

Reprint from

GEOCARTO

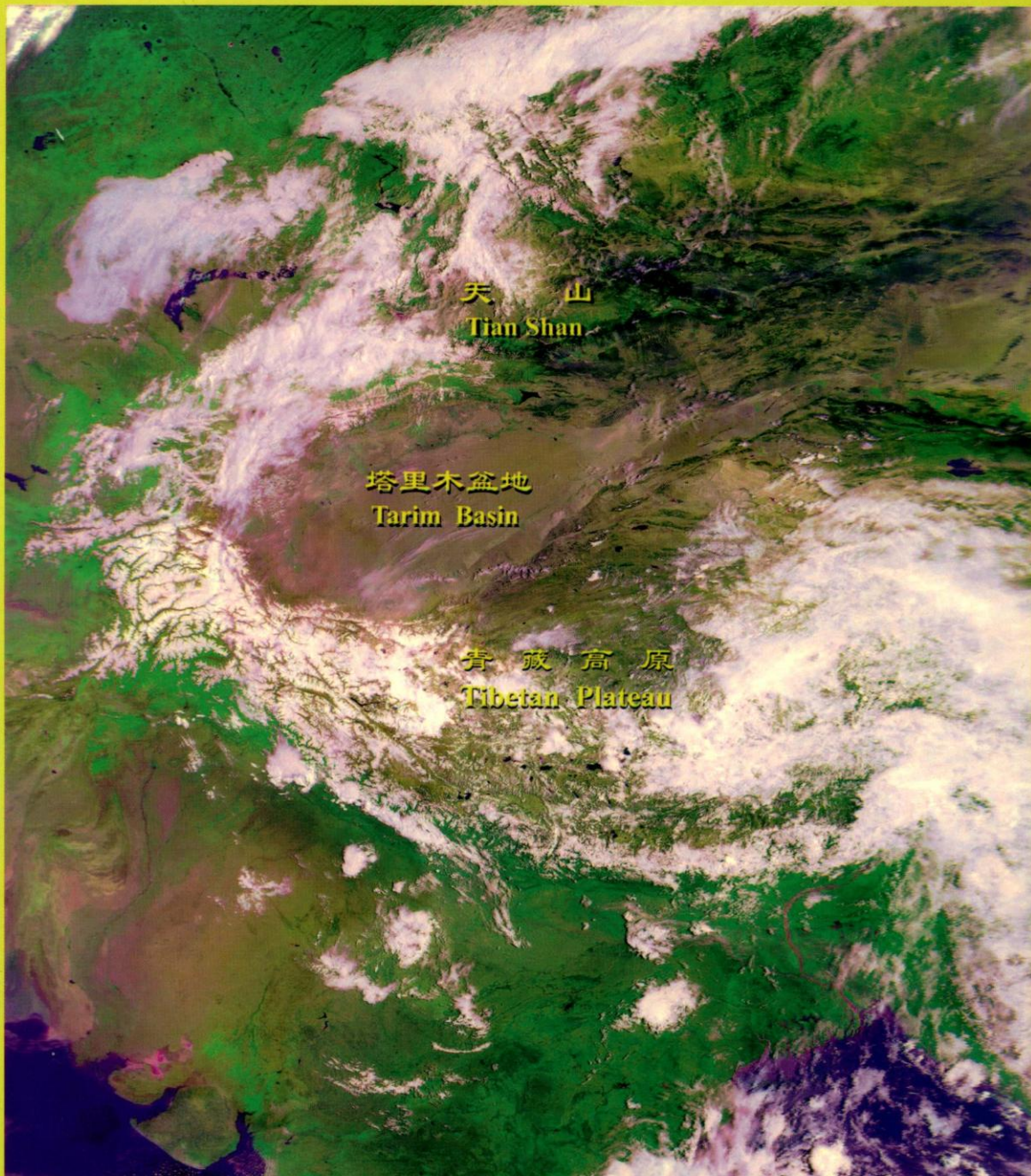
International

Vol.14

2

1999

A Multi-disciplinary Journal of Remote Sensing & GIS



The first image acquired by China's FY-1C meteorological satellite launched on May 10, 1999.
Courtesy of NSMC/CMA.



The Earth From Afar: Image Review

Editor: Paul R. Baumann

Department of Geography
State University of New York at Oneonta
Milne Library 317
Oneonta, NY 13820
U.S.A.

Powhatan, Louisiana: A Case Study in River Morphology

Paul R. Baumann

Department of Geography, State University of New York
Oneonta, NY 13820-4015, U.S.A.

This high-altitude, color infrared aerial photograph shows a section of the Red River Valley of Louisiana. It was taken on December 5, 1983 and covers an area of approximately 12.8 kilometers (8 mi) by 8 kilometers (5 mi). The hamlet size community of Powhatan (1990 Population, 147) is situated in the south central section of the image and a portion of the village of Campti (1990 Population, 929) is located on the image's eastern edge. The nearest large communities are Natchitoches, about 16 kilometers (10 mi) to the southeast, and Shreveport, 105 kilometers (65 mi) to the northwest. The corresponding topographic map comes from the 15-Minute U.S. Geological Survey Quadrangle for Campti, Louisiana which was published in 1957.

Physical Landscape

From the image area, the Red River enters into the Mississippi River, nearly 161 kilometers (100 mi) downstream, and represents the Mississippi's last major tributary before it flows into the Gulf of Mexico. Large rivers are often divided into three sections - their upper, middle, and lower courses. The image shows the Red River as being at its lower course level. At this level a river often changes its path as it slowly moves across a very flat floodplain. Within the twenty-six year period separating the map and the image, the river changed its course. Compare the location of the river on both the image and the map. In addition, the large distances between the contour lines on the map indicate a relatively flat condition, typical of a floodplain. This is also demonstrated by the agricultural fields on the image where farmers are taking advantage of the rich alluvial soil and flat land for growing crops. The poor drainage pattern shown on both the image and map further implies a low slope condition.

Common landform features associated with a lower course

river are oxbow lakes and scars, cut banks and point bars, and channel and slough fillings. They provide evidence of a river shifting over time. Oxbows generally form during flood periods when a section of the meandering river channel is cut off as the river attempts to shorten and straighten its path. (The term "oxbow" is derived from the U-shaped collar placed around an ox's neck to support the yoke.) The Old River is a classical oxbow lake. Note how the lake's water color is darker than the river which indicates stagnant versus flowing water. These lakes frequently dry up leaving scars on the landscape. Lake Paule d'eau is gradually converting from being an oxbow lake to an oxbow scar. The image shows a portion of the former lake, in white, which is now solid land and has been incorporated into an agricultural field. The image also exhibits the water section, according to the map, of the oxbow as being red in color. Since the image is in color infrared, items displayed in red indicate vegetation. The brighter the red the healthier the vegetation. It appears that the lake is covered with vegetation and in its final stage as a water body.

A river erodes the outside bank, known as the cut bank, of a meander loop and deposits materials on the inside of the loop forming a point bar. Centrifugal force whips the water out as it goes around the loop removing sediment from the outside bank. The one cut bank near Old River is moving the river closer to the community based on its location on the map in relationship to the image. The water on the inside of the loop flows at a slower rate and does not have the velocity to carry much sediment. These conditions can be observed on both the image and map. On the image the sediment deposits near the river appear white due to the high reflectance from their non-vegetated, sandy surfaces. On the map these areas are depicted by stippled brown patterns. Compare the areas on the map to those on the image to determine where new sediment is occurring as the river changes its channel.

As the water whips around the outside bank of the meander loop, it also circulates in a spiral pattern as it flows downstream, which creates a deeper channel on the outside bank. Note the difference in the water color as it moves around a loop.

Channel and slough fillings are the result of chute-type cutoffs which differ from the neck-type cutoffs related to the development of oxbows. A chute-type cutoff occurs when a river cuts across a point bar and creates a new channel. The flow of water through the old channel is slowly reduced, and eventually, the channel is abandoned creating a bar-and-swale relief. The channel is initially filled with silty-sand materials and finally with clay. Directly north of Powhatan on the south side of the river is an example of channel and slough fillings. A comparison of the river's location on both the image and map shows that the river has shifted northward cutting across a point bar. The dark colored vegetation and elongated water bodies indicate relatively recent filling with most likely silt and sand. The area immediately to the west is older and has more clay in the soil. A number of examples of channel and slough fillings can be found on the image.

Human Landscape

The Red River Valley in Louisiana was settled by the French in the early 18th century. They introduced the land survey system, commonly referred to as the long-lot system. Long-lots were long, narrow land parcels which started at a river's edge and continued inland for a great distance. They generally ranged from 91 meters (300 ft) to 182 meters (600 ft) wide and stretched back from the river 800 meters (.5 mi) or more. These parcels were laid out to give each land owner access to the river which was the main transportation route of the time. They also provided each land owner with floodplain, terrace, and interfluvial land. Each family could have its own farm but still live in close proximity to its neighbors.

In addition to Louisiana, the remnants of the long-lot system are still found on topographic maps and images relating to the French section of the St. Lawrence River Valley of Canada, Detroit (Michigan), Green Bay (Wisconsin) and Vincennes (Indiana). The map covering this particular area contains red lines with accompanying red numbers. These lines and numbers identify long-lot parcels. The image with its long narrow fields reflect some of these parcels.

A land survey system based on a river frequently encounters problems. Large rivers generally do not flow great distances in straight lines, but instead, they meander which disrupts the pattern of having a nice arrangement of lots of the same size and shape extending back from the river. Lots on the outer bank of a meander become wider as they continue inland; whereas, lots on the inside curve of a meander get narrower, and in some cases, terminate as a point.

Due to flooding, a river's path can change. In addition to identifying long-lot parcels, the red lines on the map outline the location of the river when the system was initially

surveyed. The lines circle around Old River but they then cross the present river and form a different path. In following this path across the map it is possible to trace the entire length of the river channel. Between the image and the map three different channels of the Red River can be determined.

Levees were not constructed along this section of the river resulting in long-lot parcels being significantly disrupted by flooding. Over time a number of questions pertaining to land ownership must have occurred resulting in litigation. If the river cuts across a long-lot and divides it into two parcels, does the land owner now own the land under the river? Does this person pay property taxes on the land covered by the river? If the land was being used for farming, how does the farmer move equipment and other items across the river between the now separate land parcels? Who owns the land which was the former river channel? Trying to superimpose a human landscape on a mature river can be a real challenge.

Although laid out as part of the long-lot survey system, this area, in general, never developed in this manner. Only the section around Old River truly reflects the long-lot settlement pattern. The image shows long, narrow fields spreading out from the oxbow. The small black squares on the map indicate buildings, generally dwelling units. These squares line the banks of Old River relating to where a farmer's home and out-buildings were to be located under the long-lot system. They are not found along the present river, but instead, along roads and in the communities of Powhatan and Campti. A road has been built around Old River and is located between the river and the dwelling units. It links this area to Powhatan and provides a small levee. It also indicates that the river is not being used as a transportation route.

A close examination of the image shows small dark red areas around Old River which correspond in location to the black squares on the map. These areas are the farmsteads where the farmers have their yards with trees. The white colored fields around the farmsteads are used to grow crops. Since the image was taken in December, the crops have already been harvested and the land prepared for the next growing season. If crops were in the fields, the fields would be red. Moving farther away from the river, some of the fields do become red in color and appear flat in texture indicating healthy, low growing vegetation. They are being used for pasture land. The animals maintained here are on slightly higher and dryer ground. In some cases the fields blend into dark colored woodlots. The trees are mainly deciduous in nature and their leaves have either dropped off or changed color. If they were evergreen trees, which can be detected in other portions of the image, they would be dark red.

In addition to the French impact on this river valley, other settlement patterns can be detected. Railroad lines with paralleling roads are found on both sides of the river and basically delimit the floodplain from the terraces. Steam engines found it difficult to pull trains over steep gradients making it desirable to place rail lines in the flat sections of valleys. In some cases the rail beds were placed at the outer

edge of the floodplain where the terraces began. In other cases the beds were located on the floodplain but a distance away from the river to reduce the likelihood of being washed away by a major flood. In these cases the rail beds act as levees against floods. They both contain the water and the expansion of the floodplain. Within the image area no bridge has been constructed across the river resulting in little social or economic contact between Powhatan and Campti. The nearest bridge is in Natchitoches. A river which provides a nice transportation path in one direction can become a barrier to cross in the other direction.

Finally on the north side of the river a mining operation can be detected on the image. The large pond is a detention reservoir to keep sediment from the operation from being

washed into the river. The white-colored, fan-shaped features are tailings which are depositing materials into predefined sections of the pond. These sections are eventually filled and form new land. Sand and gravel mining is very common on floodplains.

