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The Origin of Grassy Lake

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ABSTRACT

Two theories have been proposed to explain the formation of Grassy Lake. One attributes the formation of the swamp to earthquake; the other states that it is one of the many so-called oxbow lakes in the area. A study of aerial photographs showing the absence of fault zones and related sandblows tends to rule out any possibility of an earthquake origin, and in size and shape the swamp in no way resembles an oxbow lake. The aerial photographs reveal instead that the formation of the swamp was due to a natural levee being built up by a river which meandered through the low area now called Grassy Lake. The presence of dense stands of bald cypress (*Taxodium distichum* (L.) Richard), which grow in abandoned river channels, and a knowledge of the ecology of bald cypress support this hypothesis.

INTRODUCTION

Grassy Lake is a cypress swamp in Hempstead County about 7 mi north of Fulton, Arkansas. It has been suggested that Grassy Lake was formed in sunken land caused by an earthquake or that it is an oxbow lake, but a scientific study of its origin has not been made. The purpose of this investigation was to evaluate the earthquake and oxbow-lake theories, and to determine how Grassy Lake was formed.

METHODS

Ground and aerial reconnaissance for the purpose of taking photographs, studying topographical features and studying bald cypress was conducted throughout 1972. Photographs were taken through a 1.8/50 mm Oreston lens mounted on an Exakta RTL 1000 camera. Both Kodak Kodachrome II and Kodak Infrared films were used for the ground and aerial photographs. In addition, topographical maps and black and white aerial photographs provided by the U. S. Geological Service were used to study topographical features. Age comparisons of cypress trees were done by an approximation method similar to the one described by Harper (1912).

RESULTS AND CONCLUSIONS

From the study of ground and aerial photographs it became clear that the swamp was not formed by an earthquake because of the lack of both geological and botanical evidence related to earthquakes as described by Fuller (1912) in his discussion of the formation of Reelfoot Lake caused by the New Madrid earthquake. Studies also showed that the swamp is probably not an oxbow lake. An oxbow lake is a crescent-shaped body of water formed when a river shifts its channel during high water and cuts off a curve of its course. The size and shape of Grassy Lake rule out this hypothesis (Fig. 1).

The studies did show, however, that Grassy Lake is most likely a floodbasin or alluvial swamp caused by avulsion. The water in the swamp occupies a low basin situated between uplands and a natural levee formed beside an abandoned river channel (Fig. 2). Cypress stands growing in the swamp are of various population densities and ages. Uniformly dense stands of cypress mark old river channels which have lost their identity through erosional processes (Fisk, 1947). From data collected on the occurrence and size of these indicator stands of cypress, it is concluded that the Saline River which has long since abandoned the old river channel, commonly called Yellow Creek, at one time meandered through the low floodplain which is now a cypress swamp. Subsequently, the formation of a natural levee by the Saline River around the lower parts of the floodplain resulted in the present swamp condition.

Floodbasin swamps are irregular in shape and are flooded by both backwater and overflow waters. They are found in the lowest part of the floodplain, either bordering the river or between the floodplain and adjacent uplands (Meanley, 1972). Floodbasins differ from other parts of the floodplain mainly in that original erosional and depositional irregularities have been subdued or buried by floodwater sediments; however, drainage

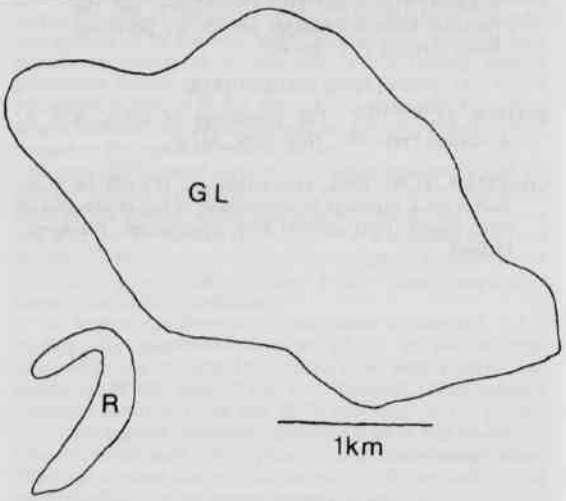

Figure 1. Grassy Lake (GL) compared in size and shape with Red Lake (R), an oxbow lake southwest of Grassy Lake.

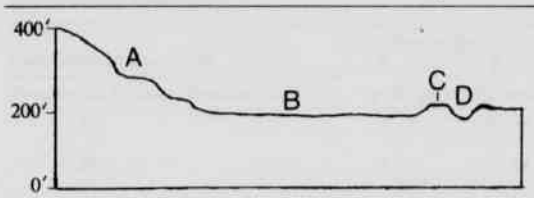

Figure 2. Topography of Grassy Lake as viewed in section toward south. A, Uplands; B, floodplain swamp called Grassy Lake; C, natural levee formed by Saline River; D, old abandoned river channel of Saline River, now called Yellow Creek.

patterns inherited from the original topography are preserved in the newtork of the swamp and are utilized both for distribution and withdrawal of flood waters (Fisk, 1947).

Because the original erosional and depositional irregularities in Grassy Lake have been buried or eroded away by flood waters, it was necessary to use cypress, which provide evidence of river meandering, as an indicator of these irregularities.

Bald cypress can be found growing along river channels and in lowlands which, except during rare periods of drought, lie under water of fluctuating levels (Allred and Mitchell, 1955). Demaree (1932) demonstrated that bald cypress seeds can germinate and survive only during the rare periods when the ground is moist but not inundated. The seedling must grow large enough during this period to withstand the deleterious effects of low respiration rates during periods of flooding.

Abandoned channels can be recognized by their "vegetation pattern." Filled or partially filled channel positions in uncultivated areas are marked by dense growth of vegetation over all or parts of the channel position. This vegetation is of the type suited to heavy, poorly drained soils and consists of cypress (*Taxodium distichum* (L.) Rich.), tupelo (*Nyssa aquatica* L.), red maple (*Acer rubrum* L.) and water elm (*Planera aquatica* (Walk.) Gmelin). It differs markedly from that of the better-drained natural levee where oak (*Quercus* sp.), pecan (*Carya* sp.), red gum (*Liquidambar styraciflua* L.) and cherrybark oak (*Quercus falcata* var. *leucophylla* (Ashe) Palmer and Steyerm.) flourish (Fisk, 1947).

Figure 3 shows cypress trees growing in an old river channel adjacent to Grassy Lake. These trees were growing first at the edge of the river. The eventual widening of the river placed the trees in the river channel. Later this river channel was abondoned and it became shallower because of sediments and periodic drying. This process eventually resulted in a dense stand of cypress in the abandoned channel. The dense stands of cypress are referred to as cypress heads.

The cypress heads in the Grassy Lake area have an average relative density of 40 trees per 0.40 hectares in contrast to a relative density of 3 trees per 0.40 hectares in other areas in the swamp. By locating these dense cypress heads in the swamp it was possible to retrace some of the old river channels which have been covered by sediments or eroded away. The cypress heads are easily distinguished from other cypress trees that have become established in the swamp during a drought. Most of the other cypress trees appear to be younger than those in the cypress heads. It is logical to assume that this is the case, as the trees in the cypress heads are the probable parents of the cypress trees scattered randomly throughout the swamp.

Examination of an aerial photograph of the entire swamp shows that there are several cypress heads of various ages throughout the swamp (Fig. 4). These cypress heads are an indication that the Saline River has changed its course several times, meandering across the low floodplain and finally stopping its avulsion for the present in this area. Before abandonment, the river channel had built up a natural levee large enough and high enough to retain water in a low floodplain or basin between this natural levee and uplands. The cypress swamp resulting from this process is called Grassy Lake.

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Figure 3. Infrared aerial photogrpah of abandoned river channel adjacent to Grassy Lake. A, Abandoned river channel; B, inundated cypress trees; C, region of erosion on natural levee between abandoned river channel and Grassy Lake.

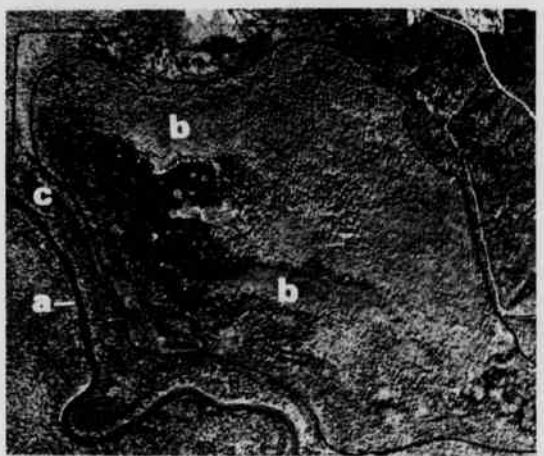

Figure 4. Aerial photograph of entire floodbasin swamp called Grassy Lake. Area of cypress swamp is outlined. A, Abandoned river channel; B, cypress heads; C, natural levee which contributes to inundated condition.