STUDY ON MORPHOLOGICAL CHANGE OF AYEYARWADY RIVER FROM PYAY TO HINTHADA

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The Ayeyarwady River is the major drainage basin and course life artery of Myanmar. According to F. Bender (1983), the Ayeyarwady has a length of 2010 kilometers (1246.2 miles) and a catchment area covering 415700 sq.km (162123 sq.ml). In this paper, study area defines from Pyay to Hinthada along the Ayeyarwady River course. It is about over 205 kilometers long.
- 9 townships
- 97 village tracts
Aim

- to describe river channel shape and how they change over time

Objectives

- to identify channel pattern and channel movement
- to examine the formation of channel-bar within the river course
- to assess channel bank erosion within the study area
## Materials and Methods

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Sensor</th>
<th>Month/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landsat 7</td>
<td>ETM+</td>
<td>March, 2006, March, 2011</td>
</tr>
<tr>
<td>Landsat 8</td>
<td>OLI</td>
<td>March, 2015</td>
</tr>
<tr>
<td>Topographic Map</td>
<td></td>
<td>1945 and 2002</td>
</tr>
</tbody>
</table>
Main channel, channel-bar and channel bank erosion data derived from Google Earth Engine (GEE) by using the Normalized Differenced Water Index (NDWI)

As a result, water features are enhanced owing to having positive values and vegetation and soil are suppressed due to having zero or negative values
(Landsat 8 OLI, Landsat 7 ETM+ and Landsat 5 TM) to calculate the NDWI with the following formulas:

\[
NDWI_{L8} = \frac{Band_3 - Band_5}{Band_3 + Band_5} \quad \text{Landsat 8 OLI}
\]

\[
NDWI_{L5} = \frac{Band_2 - Band_4}{Band_2 + Band_4} \quad \text{Landsat 5 TM}
\]
Results and Discussion

1. Classification of Channel Pattern along the Course

- In this paper emphasize on the plan-form especially on sinuosity along the Pyay to Hinthada segment of Ayeyarwady River course to explain channel pattern
The ratio between the measured length of a stream channel and that of the thalweg of its valley is measure of its sinuosity.

Sinuosity ratio $P$ is

1.0 for straight channel,
1.2 for transitional between straight and regular,
1.5 for regular channel,
1.7 for irregular channel and
2.1 for tortuous (Chorley, R.J., 1984).
<table>
<thead>
<tr>
<th>Year</th>
<th>Straight channel length (km)</th>
<th>Thalweg line length (km)</th>
<th>Sinuosity ratio</th>
<th>Channel pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>165.44</td>
<td>205.97</td>
<td>1.24</td>
<td>transitional</td>
</tr>
<tr>
<td>1996</td>
<td>165.44</td>
<td>209.29</td>
<td>1.26</td>
<td>transitional</td>
</tr>
<tr>
<td>2001</td>
<td>165.44</td>
<td>205.61</td>
<td>1.24</td>
<td>transitional</td>
</tr>
<tr>
<td>2006</td>
<td>165.44</td>
<td>214.69</td>
<td>1.29</td>
<td>transitional</td>
</tr>
<tr>
<td>2011</td>
<td>165.44</td>
<td>213.66</td>
<td>1.29</td>
<td>transitional</td>
</tr>
<tr>
<td>2015</td>
<td>165.44</td>
<td>220.92</td>
<td>1.33</td>
<td>transitional</td>
</tr>
</tbody>
</table>

Source: Based on Landsat 5, 7 and 8 satellite imagery. Calculated by author.
2. Channel Bar Formation along the Course

- The most common instream geomorphic units are accumulations of deposits referred to as bars.
- These areas of net sedimentation of comparable size to the channels in which they occur are key indicators of within-channel processes.
- In this paper, emphasize on the area of channel bar, in channel bar and total area of bar in the channel along the river course from Pyay to Hinthada segment.
### Table 6 Channel bar, in channel bar and total bar area along the river course

<table>
<thead>
<tr>
<th>Year</th>
<th>Channel Bar Area (sq-km)</th>
<th>Channel Bar Area (%)</th>
<th>In Channel Bar Area (sq-km)</th>
<th>In Channel Bar Area (%)</th>
<th>Total Bar Area (sq-km)</th>
<th>Total Bar Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>234.2458</td>
<td>80.33</td>
<td>57.3505</td>
<td>19.67</td>
<td>291.5963</td>
<td>100</td>
</tr>
<tr>
<td>1996</td>
<td>174.0022</td>
<td>67.63</td>
<td>83.2937</td>
<td>32.37</td>
<td>257.2959</td>
<td>100</td>
</tr>
<tr>
<td>2001</td>
<td>285.61</td>
<td>84.97</td>
<td>50.5058</td>
<td>15.03</td>
<td>336.1158</td>
<td>100</td>
</tr>
<tr>
<td>2006</td>
<td>244.0008</td>
<td>79.39</td>
<td>63.3261</td>
<td>20.61</td>
<td>307.3269</td>
<td>100</td>
</tr>
<tr>
<td>2011</td>
<td>247.6315</td>
<td>79.00</td>
<td>65.84</td>
<td>21.00</td>
<td>313.4715</td>
<td>100</td>
</tr>
<tr>
<td>2015</td>
<td>269.7123</td>
<td>80.32</td>
<td>66.0787</td>
<td>19.68</td>
<td>335.7910</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Calculated by author
3. Channel Movement along the Course

- In this paper, channel movement and erosion data derived from the topographic maps and satellite imagery by using screen digitizing and auto data extraction methods.

- For channel movement and bank erosion studies, there are eight selected channel movement sites along the study river course as shown in figure.
Channel movement site 1:
North Latitude 18° 29' 40.98" and East Longitude 95° 07' 48.72"
(Thauk Kyar Du village tract, Kyangin township, west bank of the Ayeyarwady River)
- No channel movement in 1996
- 0.5567 km in 2001
- 1.2117 km in 2006
- 1.6624 km in 2011
- 2.4269 km in 2015
Channel movement site 2:
North Latitude 18° 23' 39.56" and East Longitude 95° 12' 29.23"
(Sonle village tract, Kyangin township, west bank of Ayeyarwady River)
- No change in 1996
- 0.635 km in 2001
- 1.3106 km in 2006
- 1.5539 km in 2011
- 1.548 km in 2015
Channel movement site 3:
North Latitude 18° 13’ 1.25" and East Longitude 95° 22’ 3.12"
(Ka Zun Khon village tract, Myanaung township, east bank of Ayeyarwady River)
- 0.1061 km in 1996
- 2.0232 km in 2001
- 2.9019 km in 2006
- 2.5911 km in 2011
- 0.3108 km in 2015
Channel movement site 4:
North Latitude 18° 00' 6.40" and East Longitude 95° 28' 7.87"
(Nyaung Waing village tract, Monyo township, east bank of Ayeyarwady River)
- Channel movement is absent in 1996
- 0.1793 km in 2001
- 0.1754 km in 2006
- 0.7632 km in 2011
- 0.7451 km in 2015
Channel movement site 5: North Latitude 17° 56’ 39.28" and East Longitude 95° 27’ 4.33"
(Gway Tauk Chaung village tract, Ingapu township, west bank of Ayeyarwady River)
- 1.4236 km in 1996
- 1.0014 km in 2001
- 0.4267 km in 2006
- 0.3824 km in 2011
- 1.2019 km in 2015
Channel movement site 6: North Latitude 17° 52’ 22.69” and East Longitude 95° 28’ 0.50” (Sitkone village tract, Ingapu township, east bank of Ayeyarwady River)
- 1.3380 km in 1996
- 2.1398 km in 2001
- 3.2224 km in 2006
- 1.0717 km in 2011
- 1.0985 km in 2015
Channel movement site 7:
North Latitude 17° 43' 2.66" and East Longitude 95° 26' 34.51"
(Aing Ta Loke village tract, Letpadan township, west bank of Ayeyarwady River)
Ø 0.8237 km in 1996
Ø 1.1851 km in 2001
Ø 1.7039 km in 2006
Ø 1.8592 km in 2011
Ø 2.3740 km in 2015
Channel movement site 8:
North Latitude 17° 39' 10.14" and East Longitude 95° 28' 37.17"
(Gaung Say Kyun village tract, Hinthada township, west bank of Ayeyarwady River)
No channel movement in 1996

1.2250 km in 2001

1.9592 km in 2006

3.4468 km in 2011

5.2292 km in 2015
Conclusion

- 39 out of 97 village tracts are experienced to the bank erosion effect due to active channel movement.

- The study demonstrates efficient way to determine river channel pattern and understanding river erosion and siltation and how it has trended on settlement alongside the study area channel using GIS from medium resolution Landsat images and topographic maps.

- This type of study is obliging for further planning of river and river adjacent to settlement management an effective manner as it could be incorporated the long time changes of the river morphology.
References


THANK YOU VERY MUCH FOR YOUR ATTENTION