam.

The Mekong River's total runoff accounts for 59% of the total national runoff, followed by the Red River with 14.9%. And 7 of 10 largest rivers have basin sharing with the neighbouring countries.
3.3. The unsustainable factors of water resource in Viet Nam

- 2/3 of water resources comes from neighboring countries -> difficult to control and even unusable.
- Rainfall and runoff: distributes unevenly over space and time scale
- Rainy season: holds 65 – 90% of total annual rainfall in 3 – 6 months.
- Maximum amount of rainfall in one day: > 1500 mm;
Viet Nam has about 2,378 rivers over 10 km of length which have a perennial flow, and 15 basins with an area of more than 2,500 km$^2$ of which 10 river basins are of over 10,000 km$^2$ in area. These account for 80% of the total area of Vietnam.
The main river basins in Viet Nam
The main river basins in Viet Nam

<table>
<thead>
<tr>
<th>Basin over 10.000 km²</th>
<th>Basin 2.500 - 10.000 km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bang Giang - Ky Cung</td>
<td>Thach Han</td>
</tr>
<tr>
<td>Hong (Red) and Thai binh</td>
<td>Huong</td>
</tr>
<tr>
<td>Ma</td>
<td>Tra Khuc</td>
</tr>
<tr>
<td>Ca</td>
<td>Kone</td>
</tr>
<tr>
<td>Vu Gia - Thu Bon</td>
<td>Gianh</td>
</tr>
<tr>
<td>Ba</td>
<td></td>
</tr>
<tr>
<td>Srepok</td>
<td></td>
</tr>
<tr>
<td>Se San</td>
<td></td>
</tr>
<tr>
<td>Dong Nai</td>
<td></td>
</tr>
<tr>
<td>Cuu Long</td>
<td></td>
</tr>
</tbody>
</table>
Six basins depend on water inflows from other countries:

- Cuu Long, almost 95% of average yearly surface water flows are generated in the upstream Mekong River countries.
- Nearly 40% of the Red-Thai Binh basin surface water originates in China;
- 30% of the Ma basin flows, and 22% of the Ca basin flows come from Lao PDR;
- almost 17% of Dong Nai basin flows come from Cambodia.
- Bang Giang-Ky Cung flows from China through Viet Nam, and back to China.
- Se San and Sre Pok contribute significant flows to Cambodia
III. Water resources

3.4. *The unsustainable factors of water resource in Viet Nam (cont.)*

Viet Nam’s water resources tend to be degraded due to the impacts of the global climate change.

In 2070, the acceptable scenario may be the possibility of increasing by +1.5°C in the coastal areas, +2.5°C in the hinterland. Consequently, the water evaporation will be raised by around 7.7 ~ 8.4%, the irrigation demand also increases, the surface water streams will be decreased if the rainfall patterns remain unchanged.

Storms, El Nino and La Nina phenomenon will **intensify the climatic extremes.** As a result, the streams during the year within the rivers also intensify the extreme characteristics.

**Sea invasion** and **water pollution** tend to become more severe.
Environment Change caused by Sea Level Rise

Loss of Wetland

World Bank, 2007
Land Loss and Land use change caused by Sea Level Rise

Impact on 10.8% total population

Impact on 35% total population

Estimated Loss when SLR = 1m

- 17 billion USD/year
- 12.2% area of the most fertilized land
- 40,000 km² of deltaic lowland under damage of flooding

Env. Protection Journal 97/2007
Area of Cuu Long delta of level less 5 m

5m SLR resulting in loss of 16% land area, impacting on 35% of population and threatening 35% of GDP
IV. Water utilization

Water demand of sectors in major river basins (2000)

- Agriculture: 74%
- Industry: 1%
- Domestic: 4%
- Aquaculture: 12%
- Others: 9%
IV. Water utilization

Water demand of sectors in major river basins (2020)

- Agriculture: 74%
- Industry: 1%
- Aquaculture: 12%
- Domestic: 4%
- Others: 9%
WATER BALANCE FOR NORTHERN KEY ECONOMIC ZONE

### Water Balance Region

<table>
<thead>
<tr>
<th>TT</th>
<th>Water balance region</th>
<th>Water shortage volume (Mil. m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mỹ Đức</td>
<td>34,94</td>
</tr>
<tr>
<td>2</td>
<td>Đầm Hà - Hải Hà</td>
<td>4,11</td>
</tr>
<tr>
<td>3</td>
<td>Hoành Bồ</td>
<td>0,02</td>
</tr>
<tr>
<td>4</td>
<td>Hồng Vân</td>
<td>1,51</td>
</tr>
<tr>
<td>5</td>
<td>Ứng Hòa</td>
<td>5,42</td>
</tr>
<tr>
<td>6</td>
<td>La Khê</td>
<td>23,67</td>
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<tr>
<td>7</td>
<td>Chương Mỹ</td>
<td>14,35</td>
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<tr>
<td>8</td>
<td>Đồng Triệu - Uông Bí</td>
<td>10,86</td>
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<td>9</td>
<td>Bình Thạnh</td>
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<tr>
<td>10</td>
<td>Thạch Thất - Quốc Oai</td>
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<td><strong>SUM</strong></td>
<td><strong>157,05</strong></td>
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## WATER BALANCE FOR NORTHERN KEY ECONOMIC ZONE

<table>
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<tr>
<th>TT</th>
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<th>Water shortage volume (Mil. m³)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Mỹ Đức</td>
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</tr>
<tr>
<td>2</td>
<td>Đầm Hà - Hải Hà</td>
<td>1,55</td>
</tr>
<tr>
<td>3</td>
<td>Ba Chẽ</td>
<td>0,12</td>
</tr>
<tr>
<td>4</td>
<td>Ứng Hòa</td>
<td>31,35</td>
</tr>
<tr>
<td>5</td>
<td>La Khê</td>
<td>25,19</td>
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<td>6</td>
<td>Chương Mỹ</td>
<td>19,50</td>
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<tr>
<td>7</td>
<td>Đồng Triệu - Uông Bí</td>
<td>10,28</td>
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<tr>
<td>8</td>
<td>Thạch Thất - Quốc Oai</td>
<td>60,13</td>
</tr>
<tr>
<td>9</td>
<td>Cẩm Phả</td>
<td>1,00</td>
</tr>
<tr>
<td></td>
<td><strong>SUM</strong></td>
<td><strong>188,15</strong></td>
</tr>
</tbody>
</table>

2015 | 2020
--- | ---
39,03 | 42,93
1,55 | 2,02
0,12 | 0,14
31,35 | 34,81
25,19 | 27,79
19,50 | 23,12
10,28 | 11,44
60,13 | 69,41
1,00 | 1,11

**SUM** | **188,15** | **212,76**
WATER BALANCE FOR SOUTHERN KEY ECONOMIC ZONE

<table>
<thead>
<tr>
<th>TT</th>
<th>Water balance region</th>
<th>Water shortage volume (Mil. m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Thác Mơ</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Tây Ninh</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Gò Dấu Hấp</td>
<td>49</td>
</tr>
<tr>
<td>4</td>
<td>Bến Lức</td>
<td>254</td>
</tr>
<tr>
<td>5</td>
<td>Trị An</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Đồng Tháp Mười</td>
<td>73</td>
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<tr>
<td>7</td>
<td>Vàm Cô Tây</td>
<td>85</td>
</tr>
<tr>
<td>8</td>
<td>Xoài</td>
<td>71</td>
</tr>
<tr>
<td>9</td>
<td>Ray</td>
<td>105</td>
</tr>
<tr>
<td>SUM</td>
<td></td>
<td>669</td>
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</tbody>
</table>
## Water Balance for Southern Key Economic Zone

<table>
<thead>
<tr>
<th>TT</th>
<th>Water Balance Region</th>
<th>Water Shortage Volume (Mil. m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2015</td>
</tr>
<tr>
<td>1</td>
<td>Thác Mơ</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Sông Bé</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>Tây Ninh</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Gò Dầu Hạ</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Bến Lức</td>
<td>259</td>
</tr>
<tr>
<td>6</td>
<td>Sài Gòn</td>
<td>191</td>
</tr>
<tr>
<td>7</td>
<td>Trị An</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Đồng Nai</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Nhà Bè</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Đồng Tháp Mười</td>
<td>19</td>
</tr>
<tr>
<td>11</td>
<td>Vầm Cồ Tây</td>
<td>29</td>
</tr>
<tr>
<td>12</td>
<td>Xoài</td>
<td>63</td>
</tr>
<tr>
<td>13</td>
<td>Ray</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>SUM</td>
<td>673</td>
</tr>
</tbody>
</table>
Shortage and pollution of fresh water have occurred in many places

- Fresh water resources are relatively abundant, but the demand rapidly increases, water use is not appropriate, facing the risk of depletion and pollution, in many places there is a serious shortage of fresh water in dry season.
- Increased pollution by domestic, industrial wastewater in urban, industrial areas.
- Increased pollution due to agricultural activities in plain areas.
- Low rate of population having access to clean water supply. Deforestation, erosion, affecting reservoirs, causing serious floods, droughts.
Pollution, River bank slide
River Water Pollution in the North

- Red river from Dien Hong to Viet Tri is severely polluted, especially during the dry season. COD of this river section exceeds 2.37 times, BOD 3.83 times, NO2- 1.4 times and NH4+ 2 times.

- The Cau River: BOD and COD, low dissolved oxygen, the concentration of H2S is up to 7.8 to 12mg/l, NO2- higher than the standard for water source of category A by 5-10 times, NH4+ higher than the standard for water source of category A by 2 times.

- Thuong river: BOD is higher than the standard for supplied water of category A by 2.68 times, COD 1.85 times and NO2- concentration is much higher than permitted standard.


- In investigated rivers, analysis of parameters shows that they satisfy the standard of surface water of category A (for potable water supply).
River Water Pollution in the Centre

- Hieu River in Dong Ha Town are as follows: BOD and COD exceed 2-3 times the standard, NH4+, and PO4-3 1.5 to 1.8 times, respectively.
- In dry season, BOD, COD, NH3 of water in the Huong River at Hue City are lower than the standard. However, in some places near the outlet of waste water BOD exceeds the standard by 2.5 times and COD 1.6 times, respectively.
- Da Nang city, DO is nearly equal to category A but BOD is higher than the value for category B. NH3 exceeds 1.4 to 2.6 times.
- BOD of water in the stream within a radius of 3-5 km exceeds the permissible standard by 1.01 to 1.75 times. Some places in the rivers have oil content of 0.1 mg/l, such as Tuy Loan River, Cau Do river, Phu Loc bridge, and sewer of market in Han River. Nevertheless, it is still lower than the permissible maximum standard (1 mg/l).
River Water Pollution in the South

- Sai Gon river: BOD and COD 2 to 4 times. Coliform exceeds by up to 50-100 times; oil and the presence of some heavy metals (Pb, Hg, Cr, and Cd) has been detected.
- Dong Nai river: DO increases from 5.5 to 6.5 mg/l. Equivalent total N and P are over 0.2 mg/l and 0.03 mg/l, respectively.
- Thi Vai river: BOD and COD exceed the standard by 10-15 times; H2S of the mud in the bottom of the river is very high in places near the outlet; Chromium changes from 0.02 to 0.035 mg/l, Mercury is less than 0.0002 mg/l, lead is lower than 0.001 mg/l, Arsenic is lower than 0.005 mg/l.
Change of BOD concentration in river water from 1995-1999
V. Water environment: Status

V.2. River Water

This is the only domestic water supply source for the whole village of Pho Cao, Dong Van district (2002)
V. Water environment: Status
V. Water environment : Status

5.2. Surface water in the urban area

- Both domestic and industrial wastewater, as well as storm water shares the same drainage. The common facilities for wastewater treatment are not available. Therefore, wastewater is treated only superficially and then discharged directly into rivers and lakes causing serious pollution of surface water environment.
Surface water in the urban areas is polluted by organic wastes such as COD, BOD5, nitrites, nitrates and suspended solid matters. The concentration of these pollutants is always 2-5 times higher than the acceptable limits set for surface water resource (as stipulated in category B of Vietnamese Environmental Standards). In some areas it is 10 to 20 times higher than the standard. The index of E. coli exceeds the acceptable limit by hundred times. The waterways in some cities are black and stinking.

V. Water environment: Status

- Red river (Lao Cai)
- Cam river (Hai Phong)
- Huong river (Hue)
- Han river (Da Nang)
- Sai Gon river (HCM city)

![Graph showing N-NH₄ (mg/l) for different years and locations.](image)
## 5.3. Coastal water and sediment environment

<table>
<thead>
<tr>
<th>Sediment pollution (Ttd)</th>
<th>Water pollution (Ttc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn 1.2-3; Cu 1.5-2; Hg 20</td>
<td>Zn 1.25-1.6; Cu 1-1.28</td>
</tr>
<tr>
<td>Pb 4.06-6.09; Hg 1.54-5.4; Cu 1.01-1.87</td>
<td>Zn 1.7-6.9; Cu 1.2-2.1</td>
</tr>
<tr>
<td>Hg 1.54-4.61; Cu 1.01-1.65</td>
<td>Cu 1.0-8.2; Zn 1-9.1</td>
</tr>
<tr>
<td>Hg 11.3-16.6; Sb 2-3.12; As 2.1-3.56</td>
<td>Cu 1.5-2.8; Zn 1.1-3.2</td>
</tr>
<tr>
<td>Hg 11.3-16.6; Sb 2-3.12; As 2.1-3.56</td>
<td>Cu 1-4.6; Zn 2.5-3.5; As 3.6-4</td>
</tr>
</tbody>
</table>
V. Water environment: Status

5.3. Coastal water and sediment environment

- Shrimp pond water pollution
- Eutrophication in Shrimp pond
- Waste pollution
- Oils Pollution
- Too many shrimp ponds, cannot be controlled;
- More and more waste discharged into the sea
- Pollution by industry and agriculture is increasing
- From 1994 -2002, 40 cases of oil spill (4,000 tons)
V. Water environment: Status

Saltation

📍 Salinity Intrusion in Mekong River Delta

- Area: 1.4-1.6 million ha;
- Length (4 g/l): 40-50 km
- Duration: 1-3 months in a half of area

LEGEND
- Salinity isohaline 4 g/l in 1998
- Salinity annual average
- Salinity isohaline in 1993
- Salinity area > 4 g/l in 1998
5.4. Water – hazard! Large floods in rainy season and severe droughts in dry season.
Before the fire

Drought and Forest Fire

Fire points detected from Mar. 8 –19, 2003

After the fire

NDVI calculated for March. 8 –19, 2003
Heavy Rain and Flooding
Water is essential for life (for human beings and biological beings), for agricultural and industrial development, etc.

Thus, degradation of water resources will lay direct impacts on human life and socio-economic development in general terms.
VI. WATER RESOURCES MANAGEMENT

The role of water resource management

- WATER USE
- GOOD BALANCE
- WATER RESERVATION
- ENVIRONMENT
- ECONOMICS
- SOCIETY
VI. Water resources management

6.1. Legal documents on water resource management
The legal documents on water resource:
- The law on water resources (20/Aug/1998)
- The Decree on stipulating the implementation of the law on water resources (30/Dec/1999)
- The Decree on Water resource information management (19/Dec/2003)
- The Decree on Licensing for exploitation, utilization, use and discharge waste water (27/july/2004)
- The Decree on sanctions against administrative violations of water resources management regulations (17/march/2005)
- The National strategy on water resources to 2020 (14/Apr/2006)

The recently established **Dept. of Water Resource Management** (DWRM) operating in a complex policy environment attempting to bring a strategic approach to water resource management.
VI. Water resources management

6.2. *Changes in water resources management*

**Before 1990,** water resource management activities focused on:
- Promote water demand in regions
- Develop infrastructures to allocate the water resource (reservoirs, irrigation canals, water supply for domestic purposes...)

**After 1990,** due to the shortage of water (both in quality and quantity) the management of water utilization requires:
- Water quality management
- Water quantity management

The water resource planning was developed (even for each component such as surface water, underground water...) in *related with other plans of socio-economics, environment, ...* for most of provinces/cities.

But all of these plans are strictly **limited within the administrative boundaries** (province or city) while the water resource problems usually rise beyond a unique region.
VI. Water resources management

6.3. The initial attempts for river basin management

The Decree stipulates that MONRE shall formulate river basin planning tasks for the river basins named in the Major River Basin List and the Inter-Provincial River Basin List; the Provincial People’s Committee has responsibility for the river basins named in the Provincial River Basin List.

The Decree also stipulates the contents of each activities in river basin management following the above main tasks (planning, environment protection, regulation and allocation of water,…)

The Decree provides the legislation foundation for river basin management activities although they are in preparation process (establish the River basin management offices for major river basins,…)

However, up to present, there is not any secondary such as guiding circular to implement the Decree.
VI. Water resource management

6.3. The initial attempts for river basin management (cont.)

In December 2008, the Prime Minister has issued a decree on River Basin Management (120/2008/NĐ-CP) focusing on:

- River basin planning
- Protection of the water environment in river basins
- Regulation and allocation of water resources and transfer of water resources between river basins
- International cooperation and implementation of international treaties on river basins

The Decree defines 9 major river basins, as well as the inter-provincial and provincial river basin lists over Vietnam.
Cau River basin Management Committee
VII. Challenges for water resource management in VN
VII. Challenges of WR management in VN

7.1. Quality

- Climate Change
  - Sea level rise
    - Salinity invasion in rivers and estuaries
    - Salinity in ground water in coastal area
  - Increased temperature
    - Algal growth
      - Degradation of water quality in lakes, rivers and estuaries
      - …
VII. Challenges of WR management in VN

7.1. Quality (cont.)

- Climate Change
  - Increased temperature
  - Re-distribution of rainfall
  - More evaporation and water demand
  - Increased pollutant concentration due to decreased water dilution
  - ...

Increased temperature

More evaporation and water demand
VII. Challenges of water management in VN

7.1. The degradation of water quality due to economic activities

The water pollution is on the rise due to the rapid urbanization, industrialization and modernization. Meanwhile, the sewage and waste treatment are not under the close supervision. Besides, water pollution is also caused by the increasing and uncontrollable utilization of the chemical pesticides and fertilizers, the direct flows of the untreated sewage and waste from the aquacultural ponds to water bodies.…

The pollutants from economic activities in upstream regions will be transported and cause serious problems in downstream.

The high speed of urbanization, industrialization and intensification of agriculture in Vietnam leads to an rapidly increasing water demand and to enormous water pollution. Institutions in Vietnam do not yet have the capacity to efficiently plan water resources use and control water pollution.

The institutional capacity to monitor, control and sanction water use, land use or water pollution must be improved.
VII. Challenges for water resources management in VN

7.2. *Sharing water resource with neighboring countries*

The quantity and quality of the surface water depends on the use of water in the upstream countries. 95% of water of Mekong River comes from outside of Vietnam, but contributes about 59% of national runoff.

The countries in the upstream areas increase water utilization. For example- Mekong river: China has been built more than 10 large reservoirs; Laos - 35 irrigational – hydroelectric works including 27 reservoirs in the tributaries and 8 spillways in the main streams of the river; Thailand - 10 reservoirs and plans to build more; Cambodia - the plan to keep the water in the Tonle Sap Lake at a certain level to develop the irrigation...

International cooperation in river basin management is urgently needed
Shared water resource:

Red river in rainy season
VII. Challenges for Water resource management in VN

7.3. The problems in harmonizing the demand from different sectors

To regulate and allocate the water resource, many reservoirs of multi-purposes (irrigation, hydropower, aquaculture,…), have been built and planned to be built. During the dry season there are conflicts between the irrigation, hydropower and waterway navigation

- **Hydropower company wants to keep water in reservoir** for maintaining the water head to maximize the power yield while **agriculture requires to release water for irrigation**, and to **increase the water depth for waterway transportation**
- To reserve and protect aquatic environment, the **minimum flow in rivers must be preserved** while **rice paddy fields need a lot of water during driest months**
- In flood season, the dam’s owner **tend to release more water to downstream for the safety** of the dam, while it would be stored in reservoirs for flood mitigation purpose

A comprehensive technologies for optimum operation of system of reservoir are needed
VII. Challenges of water management in VN

7.4. *Protection of aquatic ecosystems*
- Economic development + low awareness of the importance of aquatic ecosystems → severe degradation of aquatic ecosystems, especially freshwater ecosystems, where many species are becoming rare, and some are on the brink of extinction.
- Cause: lack of attention to aspects such as
  - importance of ensuring environmental flows;
  - importance of water ecosystem protection when physical structures on rivers are built;
  - importance of controlling the exploiting and use of water to sustainable levels.
VII. Challenges of water management in VN

7.5. Challenge in management

a. The incomplete legal system for water resources management and the inadequate organisation and management capacity in water resources

b. Lack of coordination between the development of water resources and the efficient, multi-purpose allocation and use of water resources

c. Lack of mechanisms and policies, especially economic and financial policies in water resources

d. Inadequate and inaccurate information and data on water resources and constraints on information sharing

e. A suitable model for organisation and content of integrated river basin management has not been established
VII. Challenges of water management in VN

7. 6. Awareness of the importance of water resources in sustainable development

• For a long time, the role of water in the nation’s sustainable development, human health and life were not fully appreciated; the value of water was not appreciated, and water was not considered a scarce natural resource, an economic good. The protection and management of water resources had not been given proper attention.

• Enhancing public awareness and consciousness in protecting and preserving the resource is still limited. The poor result in this area hinders the participation of the entire society in the protection of water resources.
VII. Challenges of water management in VN

7.7. The extreme characteristics induced by global climate changes

Storms, El Nino and La Nina phenomenon will intensify the climatic extremes. As a result, the streams during the year within the rivers also intensify the extreme characteristics.

- The number and intensity of storms is increasing leading to the larger and more frequently large flood
- Also the number of severe droughts is increasing in dry season

Sea level increases 20mm/year on average has significant impacts on water supply, drainage and water degradation. The storm surges occur together with flood might cause serious inundation in low-land area.

The measures for adaptation to and mitigation climate change is essential in Vietnam
CC makes the water shortage more serious

The situation may become even worse when it comes to conflicts that may arise from sharing water resources with upstream countries.

Another serious consequence from climate change is the increase in droughts, which do not only do harm to productivity but may also cause desertification and forest fire threats as well as other potential damage in many aspects.

Water is essential for life (for human beings and biological beings), for agricultural and industrial development, etc. Thus, degradation of water resources will lay direct impacts on human life and socio-economic development in general terms.
VIII. Opportunities for WR management in VN

- Public attention (conference, media)
- New achievements in WR management and policy (eg. Decree for river basin management)
- International collaboration (ODA, projects)
- Research achievements
- More funds
IX. Sustainable WR management

Driving Forces

Pressure + Threat

Environment Status
- Quality
- Pollution
- Degradation

Resource and biodiversity status
- Quantity + quality
- Degradation

Sustainable WR management:
Water Environment Protection
Strategy for Sustainable development WR
Sustainable WR use planning
New methods for SWRM, including adaptive management.

Sustainable Development
IX. Water Sustainable management

Solutions

Natural conservation, disaster RR
SD planning
IWM
Scientific research
Education and training

Inter-sector, co-management
Ecology based management
Envi. planing
Conflict solving
Hazard mitigation

Community based management
Sustainable water resource use planning
Integrated risk assessment
Vulnerability assessment based

Sustainable forestry
Eco-agricultural model
Eco-tourism model

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IX. Sustainable water resources management

1. Develop and implement sustainable WR development strategy
2. Develop and enforce laws
3. Develop and implement plans of:
   - Sustainable water resources use
   - Water Environment protection and biodiversity conservation
4. Strengthen capacity building for SWR management
   Development and enhance awareness on WR sustainable use
5. Integration of water environment protection and WR SU into the socio-economic development planning
6. Develop and use water environment technologies
7. Develop national and international cooperations
9.2. **Capacity building development:**

- Human resource development planning
- Development of:
  - Curriculum (degree, non degree, different levels)
  - Teaching, learning methods
  - E-learning
- Development of teachers, researchers
- Development of research and training facilities
- Increasing of finance
Development of environmental science:

- Clarify Factors affecting environment quality and degradation and SD
- Hazards: history, distribution, occurrence and damage, mitigation
- Forecasting, modeling env. and WR change, degradation and env. disasters
- Scientific fundamentals and database for
  - WR management, protection
  - Sustainable use of water resources
  - Environmental disasters mitigation
- Building of modes of SWRD in different areas
IX Sustainable Development - Activities

1. Enhance Environmental Management System
2. Develop Policy and Law System of Environment Protection
3. Activities of Environment Protection
   + National Environmental Meeting
   + Examination and supervising
   + Pollution control and waste management
   + Environmental monitoring, collection, processing and dissemination environment information
   + Activities of Environment Protection in river valleys.
   + Strictly treatment with companies affecting seriously environment
   + Collection and management environment protection fee for waste water.
4. International Cooperation
5. Involvement of Community in Env. protection
   + Forms of public participation
   + Contracting join resolutions with mass, social organization about environmental protection,
   + Organizing festivals, cultural activities such as Environment day
Conclusions

1. VN is rich and poor in water resources, country of water civilization
2. The major challenges of River Basin Management in Vietnam call for:
   - Tran boundary water utilization; water resource sharing among stakeholders
   - Quality degradation; water disasters
   - Climate change: resource and hazard
   - Management challenges: lack of co- and adaptive management, coordination, cooperation both in Central and Provincial levels in the field of water resource; water management institutional changes
   - Sharing - database for all the water-related activities in international river basins as well as monitoring network
   - Comprehensive collaboration with various related academic fields and research institutions
   - The capacity of institutions on all levels to monitor, control and sanction water use, land use or water pollution remains weak
Conclusion

3. There are urgent strategies, plan of activities to response to the challenges, including
- IBM for SD
- Capacity building for water staff working in water institutions, such as MONRE, river basin organization research institutions... through the training workshops, exchange of experiences, knowledge and technology, “water talent grooming…
- International, regional cooperation in all aspects of water resources in the context of global change: research, monitoring, database, utilization, management, capacity building…
Thank you!