THE USE OF COLOR INFRARED IMAGERY FOR THE STUDY OF MARSH BUGGY TRACKS

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ABSTRACT

Due to the repeated use of marsh buggy routes in south Louisiana, marsh sediments and vegetation have been compacted. The waterlogging of the vegetation causes death of the vegetation, thereby producing elongated water bodies. Revegetation of these areas are possible, but it depends upon the number of times the tracks have been used. The revegetation period usually varies between two and ten years.

To facilitate a faster revegetation, alternate routes should be used, thereby lessening the damage to the marsh area.

Key Words: Marsh buggy, routes, vegetation, waterlogging, water bodies, revegetation, damage.

INTRODUCTION

Temporary and permanent damage of marshland environments due to the use of marsh buggies is becoming a major problem in the Louisiana coastal zone. The two kinds of buggies used, tracked and wheeled vehicles, create similar effects by compacting the marsh sediments and vegetation. Waterlogging of the vegetation causes death, leaving elongated water bodies in the tracks. Where the routes are repetitiously used, the compaction is increased, deepening the tracks and decreasing the possibility of revegetation. Revegetation periods vary according to the number of times the tracks have been used and range between two and ten years (Davis, personal communication).

GENERAL DISCUSSION

Studies have indicated that the degree of compacting and subsidence due to loads is dependent on the marsh type (Nichols, 1959b). Most important is moisture content - the higher the moisture content, the less load the marsh will support. In dry periods when there is little water on the marsh, the strength of the upper two feet has been found to increase (Nichols, 1959). The thickness of the upper portion consisting of root material and water determines the amount of compaction that will occur.

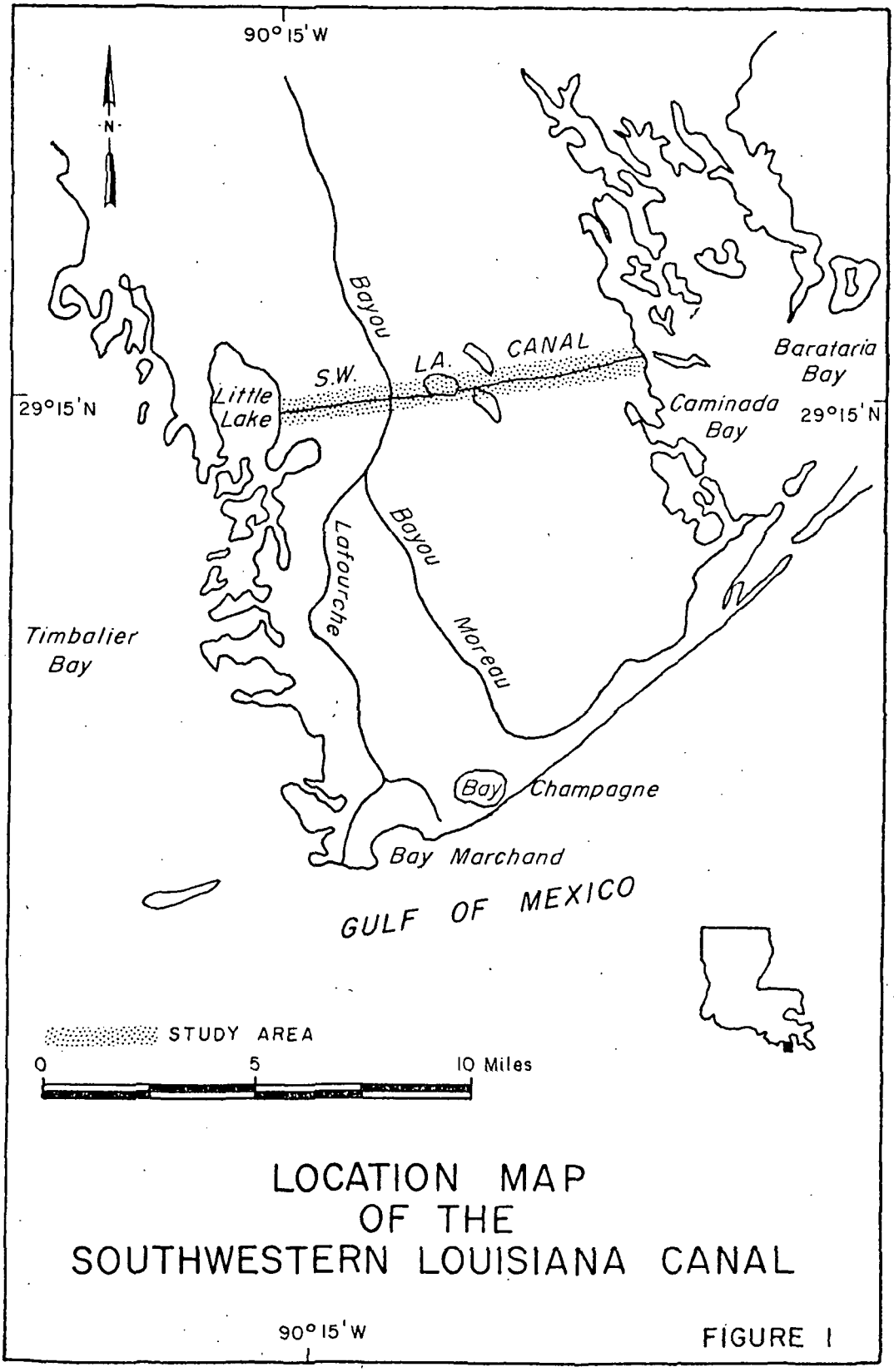
In this study, color infrared imagery was used to determine the location of buggy routes and to quantify the extent of tracks in a selected area where the marsh is seriously dissected. The imagery was also used to show successive stages of destruction.

The National Aeronautics and Space Administration (NASA) provided aircraft support for this project, as well as the majority of the flight

data, in the form of color infrared imagery, which was obtained on May 14 and October 25, 1973. The May imagery was recorded with an RC-8 camera which produced nine by nine inch transparencies at a scale of 1:6,000. The detail on the imagery was sharp and excellent for detecting the marsh buggie tracks and for measuring their length. A Hasselblad camera was used to record the October imagery, producing transparencies which had a format of 2 1/4 by 2 1/4 inch and a scale of 1:11,500. This smaller scale was used for detecting the tracks, however, distinguishing among numerous tracks is much more difficult.

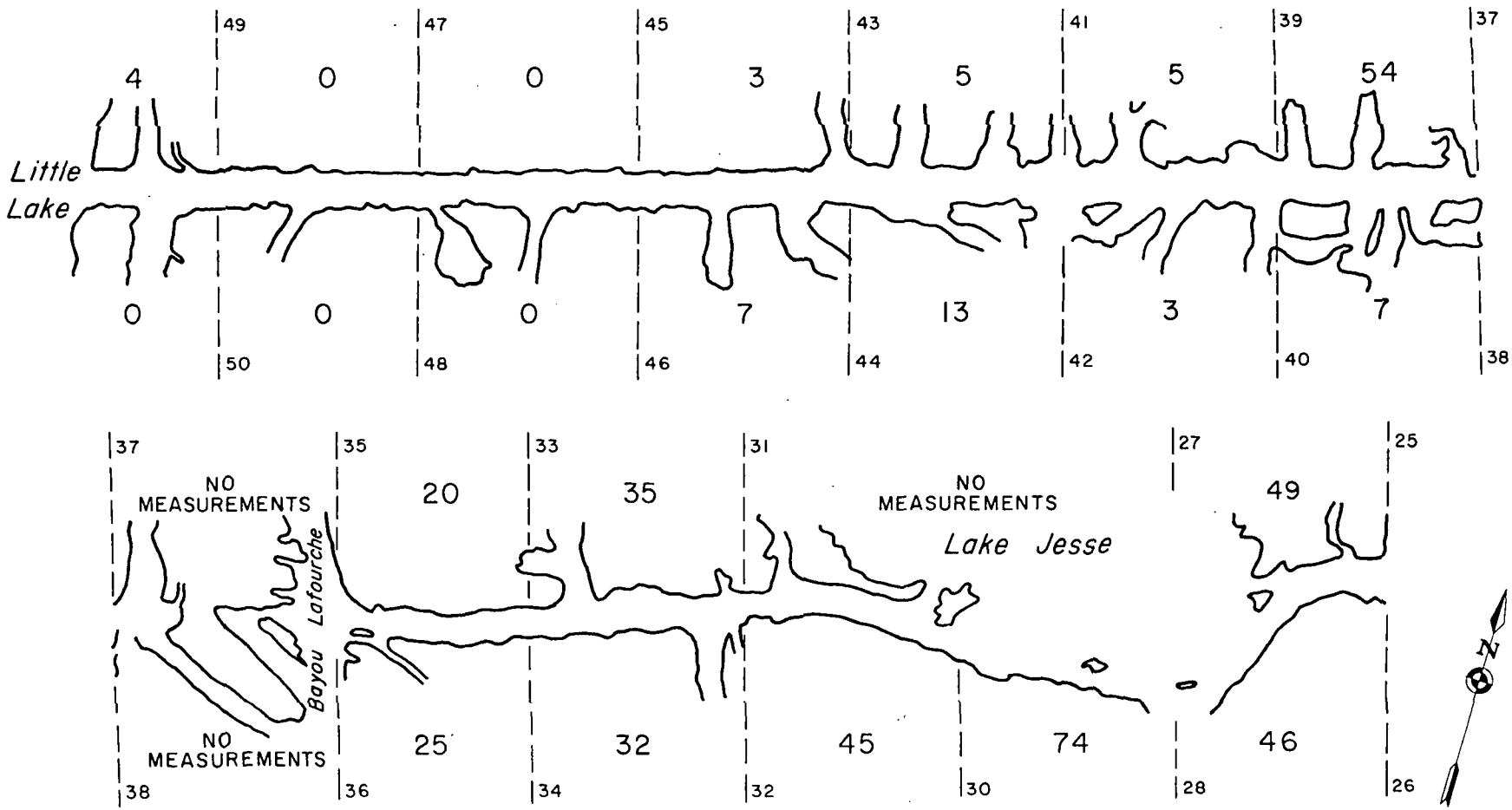
One of the main advantages of using color infrared imagery for detection of marsh buggy tracks is the strong delineation between land and water. Water reflects very little infrared radiation, and if free of particulate matter, appears dark on the imagery. Tracks which have compacted enough to contain water show as dark blue or black against the red return of vegetation. Differences in the returns based on abundance also allows detection of marsh tracks where revegetation is occurring.

Figure 1 is a map showing the general area where NASA coverage was obtained. The imagery clearly shows that the areas adjacent to the Southwest Canal to be highly dissected by buggy tracks. Vehicles are usually transported to the vicinity of a survey site by water. Spoil banks and marsh areas near the canals are used for parking and a hose of operation. The Southwestern Louisiana Canal is oriented NE-SW through a salt marsh environment dominated by Spartina alterniflora. Sediments along the canal are unconsolidated much soils consisting of approximately 15% clay, 53% silt, and 32% sand and contain an average of 20% organic material. During the summer months, the



LOCATION MAP
OF THE
SOUTHWESTERN LOUISIANA CANAL

FIGURE 1



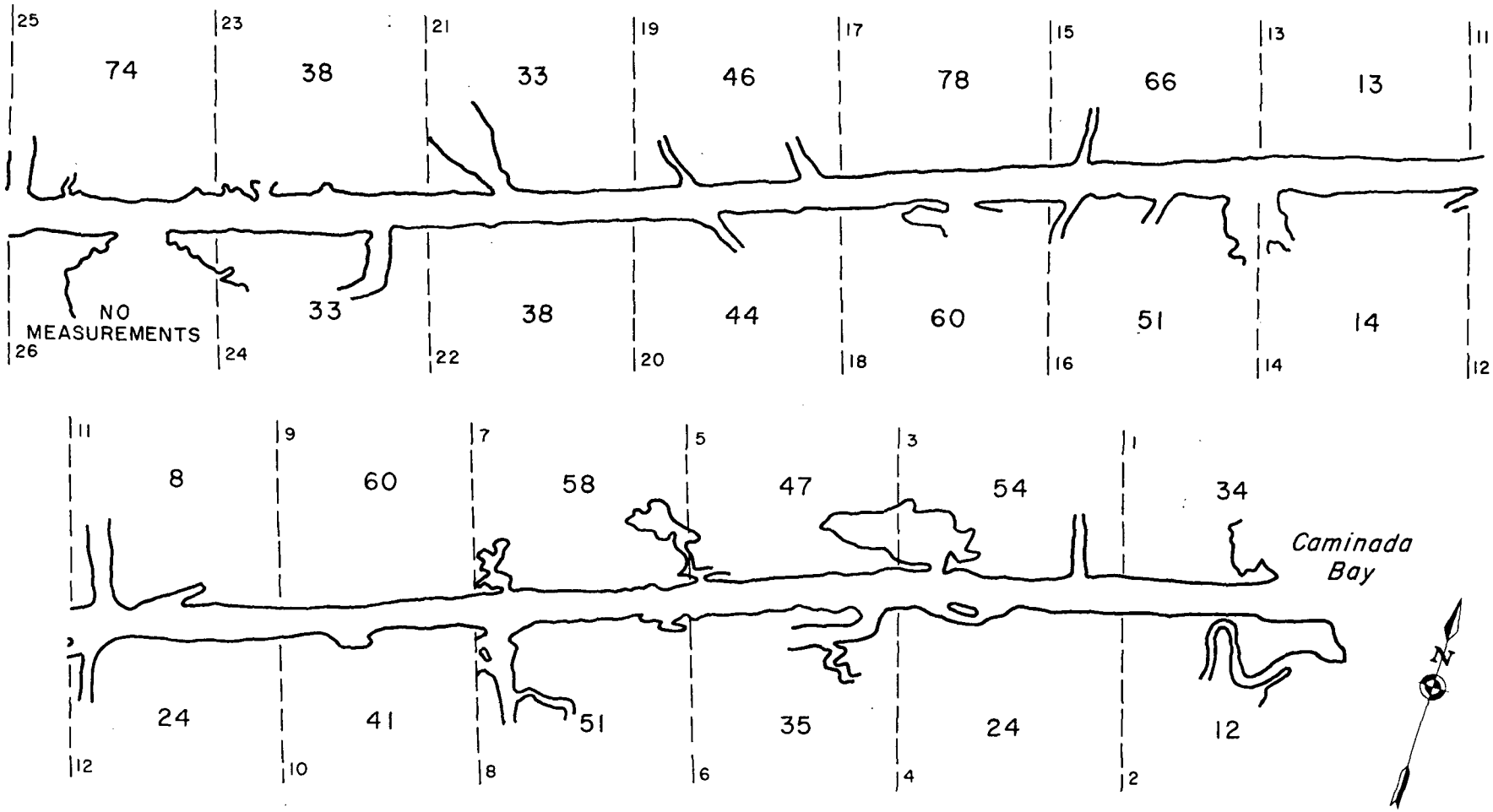
48 - Plot Number

13 - Miles of Track

0 500' 1000' 1500'

SOUTHWESTERN LOUISIANA CANAL

FIG. 2



SOUTHWESTERN LOUISIANA CANAL
(Cont.)

FIG. 2 (cont.)

marsh is saturated and usually has several inches of standing water on it. There is seldom any water covering it during the dryer winter period.

From ground level, the tracks are most obvious during the winter months when most of the vegetation is dead. In the summer when the abundance of vegetation is at its peak, the tracks can be detected from a distance since there appears to be swales across the tops of the vegetation where the tracks exist. There is no problem in locating tracks or swales on the IR imagery and only through the use of this mechanism can the magnitude of marsh buggy use in South Louisiana be determined.

The study area was divided into square plots along both sides of the canal (Figure 2). Linear measurements were made of the tracks shown on the imagery in each square. Because of the inability to determine the number of times the tracks had been used, the measurements represent routes of buggies rather than total usage. It should be remembered, however, that many of these routes are used continuously.

The data collected shows that there is only a limited area where there is a total absence of buggy tracks. These areas are in plots 47-50, and 52, which are located on the far western side of the canal. The extent of buggy use in the remainder of the plots ranged between 4 and 78 miles of track routes per plot. The total area sampled was 6.11 square miles and contains over 1500 miles of track routes.

Several stages of destruction can be detected on the imagery. In the initial stages, vegetation is matted and dead but compaction is not great enough for water to accumulate in the tracks. The dead vegetation is indicated by a whitish color on the imagery contrasting with the dark

red return of the live vegetation (Figure 3).

With continued use, the sediments and vegetation are further compacted and saturation and waterlogging are more evident. Increased moisture appears as dark tones of blue or black on the imagery making the tracks highly distinguishable (Figure 4).

Abandoned tracks will revegetate with time. Field data showed that revegetation is by the same species of plants. Due to the fact the vegetation is less abundant, the tracks are detectable on the imagery as a light pink to red color (Figure 5).

The most advanced stage of destruction results from a combination of subsidence and continued use of the tracks. Water areas increase, and there is less chance of revegetation (Figure 6).

CONCLUSION AND RECOMMENDATION

Color infrared imagery makes it possible to locate those areas which are most seriously damaged by marsh buggy tracks.

With a minimum effort in the field, considerable information regarding extent of use, stage of revegetation or deterioration, water enroachment, etc., can be obtained. This would be practically impossible to accomplish at ground level. The optimum use of buggies, or any other trackek vehicle, in marsh regions can be enhanced through proper application of aerial imagery.

If the use of tracked vehicles is to be continued, we recommend that alternate routes be defined in the operating area. This would eliminate, to a large extent, continuous use of the same route and would allow faster revegetation.

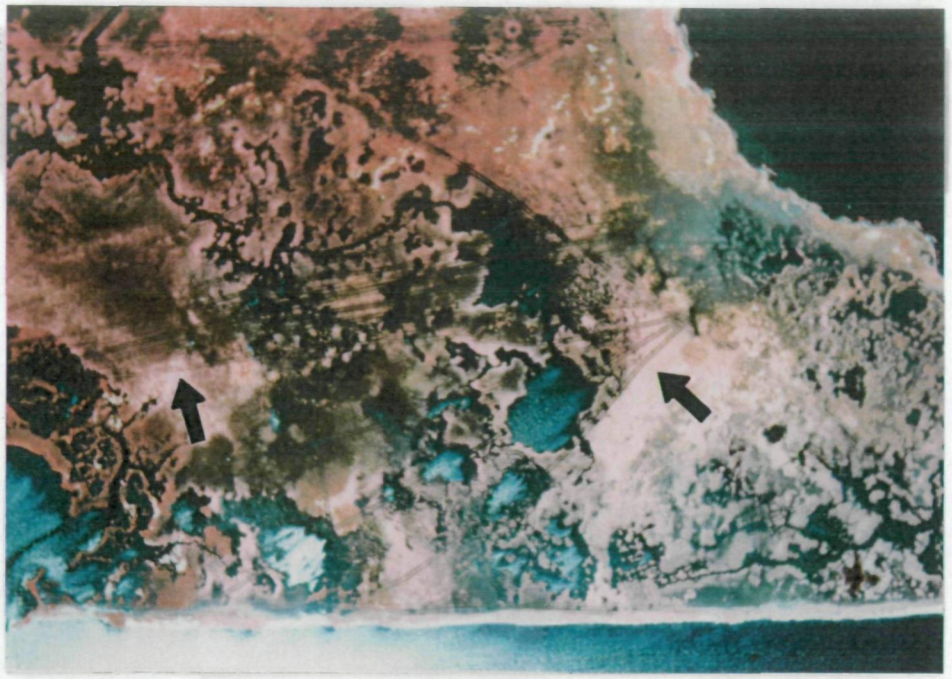


Figure 3 Initial stage of destruction where vegetation is matted

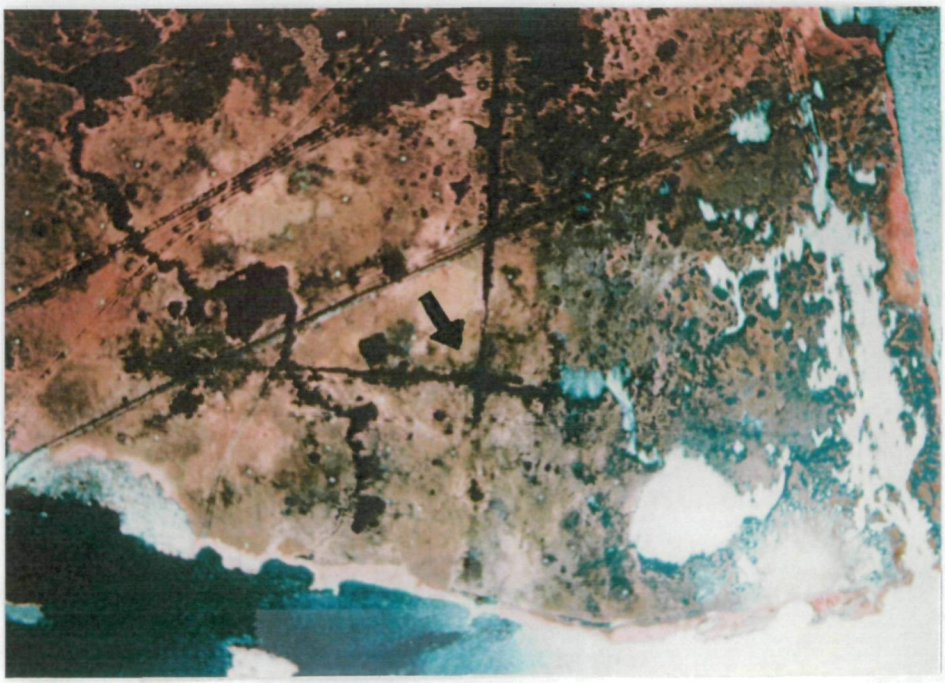


Figure 4 Continued use increases compaction and tracks become elongated water bodies

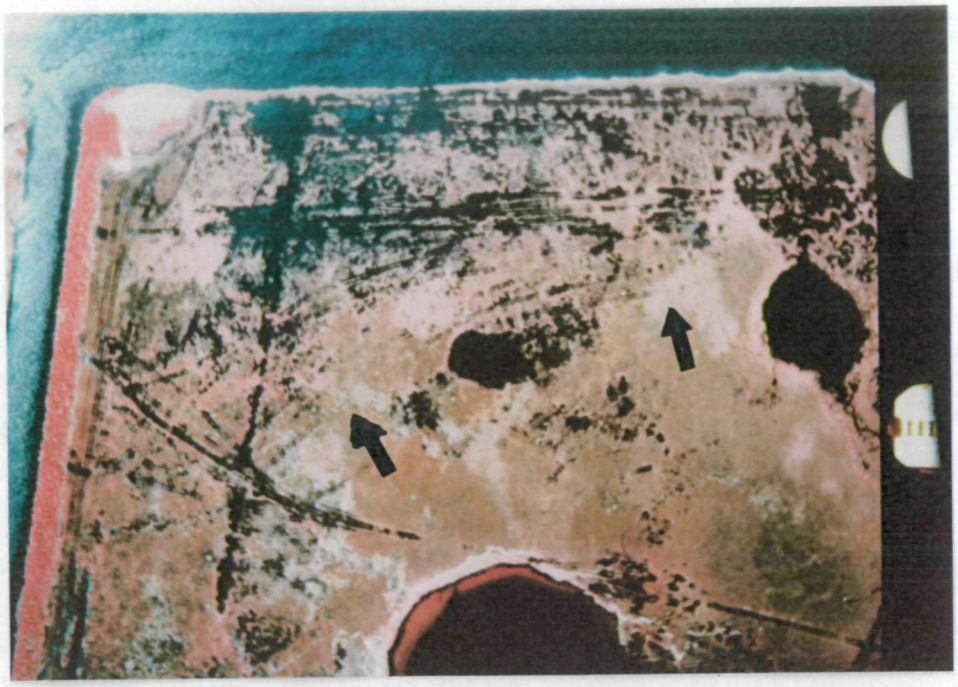


Figure 5 Revegetation of abandoned tracks

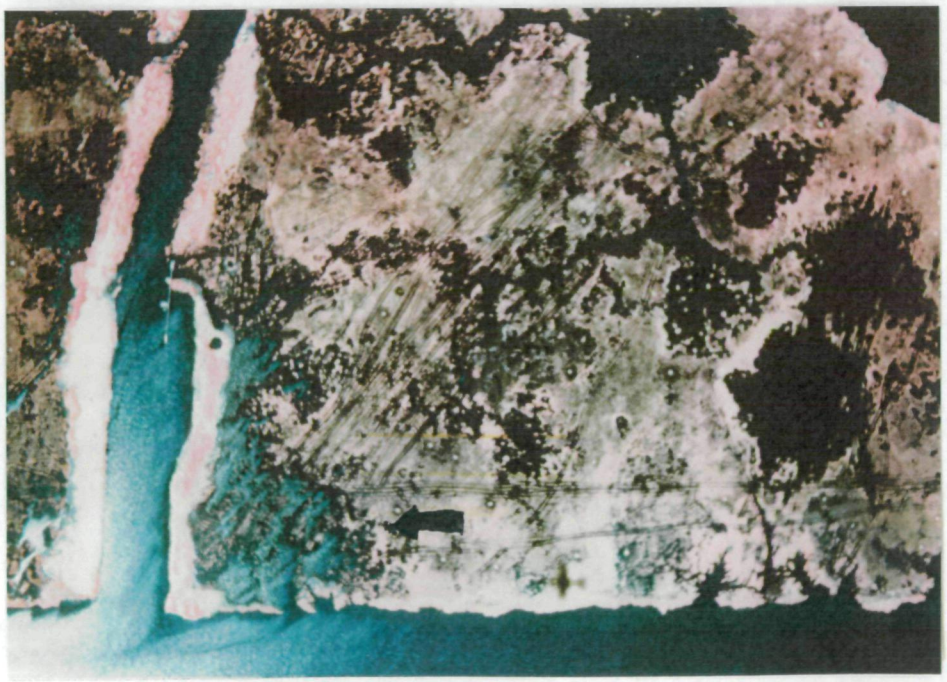


Figure 6 Advanced stage of destruction

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