Report for 2005GU56B: Developing Digital Watershed Atlas for Guam.

Publications

- Other Publications:
    - Khosrowpanah, Shahram; Yuming Wen, 2005, Digital Atlas: A Useful Tool for Examining Southern Guam Streams, College of Liberal Arts and Social Sciences 27th Annual CLASS Conference, 6pp

Report Follows

PROJECT SYNOPSIS REPORT

Project Title: Developing A Digital Watershed Atlas for Guam

Problem and Research Objectives

Protecting streams from pollution, soil from erosion, and the coastal environment from degradation requires an effective management plan. An effective management plan requires accurate baseline information. This information should be stored and formatted in such a way that it could be easily available for any water resources study such as; watershed planning and management, estimating upland erosion, and impacts of mans activities on the quality and quantity of the streams and lake. In addition, the information should be stored in such a way that it could be easily updated and will be available to all interested agencies and researchers. During the 1990s, geographical information systems (GIS), with their ability to pull spatial data from different sources into an integrated environment, emerged as significant tools for hydrologic modeling. Particularly, GIS provided a consistent method for watershed delineation using digital elevation models (DEMs). A GIS can be visualized as a series of transparent overlays placed over a map of an area being investigated. Each overlay contains data describing a particular parameter of interest, e.g. one overlay for rainfall amount, a second for ground slope, etc., etc. The relationship and interactions between parameters can be easily modeled and explored. However, in order that GIS user's can take the best advantage of the layers that have been inputted into the GIS data base, it requires that all the layers be projected in a common agreed upon projection. The overall objective of this project was to create a digital atlas of Southern Guam's watershed by using GIS technology that includes the watershed boundary with its physical and environmental components. To accomplish the goal several steps were taken such as: a) identify the map projection and a digital elevation model (DEM) that should be used for developing atlas, b) develop watershed boundaries for all major basin in South Guam, c) develop physical characteristics of each watershed such as vegetation, soil types, river miles, badlands, roads, and location of stream gages.

Methodology

To accomplish the goal of the project several steps were taken. The first step was to form a core user group for atlas development. At the startup of the project, the researchers put together a committee with representatives from Government of Guam and other related agencies. The role of this committee was to determine: a) the best available source of digital elevation data, b) the map projection to be used for the development of the atlas, c) what are the smallest sub-watersheds that should be considered, d) what data layers should be included in the atlas and, e) how will the data be made available to the users and the general public. The core group met several times during the project period. The second step was developing physical characteristics of the southern Guam's watersheds. During this phase the layers that

describe the physical characteristics of the southern Guam watersheds were put together. This included developing**;** a) standard Digital Elevation Model (DEM) set for the island, b) watershed boundaries for all major basins in South Guam, c) stream maps for all the major streams, e) layers showing river mile locations for all major streams, f) stream profiles (graphs of elevation vs. river mile) for all major rivers, and g) slope and slope aspect maps for all of South Guam. All the data in phase II was collected from the previous studies and field works that have been done on Guam. The last step was to projecting all the layers into one common projection system that was determined by the core group.

Principal Findings and Significance

A core user group was established, and three user group meetings were organized to determine an existing digital elevation model (DEM) data with the best spatial resolution we could get. The DEM data obtained from US Geological Survey (USGS) with a horizontal spatial resolution of 10 meters has been used to delineate the watershed boundaries in the Southern Guam. According to the agreement made among the core user group members, the projection used for the watershed atlas is UTM, and the datum is North American Datum 1983 (NAD83). Arc Hydro data model and hydrology functions in Spatial Analyst extension for ArcGIS 9x were used for watershed delineation. The watersheds' hydro edges were determined by using the digital elevation model, and referenced to the previously determined Flood and Emergency Management Agency's (FEMA) watershed boundaries. Some minor errors were corrected by referencing contour lines. The watershed delineation resulted in 14 watersheds in the southern Guam (Figure 1). Available GIS datasets such as DEM (Figure 2), rivers (Figure 3), soils (Figure 4), stream gage stations (Figure 5), vegetation (Figure 6), roads and satellite images were input to the digital watershed atlas for each watershed. Slope and aspect information was created from the DEM data. The completed watershed atlas will be available to the public, and a primary source for watershed management and planning, soil erosion simulation, assessment of contamination in rivers or watersheds, government's decision-making support systems, etc.

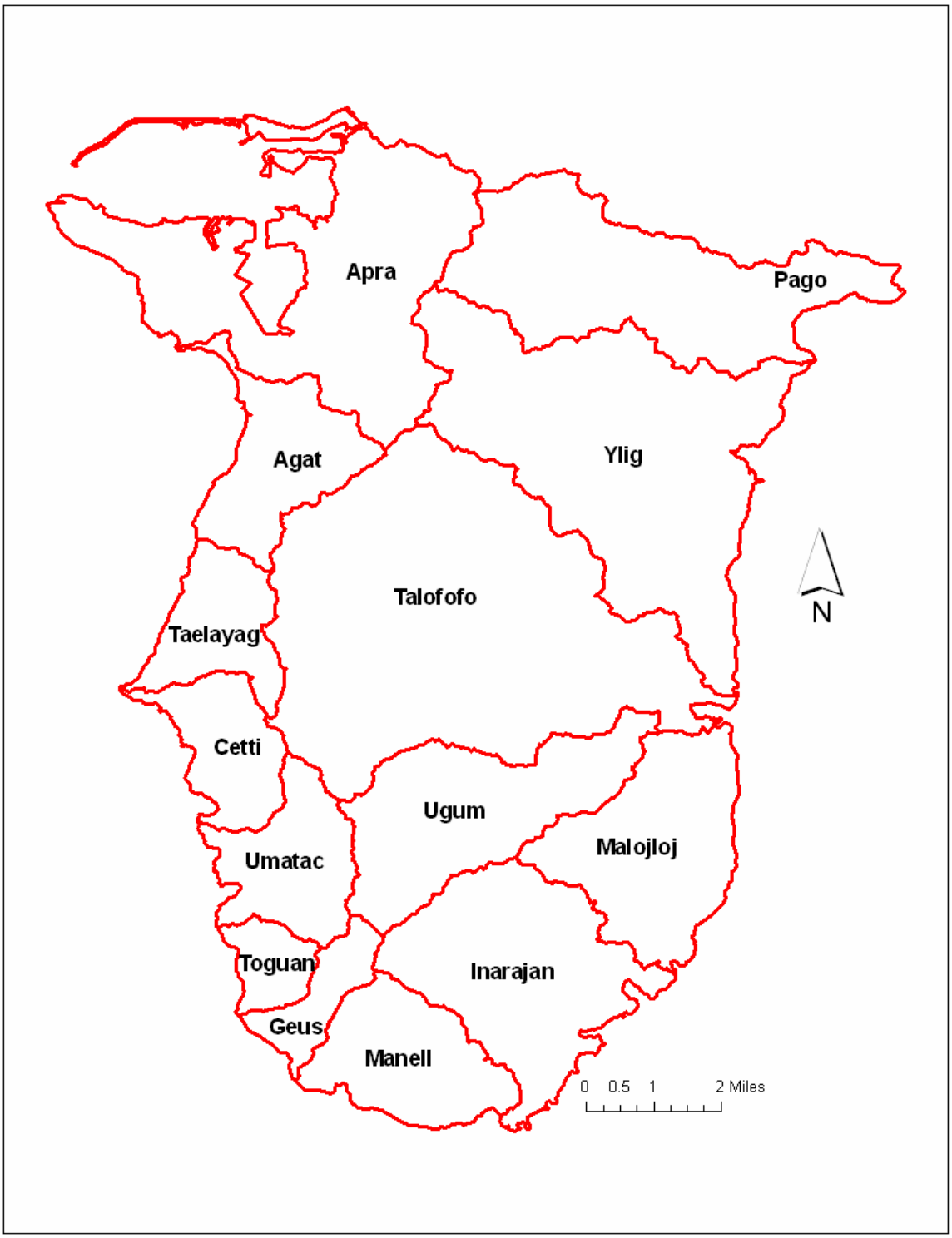

Figure 1. Delineated Watersheds in Southern Guam.

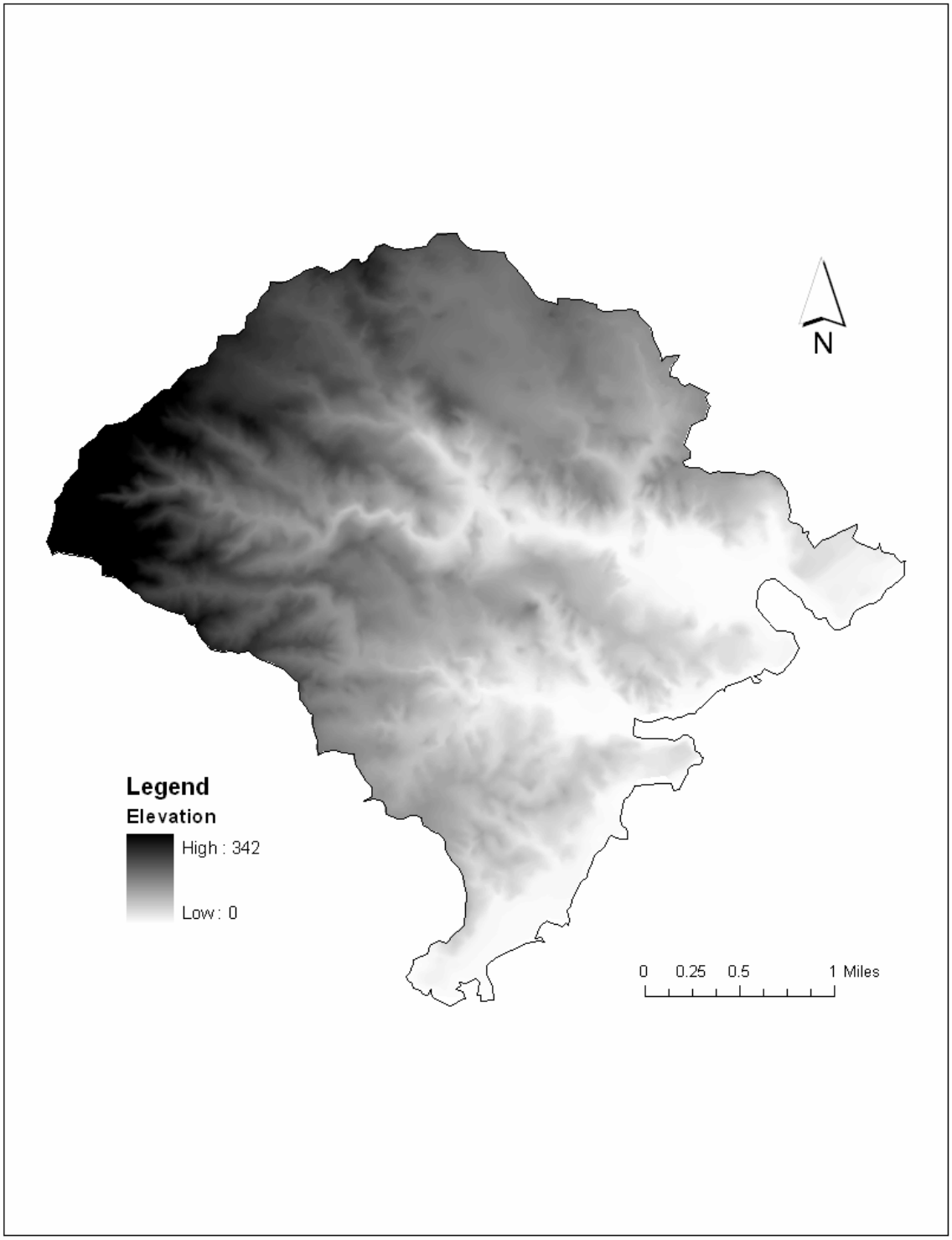

Figure 2. Digital Elevation Model (DEM) date for Inarajan Watershed.

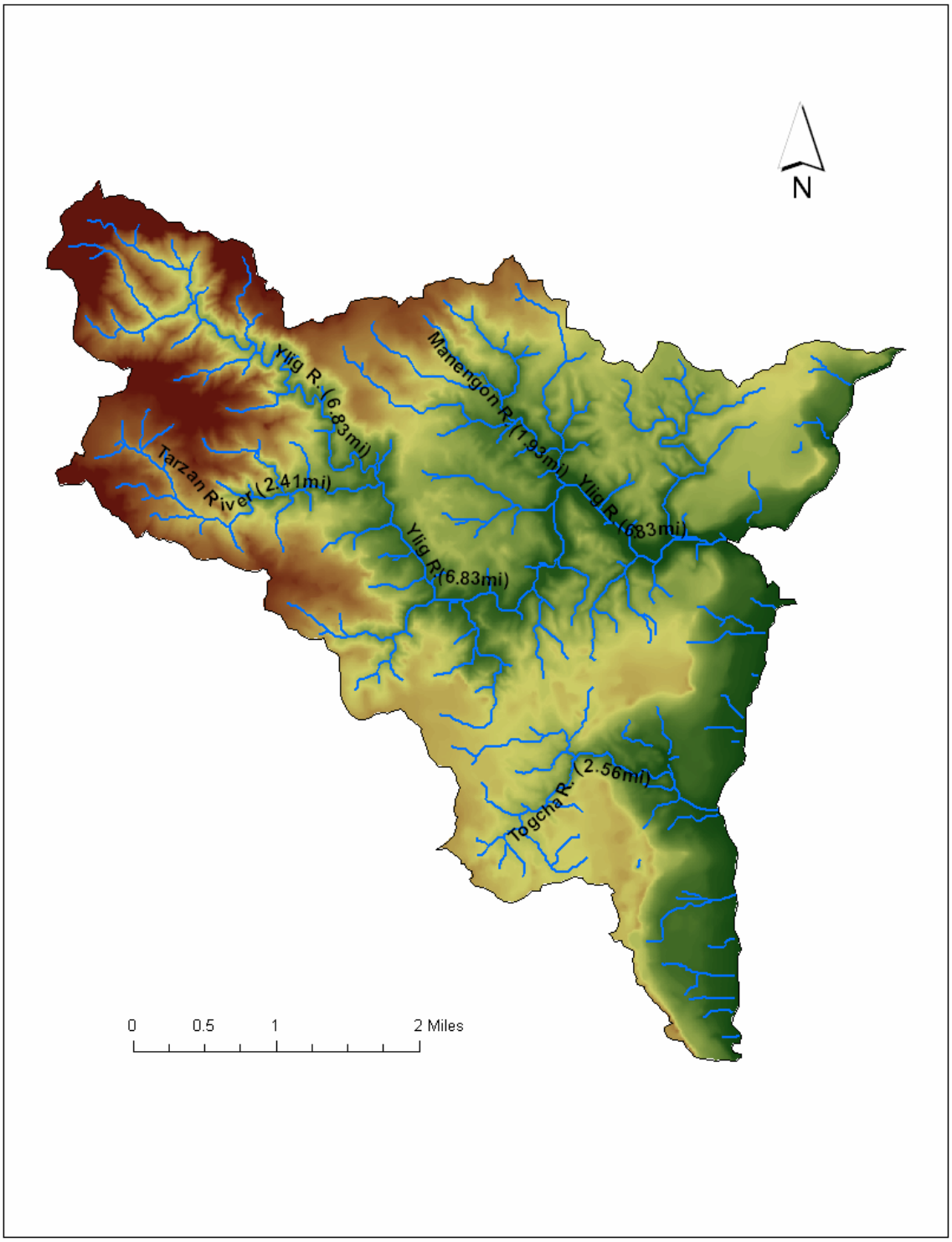

Figure 3. Rivers with River Miles in Ylig Watershed.

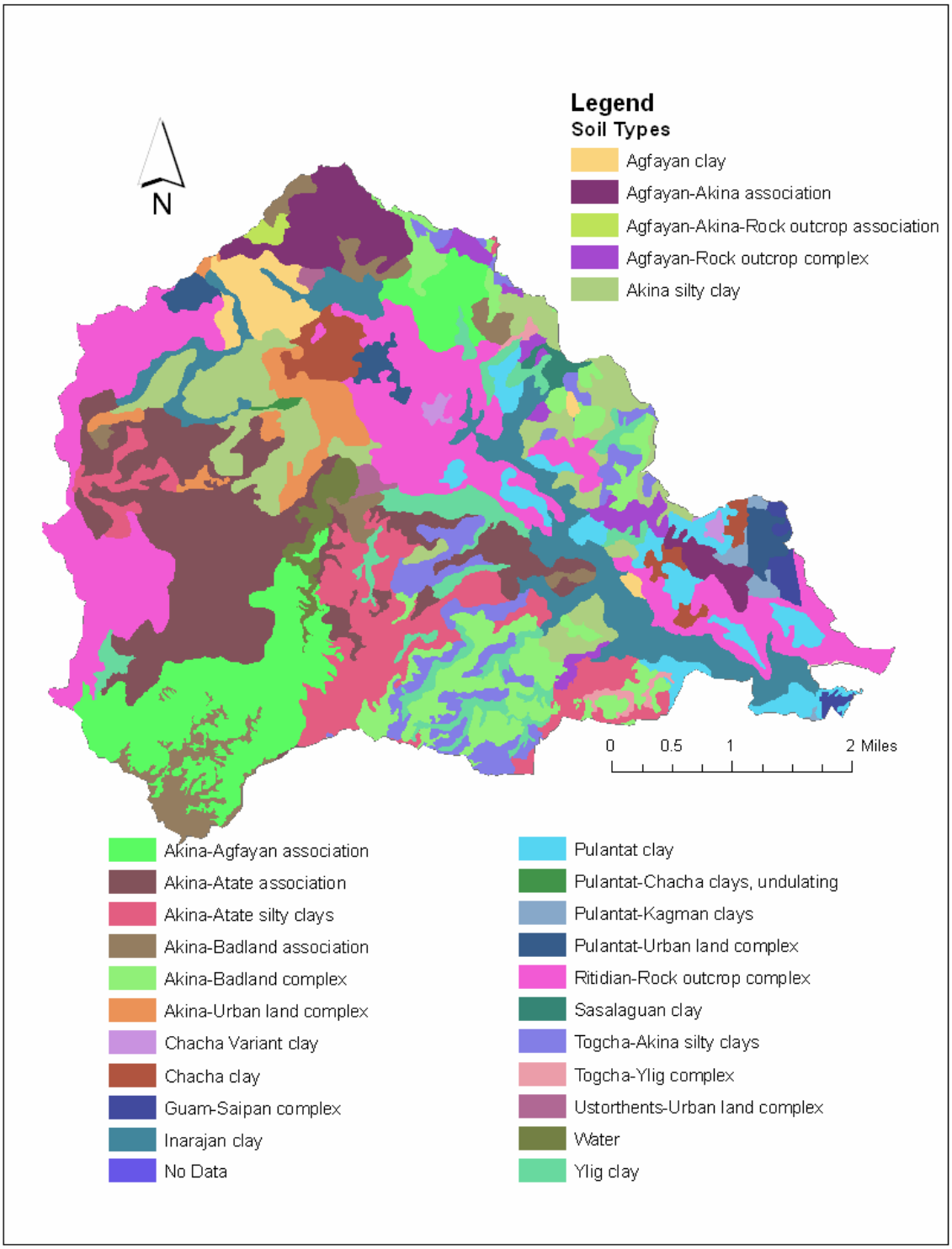

Figure 4. Soils in Talofofo Watershed

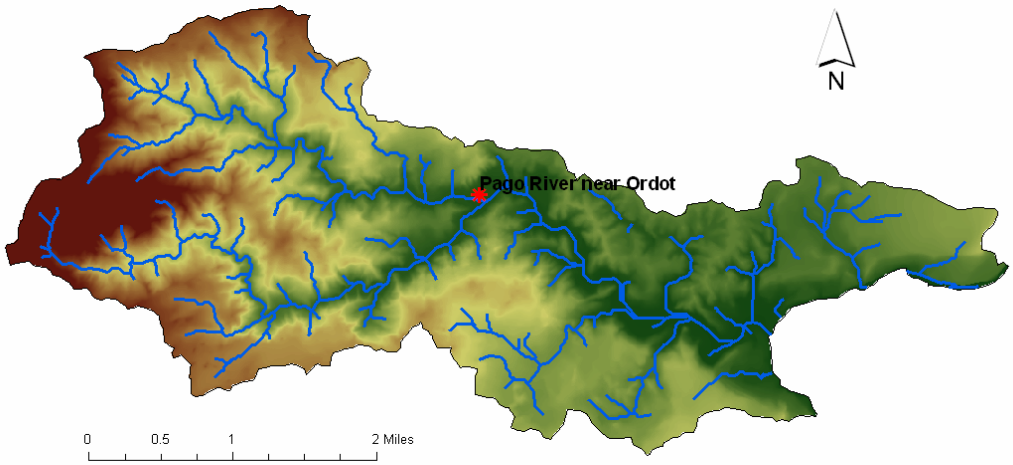

Figure 5. Stream Gage Station in Pago Watershed

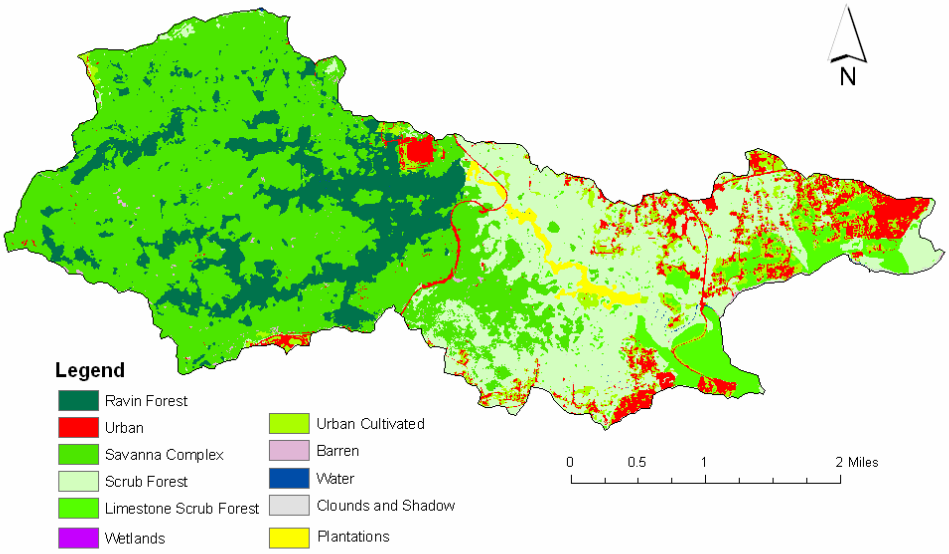

Figure 6. Vegetation in Pago Watershed