



# Geomorphology of Lajas Valley, Southwestern Puerto Rico

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## Introduction

This work shows the main landforms that make up the landscape of the Lajas Valley Agricultural Reserve. It was possible to identify forms of modeled endogenous reliefs and model exogenous reliefs, forms of anthropic origin and bodies of water. This work corresponds to a first interpretation of the authors subject to revision.

## Methods

A photointerpretation analysis of aerial photographs and satellite images was carried out, combined with three-dimensional models of the terrain from a LIDAR file at 1 meter resolution. The forms were digitized by hand based on the authors' interpretation. The analysis was complemented with field work and drone flights.

In the gilgai formations, soil samples were taken at four depths, from 0 to 120 cm in 30 cm intervals, in addition, the apparent electrical conductivity of the soil was measured with an EM38 from the Geonics company.

## Results and discussion

### Anthropic origin forms

**Agricultural drainage system:** Between the 1940s and 1960s, the Lajas Valley was intervened with the creation of an irrigation and drainage system, which had the objective of providing fresh water to all the agricultural lands in the valley that had irrigation problems.

**Roads:** The map shows the most important roads in the area and how they have modified the landscape.

## Modeled endogenous relief

**Hills:** Located at the summit of the landscape, they correspond to the mountains to the north and south of the valley. Limestone rock mounts predominate on the surface with highly altered igneous material at their base.

## Exogenous cumulative fluvial relief

**Alluvial terraces:** Predominantly flat terrain or very slight slope, formed during the quaternary period, product of the deposition of igneous rock and limestone materials from the nearby mountains. It is possible to differentiate them by their elevation. They range from 0 to 35 meters above sea level. In the past these lands were flooded by an arm of the sea, there are different sandy and clayey strata, on the surface clays 2: 1 predominate, some of these soils present problems due to high levels of salinity and sodicity.

**Alluvial deposits:** Predominantly slight slope, formed during the quaternary period, product of the deposition of igneous rock and limestone materials from the nearby mountains.

Unlike the alluvial terraces that drain centrifugally towards the lagoons of the valley, these alluvial deposits have free drainage towards the sea, so they do not have many salinity problems, although they lack a good irrigation system.

## Water bodies

The natural drainage system of the Lajas Valley is made up of three predominant bodies of water. Draining towards the Boqueron Bay is the Cartagena Lagoon, while draining towards the Guanica Bay, is the Cienaga del Anegado and the Guanica Lagoon.

Of the three, the only one that currently remains is the Cartagena Lagoon, the other two were drained for agricultural purposes.

## Exogenous erosive fluvial/gravitational relief

**Hillsides:** Steep mountain slopes, strongly affected by fluvial erosion processes and gravitational erosion. They can expose part of the igneous, metamorphic and limestone rock formations of the mountains.

**Rounded hills:** Small slopes of moderate to soft slope, located in the southern mountain range of the Lajas valley. Modeled mostly by water. Usually used for livestock.

## Exogenous relief gravitational erosive

**Toe slope:** Landscape area located under the mountain slopes where colluvial deposition predominates. They have moderate to small slopes, with shallow rocky soils.

**Foot slope:** Located between the foot of the mountain and the alluvial terraces. Zone of transition, between the zone of colluvial deposits and alluvial deposits.

**Landslides:** Movements of gravitational origin, generally occur on mountain slopes where steep slopes predominate.

## Gilgai formations

**Saline alignment:** Parallel to state highway 116 in Puerto Rico, there is a saline alignment where there is the constant appearance of soil tumors. It is presumed of an anthropic origin which has not been verified.

In theory, the highly saline drainages of the limestone mountains of the southern mountain range drain through this alignment, generating particular conditions of extreme salinity and alkalinity in the soils. The effective electrical conductivity can reach 10 dS/m.

**Pond gilgais:** Caused by the presence of high artesian pressures. They are wetland areas where the permanent flooded high sodic soils predominate, with saline soils that surround these formations. The effective electrical conductivity can reach 12 dS / m.

## Conclusions and recommendations

This is a first preliminary version of the geomorphological map of the Lajas Valley at a scale of 1: 20,000, it is suggested to submit it to a critical review by experts in the field in order to improve and validate it. It is recommended to continue the studies around the gilgai formations, it is important to determine how these sites can affect agricultural land and how dangerous they can be for human activities.

## References

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