

MOUNT PELE, AN ECOCLIMATIC GRADIENT GENERATOR

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Abstract

Generally, mountains determine the characteristics of particular areas, because of the island phenomenon they cause. However, the geological origins of mountains are multiple and they are located in different climatic regions. Nevertheless, in all aspects they reflect the basic elements of the local biologic unit. The shapes, climates, diverse water resources, biocenoses and the generated soils are the different components that determine, through their dynamic interaction, the "Mountain" ecosystem. Tectonic subduction processes lead to the development of islands such as Martinique, whose basic structure consists of a series of mountains (among them Mount Pele). Like the topographic divisions, the local micro-climates, water courses, different soils (themselves the consequences of the presence of the mountain itself) and successive volcanic eruptions determine, over time, the organization of the diverse vegetal entities.

Keywords: Martinique, ecosystem, successive process, climax, vegetation cover

1. Introduction

This paper examines the importance of a mountain massif, primarily Mt. Pele, within the Caribbean islands' (Fig. 1.) vegetation environment (Dalsgaard et al., 2007). Worldwide, whatever the regional conditions, mountains produce local climatic and ecological peculiarities (Beard, 1949, Boudon- Semet - Vincent, 1989, Howard, 1989, Dale - Delgado - Acevedo - MacMahon, 2005). With regard to vegetation, local change seems to produce similar characteristics, and the climatic population is also often accompanied by converging phenomena. Additionally, the mountain appears as a scale model of the biosphere's larger biological units (Rougerie, 1990, Howard, 1979). Hence, it can be compared to an insular system (Martí-Ernst, 2005). Generally, a real link between the different levels of vegetation and the climatic areas is evident (Lomolino, 1996, Lugo - Schmidt - Brown, 1981). Thus, topography becomes an essential factor, affecting local ground conditions as well

as the seasonal changes in atmospheric conditions. The large flowering groups are based on the framework of biotopes produced by the topography; a successional process supports and determines the organization and appearance of the vegetation. Mt. Pele only partially fits into the descriptions above, since it is a mountain of average height. However, the concept of levels or stages often applied to the planet's high mountains can be applied here. Studies of medium-high insular mountains are rare; though these give rise to extremely complex ecosystems, with horizontal and vertical variation of vegetation, the dynamics of the vegetation itself and evolution of the soil. In addition to these processes, there are volcanic eruptions whose occurrence corresponds exactly with vegetation successions, at least for the latent periods in the last millennium.

From a methodological point of view, the main aim of this synthesis is to highlight the principal determinants of the physical and biological organisation of the north

of Martinique, home to Mount Pele. This mountain is known as a medium-high mountain as is not higher than 1400 metres. In order to achieve this, results of the main research on the vegetation of Martinique have been used (D'Ercole - Rançon, 1994, Fiard, 1994, Gallois, 1902, Joseph, 1997, 1998, 1999, 2012a & 2012b, Portecop, 1978, Sastre - Baudoin - Portecop, 1983). Data from the literature of the other Lesser Antilles and of the intertropical area, although limited, has also been considered (Howard - Portecop - Montaignac, 1980, Portecop - Lurel, 1998, Marske - Ivie - Hilton, 2007, Gu - Baldocchi - Wofsy et al., 2003, Self, 2006, Vermote - Saleous - Kaufman - Dutton, 1997, del Moral - Wood, 1988, Smathers - Mueller - Dombois, 1974, Roquebert, 1985, Burnham - Spicer, 1986, Dickson, 1965). This data is related to scientific domains such as climatology (Angeles - Gonzalez - Erickson - Hernández, 2007, Giannini - Kushnir - Cane, 2000, Enfield - Alfaro, 1999, Bonatti - Gartner, 1973),

geomorphology (Le Friant - Harford - Deplus - Boudon - Sparks - Herd - Komorowski, 2004, Germa - Quidelleur - Labanieh - Lahitte - Chauvel, 2010), pedology (Colmet - Daage - Lagache, 1965, Feller et al., 2001, Lavelle, 2002, Muhs, 2001), biocenology (Rousteau, 1996, Joseph, 2009, Hatzenberger, 2001, Walker - Zarin - Fetcher - Myster - Johnson, 1996, Sastre - Fiard, 1986, Day, 1936, Dickson, 1965, Beard, 1945) and volcanology (Dickson, 1965, Fisher - Heiken, 1982, Vincent - Bourdier - Boudon, 1989, Boudon, 1993, MacGregor, 1952, Miskovsky - Bardintzeff, 1985, Roobol - Smith, 1975, MacGregor, 1938, Tanguy, 1994, Fisher - Smith - Roobol, 1980, Sparks, 1983, Roobol - Smith, 1976, Boudon, 2011, Zimmermann, 1909, Anderson - Flett, 1902) and has enabled the drawing of synthesis maps. There a few studies on a global scale that show the relationship between island mountain systems and areas through volcanicity, vegetation, hydrology and anthropic dynamics. Consequently, with



Fig. 1. Martinique within the Caribbean space

regard to the Lesser Antilles, this study of Martinique's Mount Pele is a first global approach, opening the field to more detailed studies.

Altitude variation, the major factor determining mountain vegetation

Analysis of the different physical factors controlling the spatial and temporal organization of the ecological region of Martinique allows a first approximation, which defines the area as a "mountain-island" (the Pitons du Carbet (Carbet peaks) and the Mount Pele massif constitute the highest crests and the island's mountain barrier), particularly when considering water supplies, so vital in the growth of separate species. It is Mount Pele and the high summits such as the "Pitons du Carbet" which act as the main rainfall generators, with notable differences depending on the mountain face being considered. For a biogeographical study relevant to the Lesser Antilles as volcanic islands, oceanic tectonic subduction and the base of the mountains must be considered with the coast. The foothills and lower slopes build up the land area and volume, producing a range of topological structures, and in the case of Martinique, a wild relief generating a great number of facies. This produces significant changes in intermediate factors, namely:

Primary factors: climatic (temperature, humidity, solar radiation, wind, evaporation, rainfall, mist); edaphic (soil structure, texture and depth);

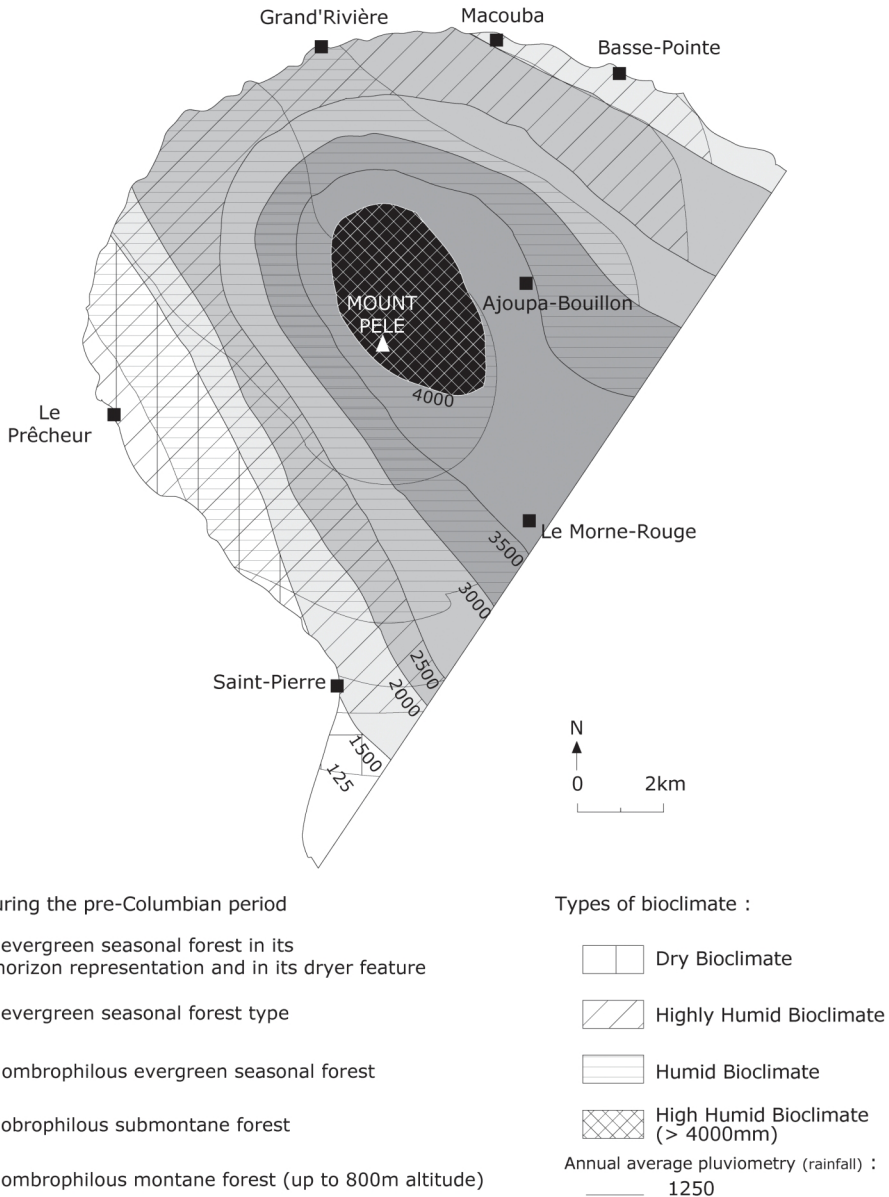
Secondary factors: relief (geomorphological features), topography (margin effects, crest effects, shelter and shadow effects). These complex intermediate factors make Mt. Pele a mosaic of environments.

The presence of high summits in the north of Martinique gives rise to a north-south and an east-west altitude gradient. The position of the Lesser Antilles arc, in relation to the atmospheric dynamics of this part of the world, means that the barrier characterised by the Pitons and Mount Pele presents an obstacle to the trade winds, the carriers

of water-laden air. This is most noticeable during 'hivernage' (the wet season). Hence the description of the mountains as the 'water towers' of the island. This orographic rainfall is the principal water source. The distribution of the isohyets on the north side demonstrates this characteristic of the small mountainous islands of the Antilles. From the barrier presented by the island described above, two rainfall gradients appear, depending on whether or not the side considered faces the wind. On the Atlantic (north-facing) side, from the shore to the highest summit, annual rainfall is heavy, at between 1800 and 4000mm per year (minimum). In contrast, the side facing the Caribbean (leeward) receives between 1000 mm and 4000 mm (Fig. 2.). Mount Pele is not entirely part of this asymmetric rainfall distribution system since the overall rainfall volume is almost identical whichever face of the mountain is considered.

This geomorphologic peculiarity of Martinique depends on the medium-altitude mountains where the whole rainfall potential is concentrated. This has consequences for a large area of Martinique. Mt. Pele and the Pitons du Carbet affect, well outside their territorial limits, the whole of the island domain. The effects may be direct, providing the distant areas of the island interior and the Atlantic and Caribbean coastal areas with water, or indirect, via water courses, particularly those originating in the Pitons du Carbet which reach the central regions of the island. The distribution of surface water shows an abundance of rivers, streams and ravines.

In general, in this northern zone, average humidity is high, and insolation and evaporation are lower than in the more distant areas of the centre and the south. As for the temperature, the same seasonal and diurnal variations are noticed, but with lower levels than are observed in other areas of the island. This is particularly noticeable at the middle and upper levels. The way in which the different factors vary with altitude determines the presence of



Joseph Philippe 2001

Fig. 2. Potential forest types and bioclimate forms generated by Mount Pele

favourable environments. The direct result is the presence of bio-climatic belts, which give rise to plant growth and reveal themselves through a very noticeable terracing of species. Mt. Pele, along with the other mountainous massifs of Martinique, plays an important role in the local climates, and contributes to the great diversity of habitats. It is one

of the essential elements conditioning the bioclimates which affect almost all the vegetational zones of the island. Without this elevation, a sign of the tectonic activity at the heart of the Caribbean region, there would be no mountainous islands or indeed "mountain-islands" to produce powerful rainfall gradients.

2. The ecosystem potentiality of Mount Pele

In a mountainous environment there are two major factors which determine both climate and soil: altitude and topography (which has several varieties here). These operate together and at different levels, on two principal factors of soil generation, temperature and water (Jankowski – Ciecka et al, 2009, Rousteau, 1996), which are associated with an external mechanical factor: erosion influenced by slopes. Further away, in the lower zones (here, water course terraces) water is plentiful in the alluvial soil enriched by elements transported from higher up. There is also a tendency towards hydromorphism. These phenomena all contribute to the great diversity of plant communities (Fiard, 1994, Joseph, 1997, Fournet, 2002).

The diverse expression of the group of factors produces the stages already described, but does not result in a clearly defined set of bio-climatic bands. Instead, it produces an ecological probability, whereby the average presence of each species marks the different levels of vegetation. Like high continental mountains, Mt. Pele does not exist in complete isolation from the island, hence the partial absence of endemism among the species at higher altitude. Many studies (Joseph, 2012a, Howard, 1979) and surveys of the area (Joseph, 2012b, Ray – Dallmeier – Comiskey, 1998) allow three stages of vegetation to be suggested: upper, middle and lower, corresponding to three bio-climatic domains dependent on altitude factors (Helmer – Ramos – T. López – Quiñones – Diaz, 2002, Murphy – Lugo, 1995, Areces – Mallea – Weakley – Li – Sayre – Parrish – Tipton – Boucher, 1999).

To allow concepts and hierarchies to be compared on a planetary scale, the UNESCO (UNESCO, 1973) classification is used for the description of tropical forests. It is general, but nevertheless inappropriate, for describing some specific features of the vegetation cover of the Lesser Antilles. For example, there

are inversion phenomena caused by meso-climates, in turn caused by topographical details such as valley floors and wind-blown crests. The three forest types retained from the UNESCO nomenclature, from sea level towards the summit of Mt. Pele, have been expanded: evergreen tropical forest and tropical ombrophilous submontane forest in their sub-types and features, tropical ombrophilous montane forest. The interplay of factors meant that an intermediate forest, today marginal, formally occupied relatively large areas: tropical ombrophilous evergreen seasonal forest. The direction that the ground facies determine the space occupied by each of these forest types. The windward face, where the vegetation is climacic or mature, is where tropical evergreen seasonal forest, tropical ombrophilous evergreen seasonal forest, tropical ombrophilous submontane forest and tropical ombrophilous montane forests are found. Spatially, the last three are the most significant (Fig. 2.).

To the leeward side, in a triangle whose base is situated between the cove of “Belle-Ville in Precheur and “Fond-Core” in the commune of “Saint-Pierre”, the specific area is of great importance for tropical seasonal ombrophilous evergreens and tropical seasonal evergreens, in comparison with tropical ombrophilous submontane growth (Fig. 3.). Between sea level and 250m altitude in this northern area, a rarely seen facies of the tropical evergreen seasonal forest, finding a lower horizon for the subtype in the drier (arid) area. From this zone to the St. Pierre commune, the plant staging levels become identical to those on the windward side. Here too, the Foehn effect is barely noticeable. Above 800m, steep slopes produce particular formations of the vegetation because of one or more limiting factors such as hydromorphic (gley) soils, landslides, and the effects of some water courses, particularly at the level of riparian terraces. These destabilising factors stop, or further modify plant dynamics. The direct result is the development of a great diversity of shrubs and herbaceous plant types, with a

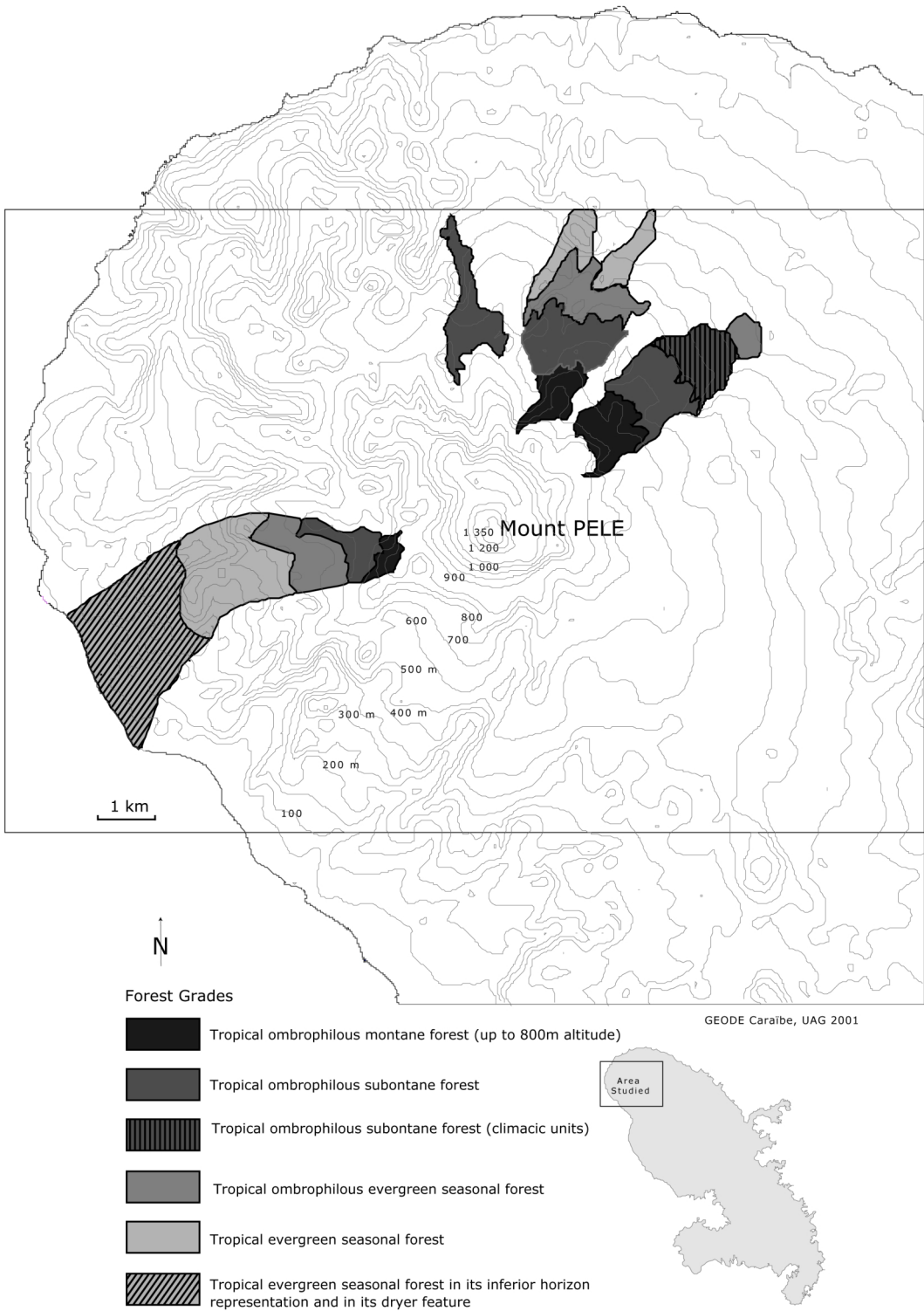
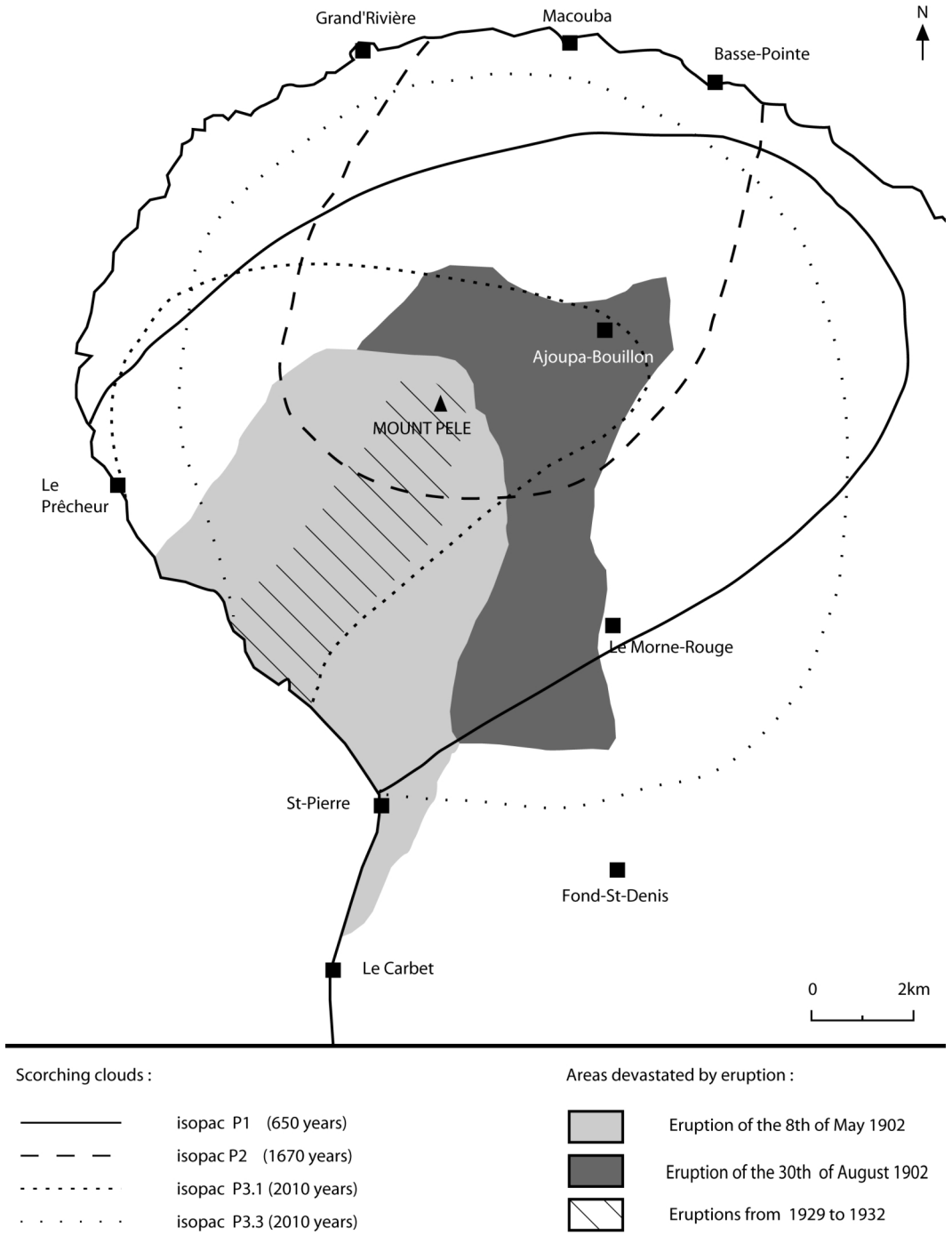


Fig. 3. The forests of Mount Pele



GEODE-Caraïbe, UAG, 1999

Fig. 4. Damaged areas during the prehistoric and recent eruptions of Mount Pele

few stunted and shrub-like tree varieties on the periphery.

Forest formation under the dominance of the volcano.

Today, the visible landscape is still the result of natural diversity (in line with physical factors) and diversity produced by human use of accessible areas available for development. As with climate disturbances, the volcano in some of its longer lasting eruptions can bring complete destruction of the vegetation. The area of the zone affected depends on the strength and character of the eruption. It must be remembered that the whole of Martinique is the result of geological processes dependent on subduction linked to three island arcs. Chronologically, the oldest area is the region of Sainte-Anne and "Presqu'île de la Caravelle" where activity stopped at the beginning of the Miocene, about 20 million years ago. The recent arc (in global terms) began the creation of the northern part of the island, less than 6 million years ago according to estimations. The formation of this northern part was a very complex process, and the different phases of activity have resulted in a very rugged landscape. The currently dormant crater of Mt. Pele has been active for around 400,000 years and the various eruptions have certainly affected the vegetation covering its surface. Over a period of 6 millenia Mt. Pele's volcanism was manifest in a spaced out alternation of high-magnitude eruptions and pyroclastic flows.

The expelled debris affected different sites depending on its transportability by wind and the topography. The heavier deposits followed the directions of the valleys and depressions and affected sectors to the volcano: more specifically in the extreme north: the valleys of the "Couleuvre" cove and the "Prêcheur" river separated by imposing screening massifs with summits between 300 and 600 metres. Finer materials were carried over much larger elliptical areas having average radii of several kilometres, (Fig. 4.).

Trainau (1982) has highlighted three major Plinian eruptions over a period corresponding to the last ten millennia. The suggested map of the aerial fallout (isopacs, Figure 4) shows the size of the devastated zone. The whole of the area was affected by the lighter debris (ashes and lapilli), with destructive power (from heat and impact) depending on the distance from the volcano. Whether or not the zones were destroyed they were certainly changed, probably through the disappearance of the vegetation cover. The time intervals between the last three prehistoric eruptions were sufficient to re-establish the vegetation cover, leading to a climax plausibly not very different from the previous optimal organization. What remain undefined are the different successional stages (whose physiognomies are predictable) and the spaces colonized.

The description of the appearance of the landscape by Lacroix (1904) is the basis for reviewing the effects of the last 1902 eruption (Lacroix, 1904, Revert, 1933, Zebrowski, 2002), which had such drastic consequences for the population of St. Pierre. It allows the boundary of the areas affected by the eruption on May 8th 1902 to be drawn. The area slightly simplified lies between the commune of Carbet (Petite Anse) and the islet La Perle (Anse Couleuvre: Commune du Prêcheur). The destruction was naturally not of the same level throughout, and Lacroix divided the affected area into a central and a peripheral zone. The first was in Prêcheur (between Latouche cove and the village of Boiville), the second from the outer limit of the central zone to the edge of the commune of Carbet in the south and the Anse Couleuvre in the north. The different topological elements, particularly the massifs and depressions, some acting as protective screens, determined the intensity of land destruction.

On May 30th 1902, there was pyroclastic flow affecting an area to the north-east, roughly between the upper area of the Lorrain commune (above the Grandis and Leyritz woods), a northern sector of the

town of Ajoupa Bouillon, the area called “Falaise Gorges”, Morne Rouge commune and the whole of the river Roxelane. Finally, the eruptions of 1929 and 1932 were much less powerful and destructive than their predecessors. Moreover, the perimeter of the affected area was not clearly defined by the various observers. However, the details given by Sastre-Fiard (Sastre – Fiard, 1987), particularly referring to the work of Perret (Perret, 1935), suggest an area to be included in the territory affected by the 8th May 1902 eruption, roughly bounded by the summit of Mt. Pele (Plateau Palmiste), to the west by the upper parts of the Grande Savane and the Picodo river, and to the east by the valley of the river Blanche (strongly affected by the event).

During the most recent eruptions, a substantial area was degraded in several ways, although there was an exception for the most northerly zone between Prêcheur and the town of Grand-Rivière. Here the vegetation was affected by the fallout of volcanic ash, although there was a relatively small amount and it was fairly cool. However, the heat generated was not enough to cause regression of the ecosystems, as much in their structural organization (plant mass and density of cover) as in the potential to regenerate different species. In this case the exchange surfaces binding the multiple foliage strata of mature forest disappeared, notably by the loss of aerial biomass (leaves, branches, boughs). The extensive damage would be a factor weakening plant growth and causing disease and death. Natural mortality, to which must be added that caused by the cataclysm, is an element to be taken into account, because subsequently there is a reduction in the complexity of the organization (architectural and structural) of the existing vegetation. In reality, small degradations are not enough to prevent a return towards climax vegetation, even if modified. In general, the time necessary to restore the original state depends on the characteristics of the perturbation.

Protection of the northern zone of

Martinique, from the shoreline up to 600 or 700 metres altitude, depends on numerous massifs reaching heights between 700 to over 1000 metres and acting as bulwarks. Nevertheless, this protection is relative and depends on the type and intensity of the Pelean mountain eruptions. The principal prehistoric eruptions (Traineau, 1982) show the importance of the point of emission of the volcanic materials for the area which might be affected. In the course of the last prehistoric and historical eruptions of Mount Pele, a significant area of vegetation on the north headland of Martinique suffered only minor damage.

3. Some factors of vegetation dynamics

The variability of eco-climatic factors produced by the mountain's gradients produces a variety of environments, as well as the specificities of plant succession (Freitas – Nijhof – Rojer – Debrot, 2005, Gonzalez – Zak, 1996). Within the vegetation potential, these habitats will select, at each dynamic stage, the succession of dominant, progressive or regressive species. During prehistoric times in Martinique, with the exception of volcanic eruptions, the plant system evolved towards a forest state on almost all the flanks of Mt. Pele. For all the stages, plant or eco-climatic, the ecosystemic and homeostatic climax level was reached (Fiard, 1994, Joseph, 1997). The great complexity made up for small differences in different conditions (topography, soil, rainfall, bodies of water) existing between the different habitats, smoothing out the various factors and giving a degree of uniformity to each stage. While the altitude gradients are steep, because of the low variability of atmospheric and geomorphological factors, the horizontal gradients are small, not greatly affecting the reality of terracing. In those sectors, at climax or below, which we have studied, it is possible to catch a glimpse of these mechanisms by taking an inventory and making an ecological analysis.

Up to 800 metres altitude, wherever the topography is favourable, the variety of simple woodland growth, direct expression of the local biotopes, correspond to the multiplicity of landforms, orientation, soils and local landscapes. As a consequence, in the absence of any significant human activity (by the Amerindians) and except for natural regeneration processes (over a few decades) caused by the renewal of forest cells (openings or clearings) only atmospheric disturbances (storms and hurricanes) and volcanic eruptions occurring respectively at centenary and multi-century (even millennial) intervals, brought significant and often irreversible degradation of plant cover.

Currently, the information on the succession mechanism of vegetation is not sufficiently detailed to permit exact knowledge of the timeframe for each dynamic stage, and is even less able to determine the time needed for a devastated system to reach its phase of maximum maturity (climax). The three essential processes of plant succession in our mountainous island are:

- Vegetation renewal inside the forest matrix (In the climax equilibrium state (homeostatic) there is bipolarity between matrix and clearings corresponding to two functional aspects. The matrix of terminal forest growth is composed of highly specialized sciaphilous and helio-sciaphilous species which regenerate under cover. The clearings (or gaps), in which regeneration is much faster, a function of their layout, shelter heliophilous or semi-heliophilous species which are short- or long-lived scars) with assistance from gaps (clearings) caused by fallen trees.
- structural reorganisation and development of some plant species already present in terminal phase forests following cyclonic destruction. (Generally, old or climacic forests are much more resistant to storm damage).
- colonisation of new, post-eruption volcanic substrata, pioneer succession or colonisation of a virgin stratum.

Only damage caused by volcanism requires for complete restoration from bare soil, a transition through all the dynamic stages, from pioneering to climacic via secondary or transient (the final vegetation cover being forest, there existed two long periods in its forward evolution, the successive extra-forest and in-forest cycles). In areas which are slightly affected because of their distance or protection by screening, account of destruction varies and brings about intermediate dynamic processes. This increases the level of heterogeneity, both spacially and temporally, in the plant system.

The approach to, and formalisation of, these developments is particularly complex. The outlines and models of plant dynamics in the mountains of the Lesser Antilles, above all in the zones devastated by recent volcanism, are unconvincing. They are not based on any strict and rigorous methods, and as such they hardly consider all the biocenotic peculiarities.

Furthermore, the edaphic components have not been taken into account in the dynamics of the reconstitution of the vegetal ecosystem and the associated plant landscape.

- What are the pedogenetic characteristics (giving rise to soils several decades later) after the ground is covered with volcanic ash?
- What are the characteristics of the stages preceding the appearance of vegetation?
- In terms of scale of the eruptions, how does the vegetal ecosystem initiate (in space and time) the arrival of representative examples of the floristic potential?
- Have the dynamic processes been – and do they remain – identical in terms of the chronology of installation of the plant succession?
- Did the vegetal succession, particularly after the P1 eruption (Fig. 4.) produce the same floristic eco-units?

The concepts developed in contemporary

works on the dynamics of plant ecosystems (Howard – Portecop – Montaignac, 1980, Fiard 1994, Joseph, 1997, Joseph, 1998, Joseph, 1999) and on the ecology of landscapes (Joseph, 2012a) allow for a better understanding of the vegetal recolonization following an eruption. On newly formed deposits, the first herbaceous plants, in isolation or in colonies, settle slowly. They progress to form communities which become more and more dense and continue until they are joined by small numbers of shrubs which begin the woody colonization. Right up to the final forested state, plant communities are dominated in turn by shrubs, bushes and trees (becoming more and more specialized).

The majority of the forest areas destroyed in the course of recent eruptions had partially recovered. It is difficult today to be precise about the forest levels reached after the 1902 events, because human activity has certainly caused some regression. In light of new knowledge of the succession mechanism of the vegetation in the Lesser Antilles, it seems very probable that after a century the ecosystem would have reached a stage of barely structured secondary forest. The latter is characterised by floristic units or eco-units made up of post-pioneering, short-lived, heliophilous species. These species are common in the large clearings (gaps) of old forests and may be characterised as brief scars.

Plenty of questions remain and the answers are not obvious. Today, the landscapes which offer these plant systems are as diverse as they are multiple, the result of destructive factors operating on different time scales, whose extremes are eruptions on a geological time scale and anthropic interventions on the human time scale. Overall, from shore to summit, there is a mosaic of landscape types, showing ecosystemic complexities translating into evolutionary stages, physiognomies, combinations of species and specific phenological details. The plant stages shown by large floristic groups, despite their current heterogeneity, are a direct consequence. via a different conceptual

framework, to tackle all the aspects, direct or indirect, of the mountain whose volcanism is but one characteristic, albeit a major one.

4. Conclusions

There are matters of real substance in question when undertaking a study of these volcanic land systems (Whittaker – Schmitt – Jones – Partomihardjo – Bush, 1998). The volcanic aspects have always been the main points of interest. Mount Pele, along with the Pitons du Carbet, give character to the entire island since they determine in part its climate as well as some primordial ecosystems necessary for the overall biological equilibrium. Hence, Martinique is truly a “mountain-island”. Mount Pele generates varying amounts of rainfall over the area, causing specific types of pedogenesis (all the aspects of pedogenesis which arise from different micro-climates due to the presence of Mt. Pele are considered here) and woodland growth (Sylvigenesis represents all the recovery mechanisms of the forest ecosystem). via the main water courses it affects regions well beyond the perimeter of its direct influence. The abundance of water and the density of the hydrographic network favour agriculture and silviculture.

There is a long way to go in understanding, within a comprehensive framework, the complexity of the geosystem, with the exception of its vegetation. Taxonomic, botanic, biogeographic and ecological studies of vegetation have allowed the decoding of the geosystem’s functional mechanisms. Conversely, the newly formed soils (Peleen andosols) are hardly understood, nor are the effects of the large number of topographic facies on the dynamics of edaphic water and on the phenomena of vegetation inversion (Joseph, 1997, Pagney 1986, Fiard 1994).

It is essential to view Mount Pele as a whole, not just as a volcano. The littoral soils and vegetation of all types are dependent on it, since it is the presence of the mountain, the result of subduction, which gives them existence through the eco-climatic

conditions which it creates. In light of this observation, to get closer to an analysis of the true impact of Mt. Pele on our island system there are many fields of research and study. Furthermore, this is an example of the combination of factors which are as much physical as biological, among which the presence of volcanism is a major determining parameter for the vegetation cover, despite its infrequent occurrence.

Comparisons with the other mountains of the Lesser Antilles must be made, since the environments produced are greatly diversified and localized, the zones involved at the times of eruption differ and there are many exceptions (Robertson – Aspinall – Herd – Norton – Sparks – Young, 2000, Rowley, 1992). In reality it is a complex tapestry of spaces, landscapes and evolutionary levels of ecosystems which are all controlled by eco-climates, human actions and eruptions (Foster – Knight – Franklin, 1998, Whittaker – Fernández – Palacios, 2006). The Peleen Massif, a medium-high mountain but an active volcano, bringing about unique biotic and abiotic environments, should be the subject of an observatory. Finally, the mountains of Martinique affect, directly or indirectly, all areas of human life, the economy, development, agriculture, city life, the environment and culture (Rançon, 1994).

In general, this study shows that it is necessary to reconsider the role of mountains in the Lesser Antilles. Through their volcanism and the geomorphological models that they create, they emerge as driving forces of hydrologic, climatic, pedologic and ecosystemic processes that have shaped, and that continue to shape, human activity.

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