SOCIÉTÉ AUDUBON HAÏTI

CRITICAL ECOSYSTEM PARTNERSHIP FUND

Geographic Profile of Grand Bois, Haiti

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ACRONYMS

ArcGIS	Arc Geographical Information Systems (ESRI software)
BPDA	Bureau pour le Développement de la Production Agricôle
CEPF	Critical Ecosystem Partnership Fund
CNIGS	Centre National de l'Information Géo-Spatiale
ESRI	Environmental Systems Research Institute
GE	Google Earth
IHSI	Institut Haïtien de Statistique et de l'Informatique
Kml	Keyhole Markup Language
MARNDR	Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural
MDE	Ministère de l'Environnement
MINUSTAH	Mission des Nations Unies pour la stabilisation en Haïti
MPCE	Ministère de la Planification et de la Coopération Externe
NSF	National Science Foundation
SAH	Société Audubon Haïti
SIG	Système d'Information Géo-Spatiale

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Introduction

Grand Bois is located in the extreme western part of the Tiburon peninsula of southwest Haiti. The presence of a relatively intact rainforest with an exceptional biodiversity of endemic plant and animal species makes Grand Bois a prime candidate as a protected area (Hedges and Timyan, 2014; Lescoart, 2014).

A series of maps were analyzed to study the political, socio-economic, biophysical parameters of Grand Bois. A fifty square kilometer study area was selected. The center of this area is the highest peak in the area (approximately 1256 m) and shown by the red triangle in **Figure 1**. The nearest large towns are Tiburon to the southwest and Les Anglais to the southeast.

Figure 1. Grand Bois study area (Google Earth, 2015; SAH, 2015).

Administrative Boundaries

The study area is bounded on the north by the *Département de la Grande Anse* and on the south by the *Département du Sud.* The boundary between the departments passes through Morne Grand Bois peak and follows the ridgeline of the mountain chain (**Figure 2**).

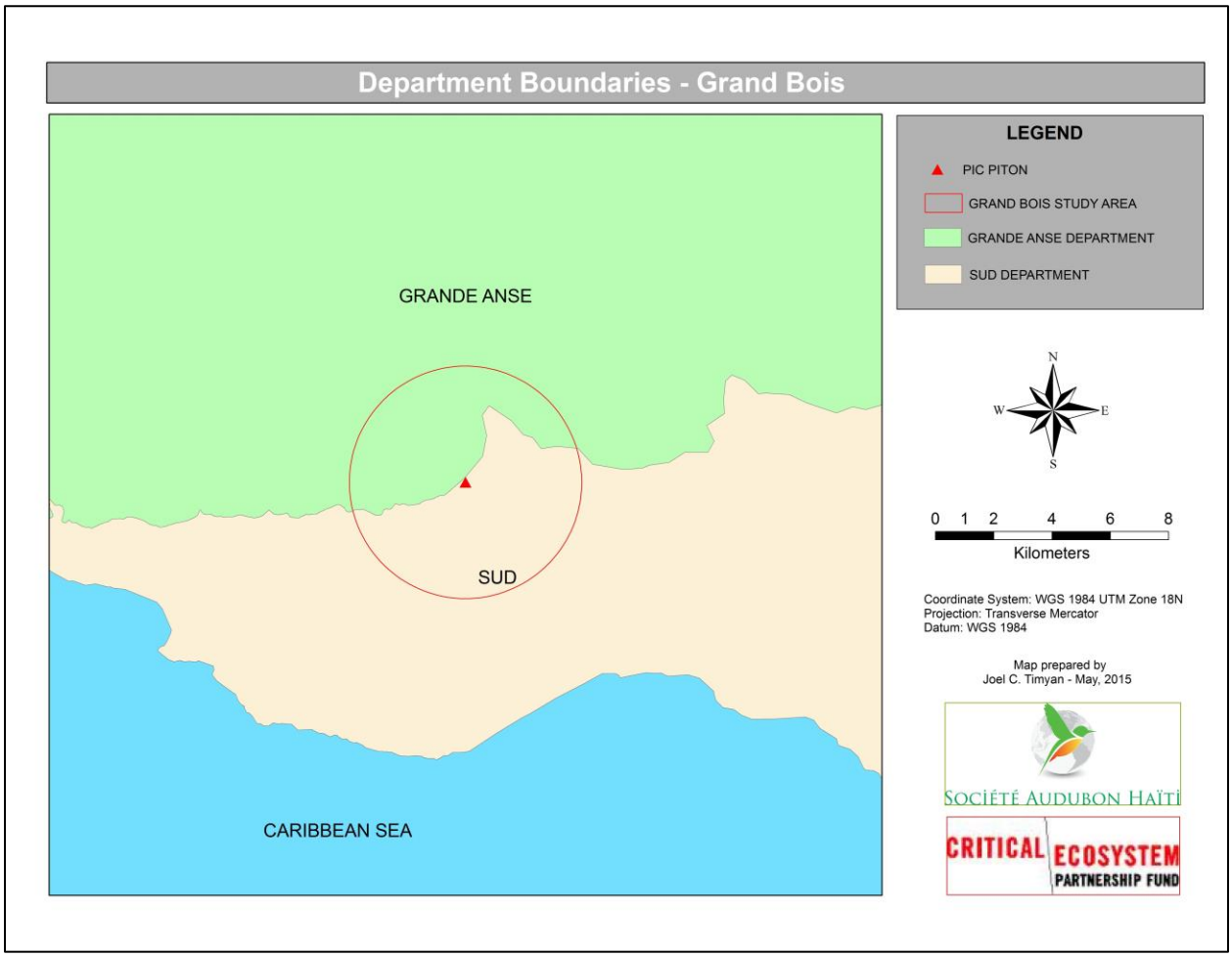

Figure 2. Department boundaries of the Grand Bois study area (CNIGS, 2001; SAH, 2015).

The Grande Anse department is represented in the study area by 2 communes – Les Irois and Moron. Les Irois commune is represented by the communal section of *5ème Matador.* The Moron commune is represented by the communal sections of *3ème L'Assise* and *2ème Sources Chaudes.* The Sud department is represented by only one commune – Tiburon – which has 2 communal sections within the study area: *3ème Loby* and *2ème Nan Sevré*. These communal section boundaries are shown in Figure 3.

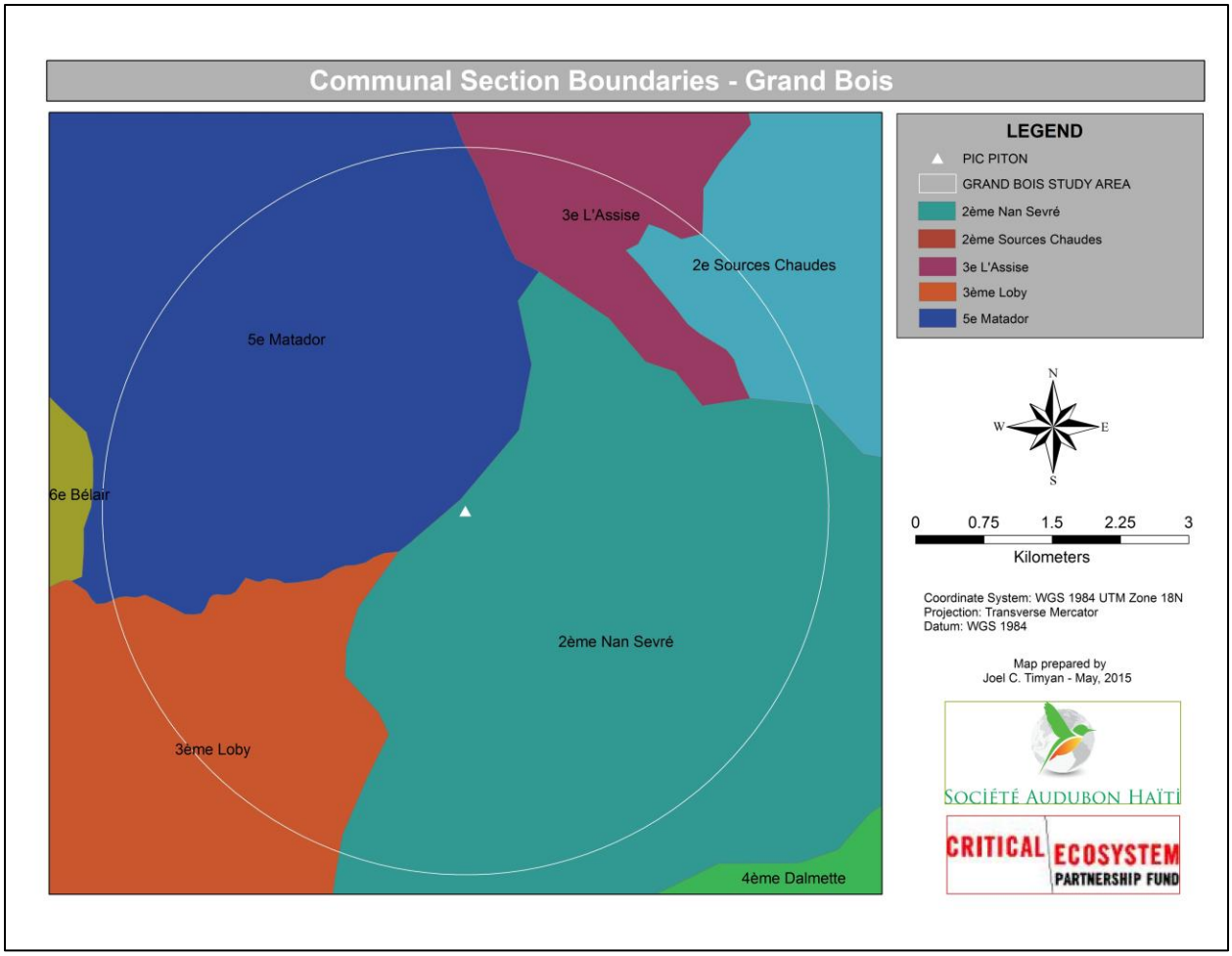

Figure 3. Communal section boundaries of the Grand Bois study area (CNIGS, 2006).

Population

The most recent census was conducted in 2003 (IHSI, 2003). The rural population of the communal sections estimated for the Grand Bois study area in 2003 was 3896 (**Table 1**).

Table 1. Communal sections and their proportional rural population represented within the Grand Bois study area.

Section Communale	2003 Population	% Area in Study Area	Est. 2003 Population
2ème Nan Sevré	2343	54	1264
3ème Loby	5612	11	629
5ème Matador	6716	24	1612
3ème L'Assise	9205	3	259
2ème Sources Chaudes	3968	3	132
Total	27844		3896

In general, rural population in Haiti has been decreasing by an annual average of -1.25% over the 10-year period of 2004-2013 (http://data.worldbank.org). Given these trends, a minimum estimate of 3326 is estimated in 2015 for the Grand Bois study area. Conversely, the data provided by IHSI for 2012 suggests that population rates have increased considerably since the 2003 census, ranging between 9.1 – 28.8% for the 2003 – 2012 period (IHSI, 2012). Estimates based on these rates of increase would be considered maximum. The current 2015 population estimate is likely to fall between these two estimates (Table 2). The actual estimate is nearer to the minimum given that rural population density is negatively correlated with elevation of the communal sections.

Table 2. 2015 population estimates based on World Bank (2015) and IHSI (2012) for the Grand Bois study area.

Section Communale	2003 Estimate	2015 Min. Estimate	2015 Max. Estimate
2ème Nan Sevré	1264	1079	1417
3ème Loby	629	537	708
5ème Matador	1612	1376	2099
3ème L'Assise	259	221	324
2ème Sources Chaudes	132	113	183
Total	3896	3326	4731

Habitat Density

Habitations were located on high-resolution orthophotos (2010) and compared to the most recent Google Earth images (July 16, 2013). The results are shown in **Figure 4**. An estimated 854 habitations occupy the 50 km^2 study area, as shown by the red dots. The high concentration of habitations occur along the Tiburon River near the market town of Sevré. This concentration extends along the axis of the main road corridor that connects the market to the coastal town of Tiburon. The remainder of the habitats are a combination of residences and seasonal huts used by farmers during cropping seasons. Although widely dispersed in the upper elevations of the study area, they occur mainly in the more fertile growing areas of the north rather than the drier southern slopes above the Tiburon River valley.

In addition to the habitat density map, a trail map for the study area is under construction. This map will show the major trails and roads with obvious implications on the ecology and the economy of the area.

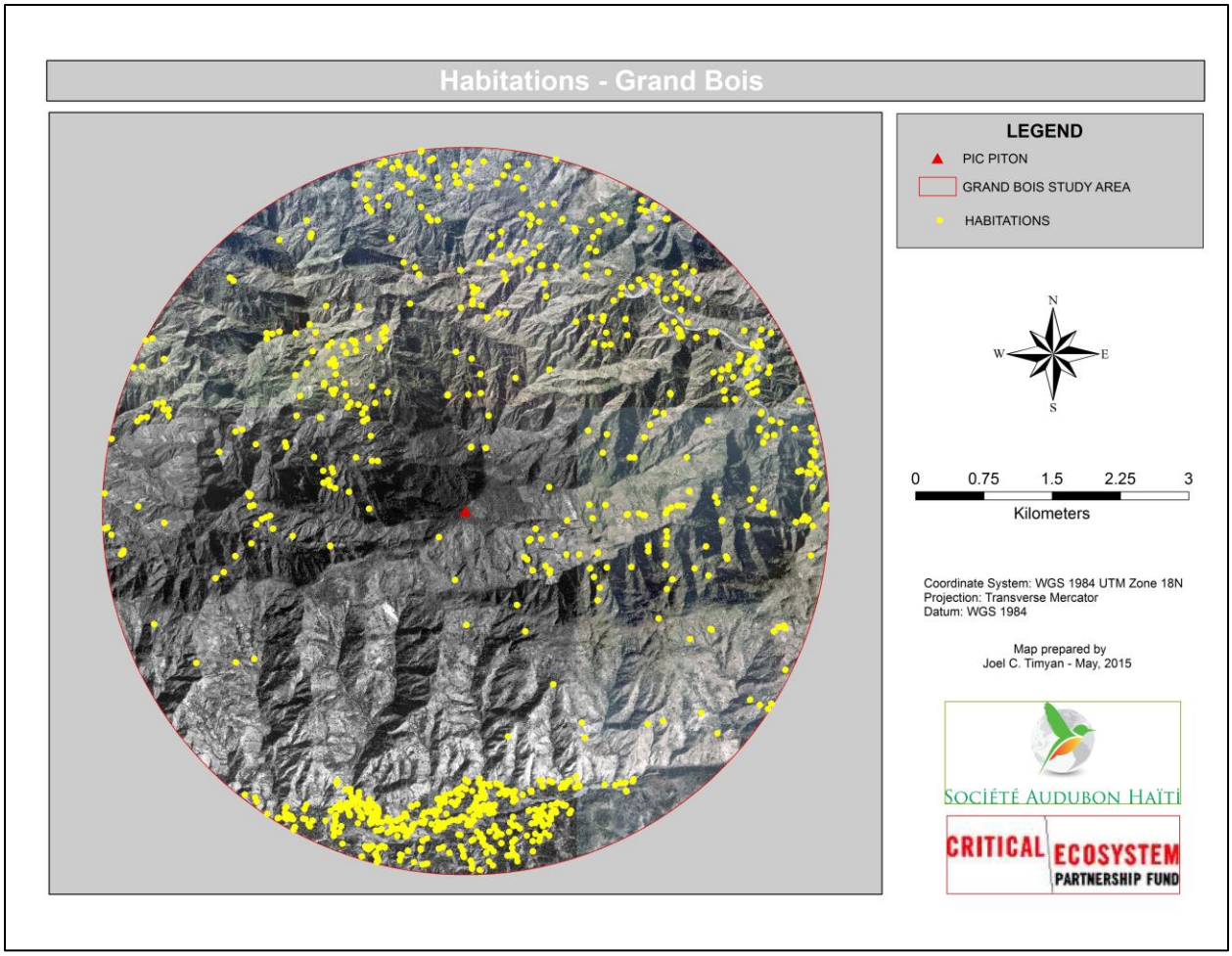

Figure 4. Habitation density in the Grand Bois study area (CNIGS, 2010; SAH, 2015).

Geology

The coarse scale geological map of the study area shows a mix of 3 major geological formations (**Figure 5**). The majority of the study area is comprised of hard limestone dating to the Cretaceous period approximately 88.5 – 65 million year ago (Butterlin, 1954). Approximately 40% is a volcanic – sedimentary rock and 5% is detrital sedimentary rock and alluvium that is the result of eroded fractured rock material typically found in the ravines and river valleys.

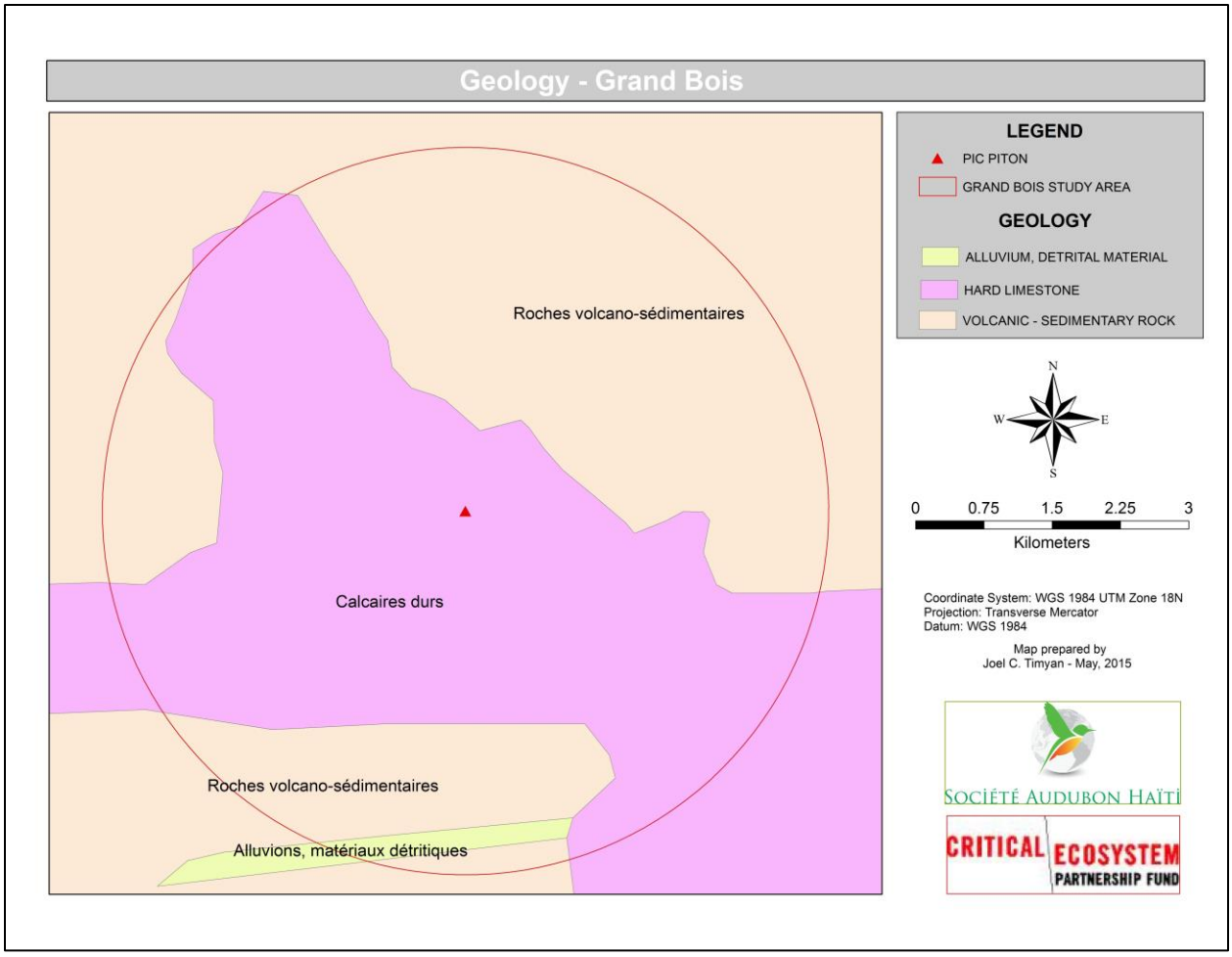

Figure 5. Geological map of the Grand Bois study area (CNIGS, 2003; SAH, 2015).

Grand Bois occurs along the major east-west Enriquillo Fault that is responsible for the uplifts that created the Massif de La Hotte and the Tiburon River that flows to the west (**Figure 6**). The numerous fault lines of the area are responsible for the geomorphological patterns of the mountainous landscape.

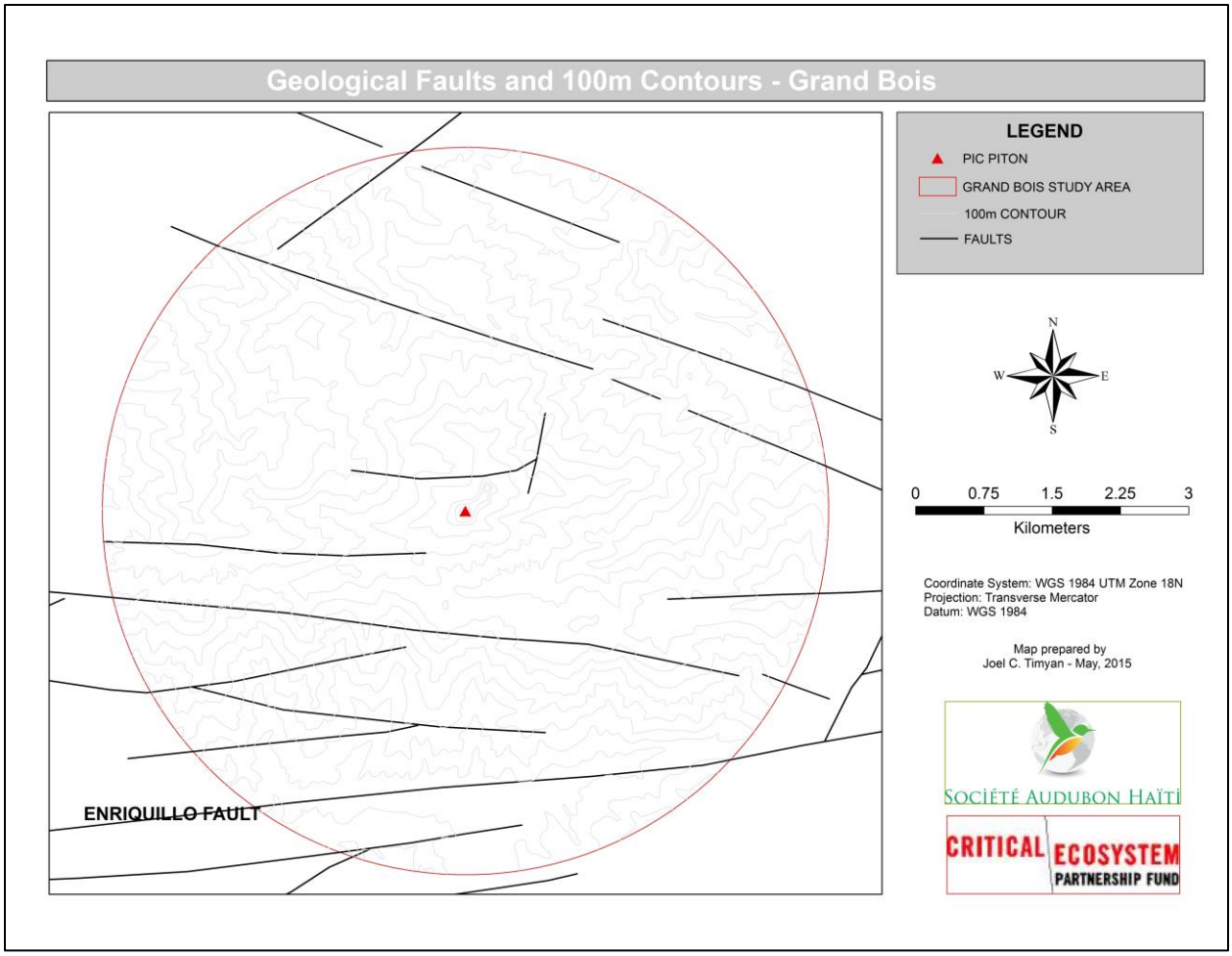

Figure 6. Map showing relationship between geological faults and 100-m contours of Grand Bois (MINUSTAH, 2010; CNIGS, 2014; SAH, 2015).

Hydrogeology

Three major geological formations determine the basis for the aquifers supplying groundwater to the study area (**Figure 7**). The area is dominated by karst aquifers with minor contribution of alluvial aquifers bordering the Tiburon River and crystalline formations on the southern and northern slopes of the mountain range.

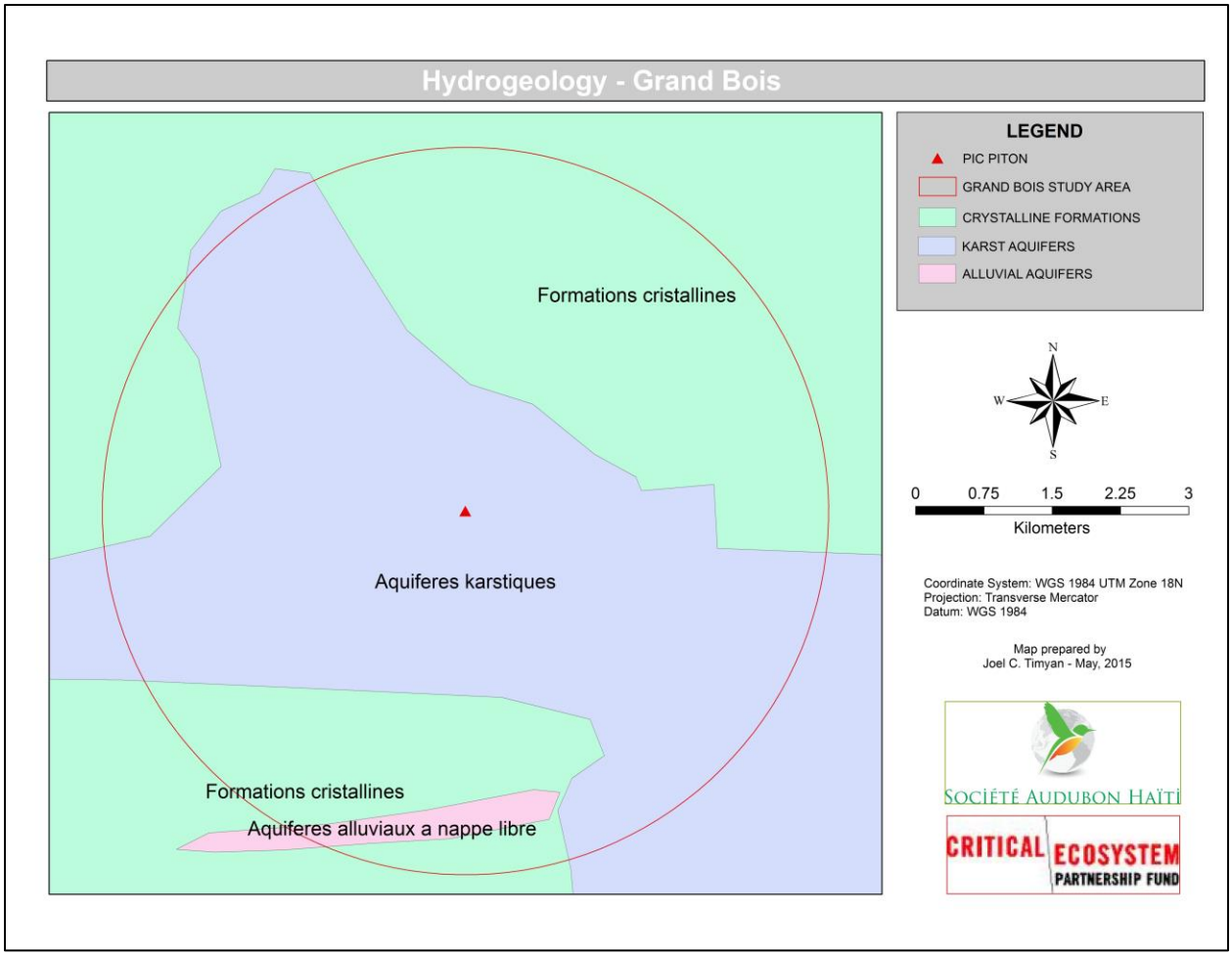

Figure 7. Hydrogeological formations of the Grand Bois study area (CNIGS, 2004; SAH, 2015).

Hydrography

There are two major watersheds that occur in the study area: Grande Anse and Tiburon (**Figure 8**), named for the rivers that drain the area. The tributaries of the Grande Anse River flow north and east while those of the Tiburon River flow south and west. There are numerous springs in the Grand Bois area that are the origin of these tributaries, but they have not been georeferenced.

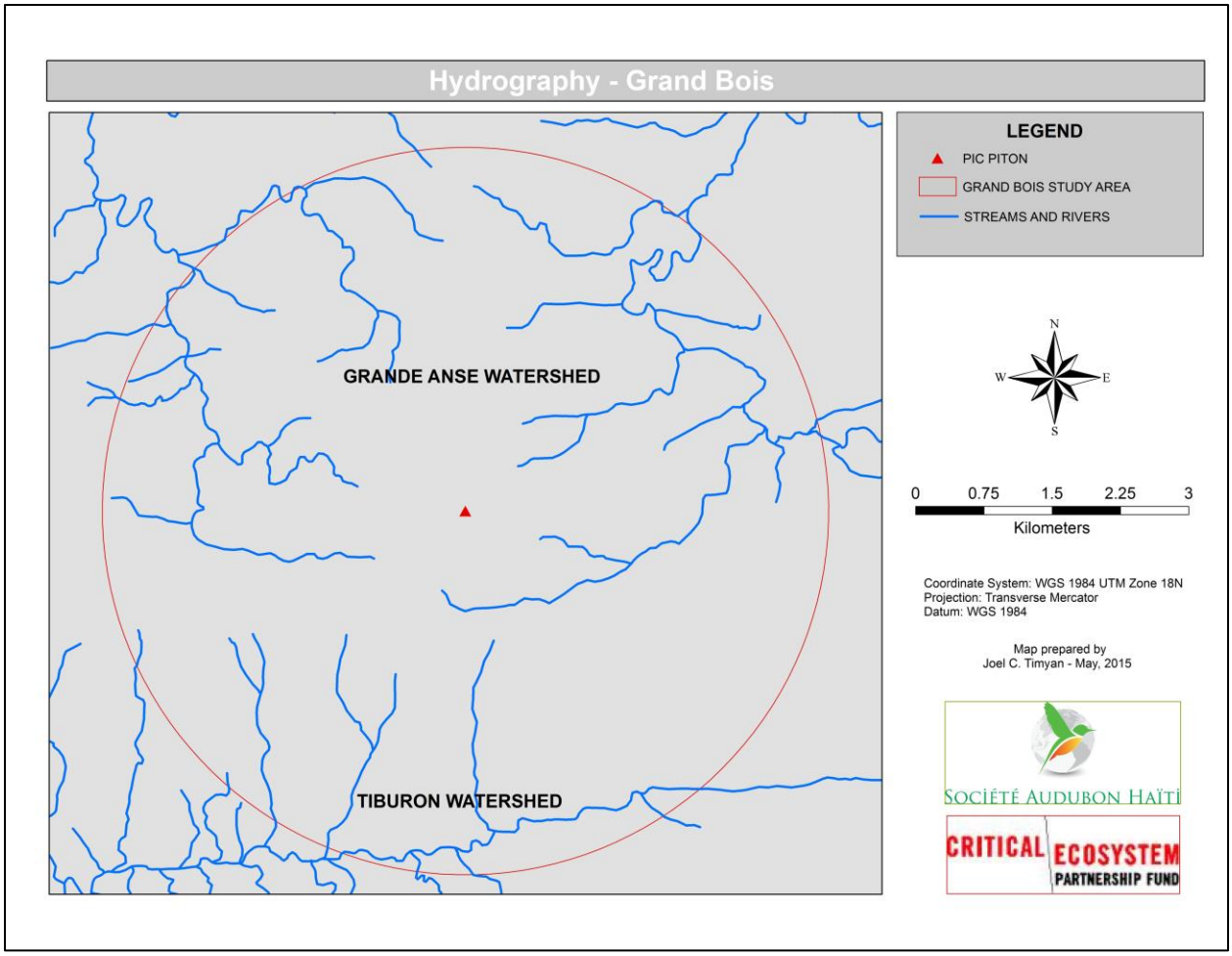

Figure 8. Hydrography of the Grand Bois study area (CNIGS, 2006; SAH, 2015).

Soils

Soil classification maps were not available for the Grand-Anse department. However, a recent study by Vilmont et al. (2013) for the South department describes the major soil types found in the region and these are shown for the Grand Bois study area (**Figure 9**). As shown, only part of the study area is available. The light tan is attributed to eroded poorly evolved soils (*sols peu évolués d'érosion*) that occur due to the constant erosion and lack of time to develop true soils, absent of a differentiated soil horizon and consisting mostly of rock fragments on mountain slopes and near the summits. This soil lacks fertility and is very poor for any type of agriculture.

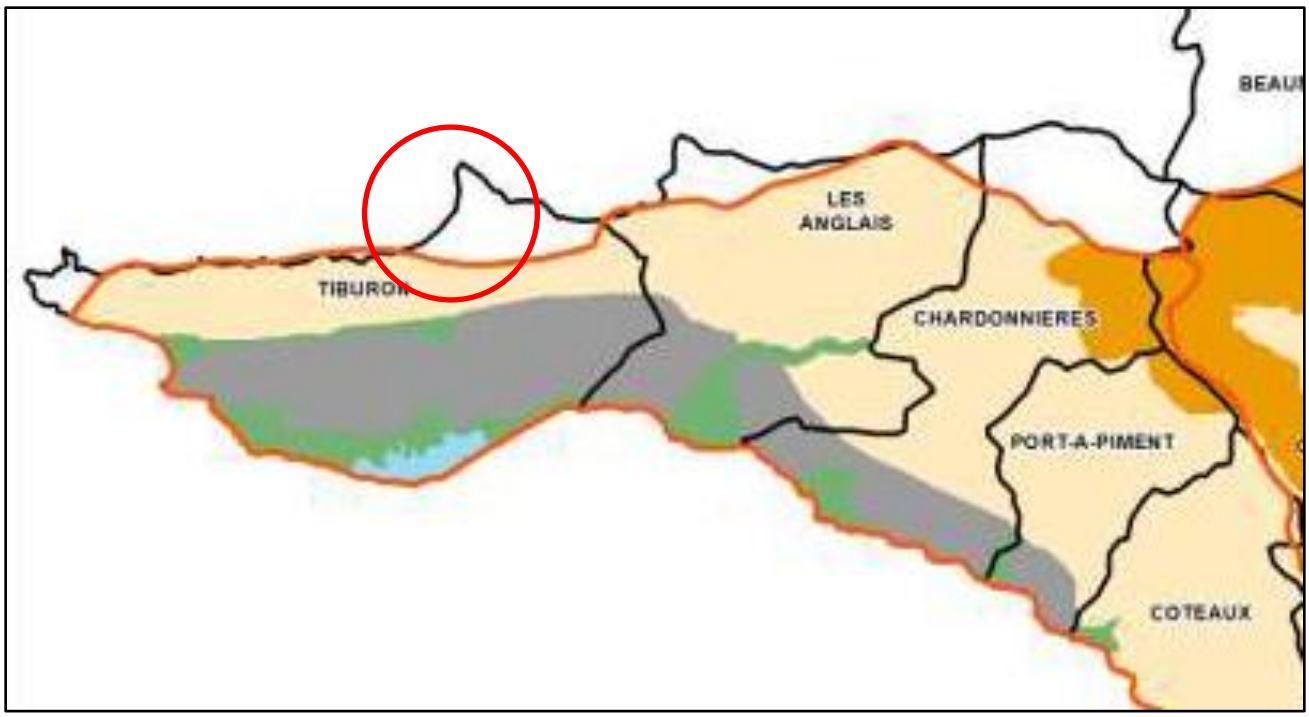

Figure 9. Soil map showing location of the Grand Bois study area (Vilmont, 2013).

Soil Erosion Risk

The risk of soil erosion map provided by CNIGS is based on an index that takes into account slope, soil properties and climate, principally rainfall (MPCE, 2002). The index has 6 categories ranging from zero or very low (0) to extremely high (5).). The soil erosion risk map for the Grand Bois study area is shown below in Figure 10.

The highest risk category, extremely high (5), covers 78% of the 50 km^2 area, equivalent to 39 km^2. The next 2 categories (above average and high) each share 11% of the study area, equivalent to 5.5 km^2. The map in **Figure 10** shows the distribution of these 3 categories in the study area. None of the 2 lowest risk categories are present in the Grand Bois study area. Over 83% of the study area exhibits slopes greater than 30% with approximately 3% of the area in slopes greater than 60%.

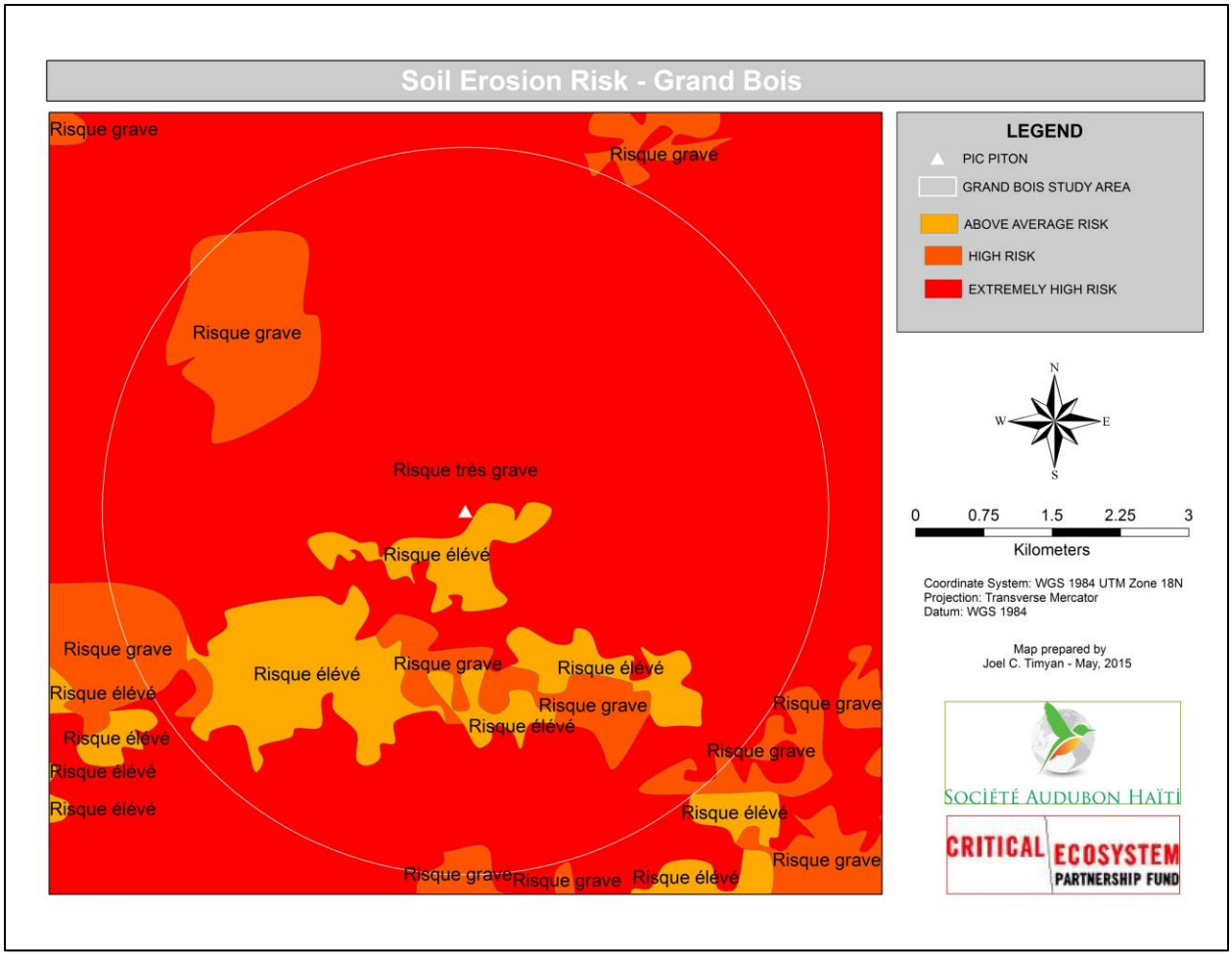

Figure 10. Soil erosion risk map for Grand Bois study area (CNIGS, 2004; SAH, 2015).

Soil Quality

As a result of the significant soil erosion risks, mostly due to slope but also to the high rainfall of the area, the potential of the soil to support agriculture is very poor (**Figure 11**). Most of Grand Bois (83 %) has the least arable category, shown in the map as "Très Limitées," after the method developed by BPDA (1982). These soils are characterized by steep slopes and shallow soil depths due to past erosion. The other major category of soil potential, shown in the map as "Faibles," are also shallow soils but on less steep slopes. Only 4% of the study area, containing the relatively fertile alluvial soils of the Tiburon River floodplain, are suitable for agriculture.

Regardless of these conditions, the soils are cultivated anyway and once deforested and infertile, become dominated by ruderal grass, forb and shrub species that are continually grazed by cattle, goats and sheep or suffer from uncontrolled fires.

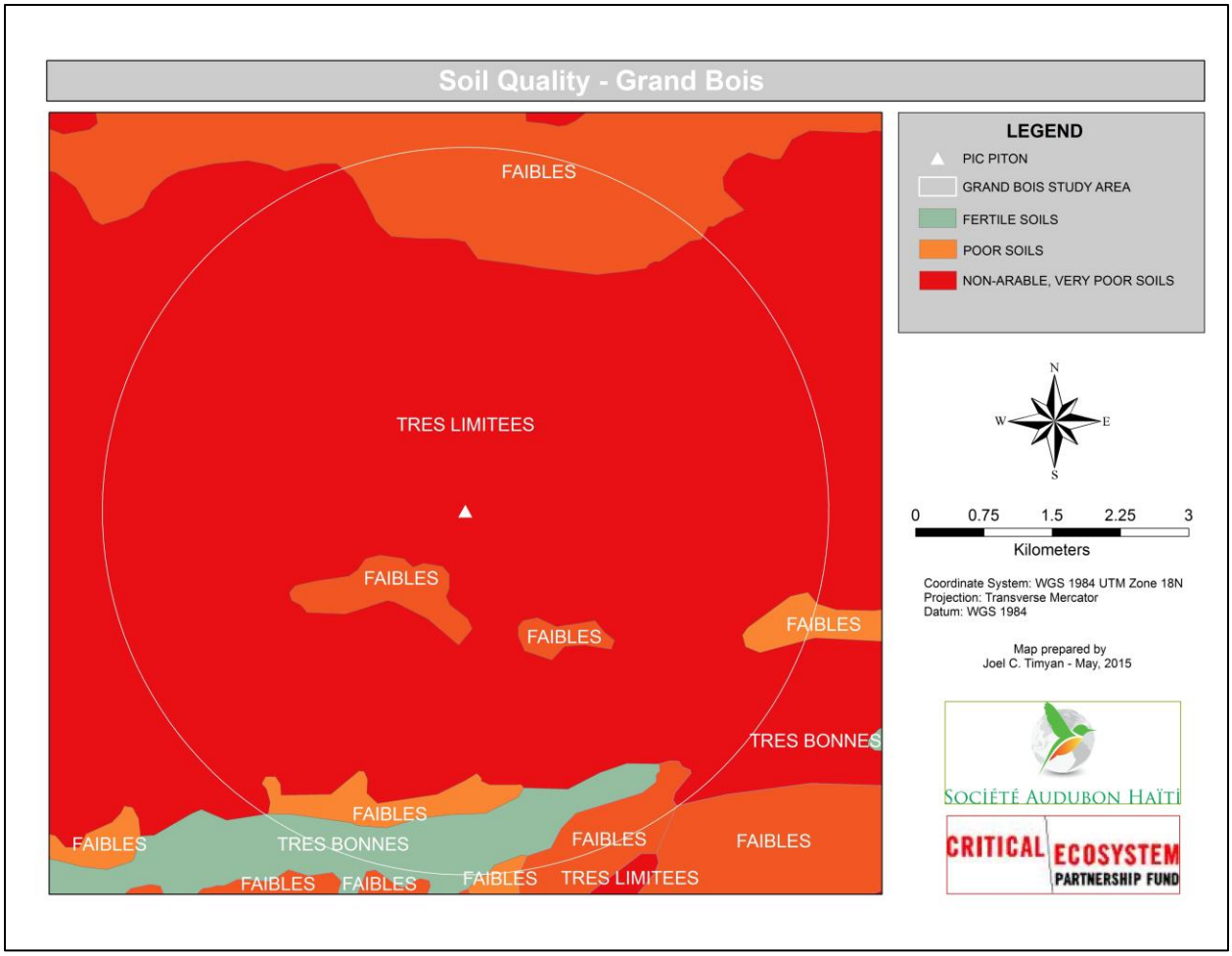

Figure 11. Map of soil quality in Grand Bois (CNIGS, 2002; SAH, 2015).

Precipitation

The Massif de La Hotte is among the wettest areas of Hispaniola. The mean annual rainfall can reach above 3800 mm in the higher elevations above 2000 m (Mora-Castro et al., 2012). In the area of Grand Bois, the average rainfall is approximately 2800 mm at 1200 m elevation (**Figure 12**).

Most of the rainfall is due to the orographic effect of the mountainous terrain and the orientation of the mountains relative to prevailing winds and ocean currents in this western portion of the southern peninsula. In addition to rainfall, fog contributes a significant amount of moisture which decreases in importance as the land becomes deforested and no longer benefits from fog drip.

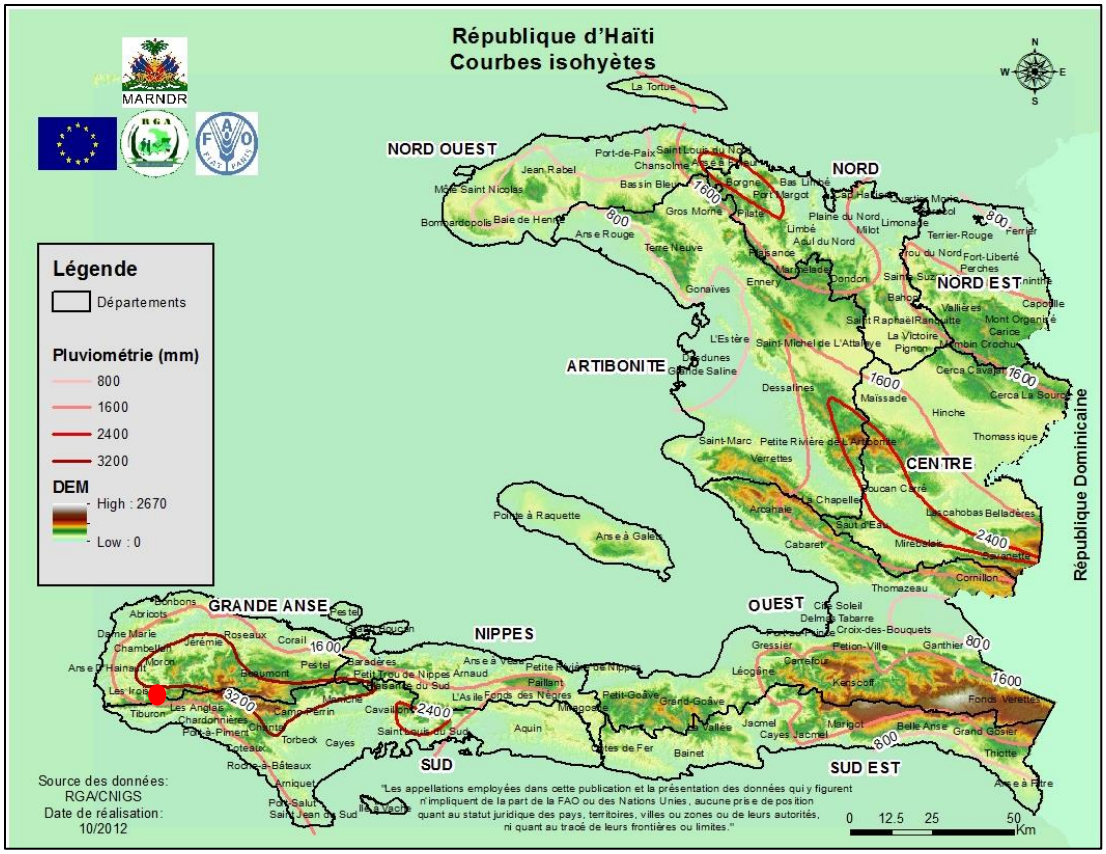

Figure 12. Map showing Grand Bois between 1600 and 3200 mm isohyets (red dot). Source: MARNDR, 2012.

Holdridge Life Zones

Life zones are determined as a function of climatic factors that determine the land cover type that occurs in a given area (Holdridge, 1967). Three life zones occur in the study area: (**Figure 13**). These are Subtropical Rain Forest (64%), Subtropical Lower Montane Rain Forest (22%) and Subtropical Moist Forest (14%). Most of the native forest remaining in the Grand Bois study area falls within the Subtropical Montane Rain Forest (Figure 7) which occurs above the 900 m elevation contour (Timyan, 2015).

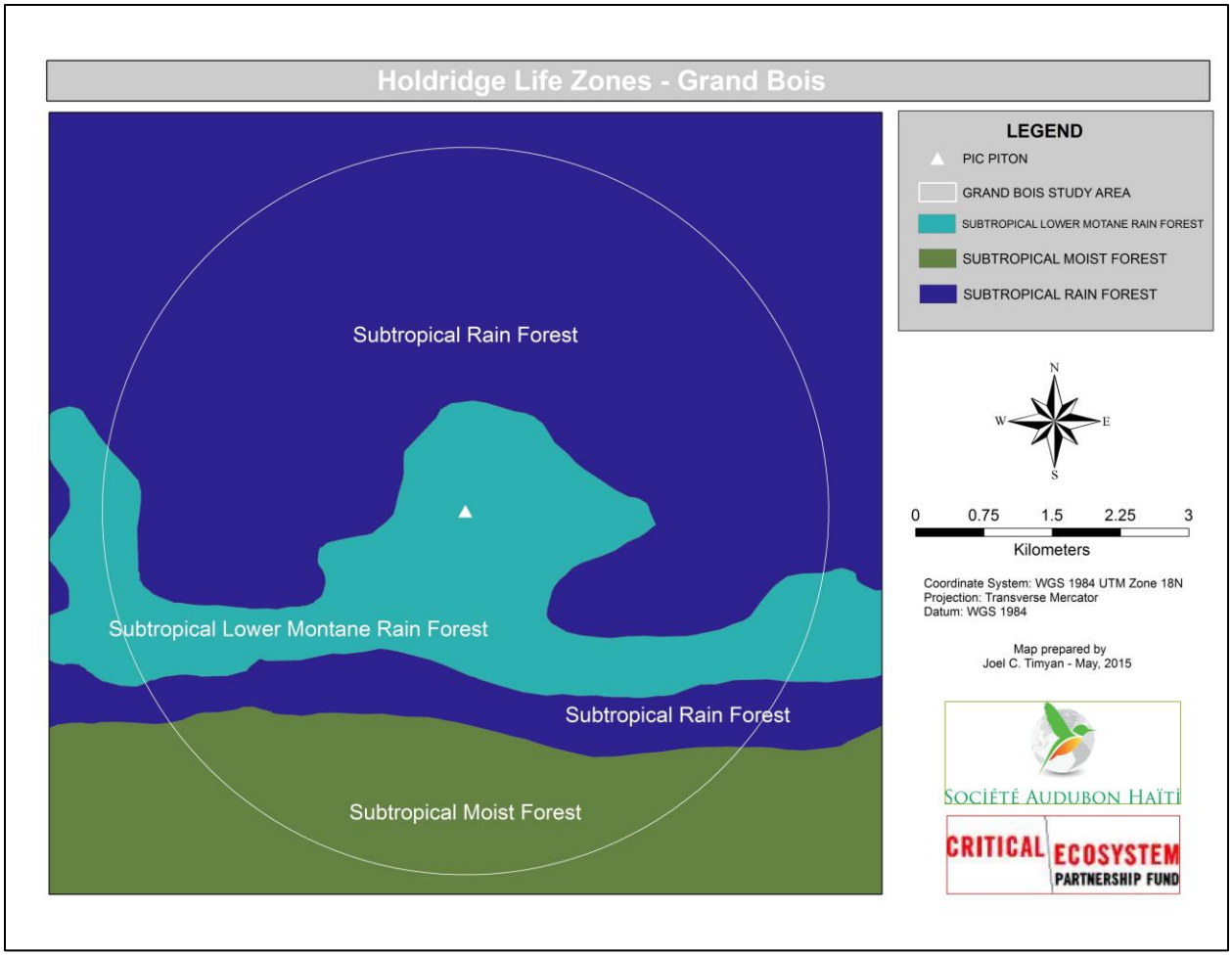

Figure 13. Holdridge Life Zones occurring in the Grand Bois study area (CNIGS, 2004; SAH, 2015).

Land Use

Land use categories were assigned to 1998 aerial photos of Haiti and analyzed for coverage in the study area (MPCE, 2002). The results for the Grand Bois study area are shown in **Figure 14**.

The largest category were gardens that occupied 16.8 km^2 (34%) of the study area. The next most important land use category was dense agroforestry (15.7 km^2 = 32%), followed by a grasslands (13.8 km^2 = 28%) and forests (3.6 km^2 = 7%). The latter coverage agrees with the most recent study of forest cover by Timyan (2014) that estimates 6% of the study area remains in natural forests.

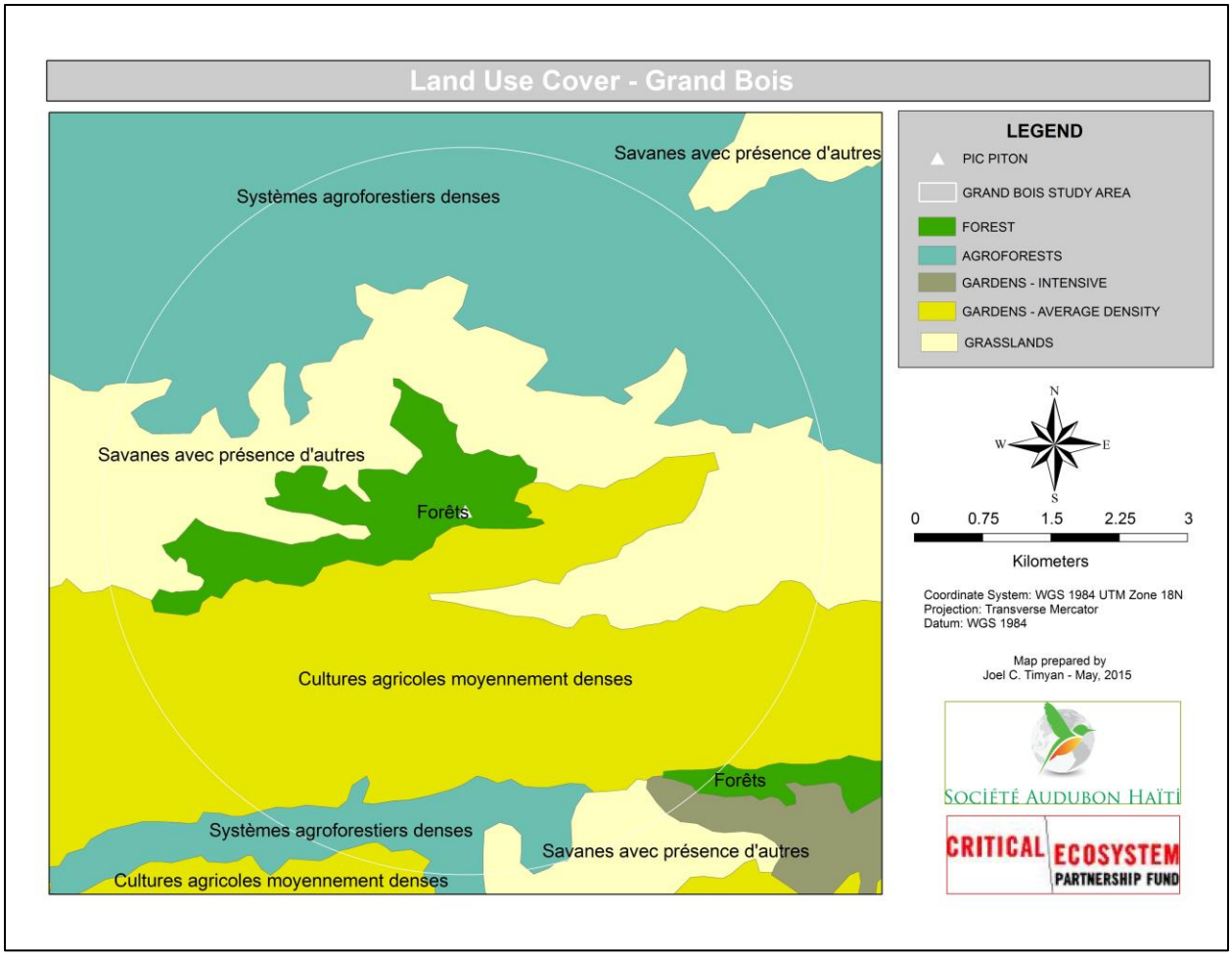

Figure 14. Land use categories in the Grand Bois study area from 1998 aerial photos (CNIGS, 2009; SAH, 2015).

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