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HUMANS AND PHYSICAL CHARACTERISTICS OF THE CLAROMECO RIVER BASIN, ARGENTINA

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ABSTRACT

The characteristics of the Claromeco basin, located in the southeast of the province Buenos Aires, Argentina, are described. There are no previous studies of the river, although it has a great significance in the agricultural activities of the region. The study zone is characterized by farming, agricultural and cattle raising activities. The river which flows across a plain, results from the confluence of three courses — the Seco creek or 3rd branch in the west, the Medio or 2nd branch in the centre, and the Orellano creek or 1st branch in the east. The measuring methods planimetry, weighing, grease-proof paper, and curvometer were used to analyze the basin. The basin of Claromeco creek has an area of 3,017.18 km^2, its perimeter is 285 km and its principal creek is 135 km long. Two different types of drainage were identified dendritic and anarchic.

Key words: Claromecó Creek, Farming zone, human activity, basin.

RESUMEN

El objetivo del presente trabajo es determinar las características de la cuenca hidrográfica del Arroyo Claromecó, ubicado en el sudeste de la provincia de Buenos Aires, República Argentina. Se trata de un arroyo de llanura, conformado a partir de la confluencia de tres cursos; el arroyo Seco o 3er Brazo al oeste, el arroyo Medio o 2do Brazo al centro y el arroyo Orellano o 1er Brazo al este. Los parámetros hidrográficos de la cuenca se calcularon utilizando la metodología del planímetro, pesaje, vegetal cuadriculado y curvímetro. La superficie de la cuenca de drenaje del arroyo Claromecó es de 3.017,18 km^2, su perímetro de 285 kilómetros y el curso principal alcanza los 135 km. Los diseños de drenaje predominantes son el anárquico en la cuenca alta y el dendrítico en la cuenca media.

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1. INTRODUCTION

The rivers in the south of the Buenos Aires province generate small networks which are ruled by two important hill systems: Tandilia and Ventania (Fig 1). The sierras originate a series of rivers that are sometimes linked to the Atlantic Ocean, and on other occasions they are either lost through infiltration, or they form lagoons. The study of plain rivers is very important because of their close relationship to man's activies.

In the last decade there has been some research of river basins of the southern zone of the Buenos Aires province (de Ferreras and Piccolo, 1996) investigated the basin of the Quequen Grande river. They determined its size and its type of drainage. The Quequen Grande is the most important river in the farming zone of the Argentine country. The waters of the river are used to irrigate the crops and not all the tributary waters are good for irrigation, unfortunately there is no a water management plan. Marini et. al. (1997) studied the river basin of the Quequen Salado river also located in the south of the Buenos Aires province. The dynamics of this river is very complex. Upon analyzing historical maps the authors discovered the generation of several tributaries of the main river course. Most of them after periods of heavy rain and plain inundations. Moreover the effects of human activities are significant due to the great quantity of irrigation channels found in the area. Both basins were studied for the first time with no previous knowledge of their characteristics. Actually, little is known about the coastal river basins of the Argentine country. Only the La Plata river is very well known.

The present study refers to the Claromeco or Tres Arroyos river which is also located in the south of the Buenos Aires province (Figure 1). Its boundaries are the Gaucho creek to the West, the Quequen Salado River to the Northwest, the Quequen Grande to the Northeast, and the Cristiano Muerto Creek to the East. The Claromeco river originates in the Pampa de Juarez, the plain located between the two sierra systems (Figure 1).

According to its size the Claromeco river is a creek and therefore it is not among the most important water courses of the province. However it is placed in one of the main farming regions of Argentina, the pampean plain.

The main objective of this research is to investigate the basin of the Claromecó creek. The specific objectives of the present study are: to delimit its basin, to determine the hydrological and morphometrical characteristics and to study the vegetation, the fauna and the land uses in the area.

2. METHODOLOGY

The study of any hydrographic basin involves a great quantity of morphometrical variables. The water divide of this basin was defined applying traditional methodology (Heras, 1983) and following the direction of the slopes according to the contour lines. More detailed scales were used in areas with particularly gentle slopes. Such was the case of the interposing plain located in the northern sector of the basin, which has a large quantity of lagoons.

Satellite- generated maps in 1:100,000 and 1:250,000 scales were utilized to update the information regarding land use and the present state of the water courses. The length of the

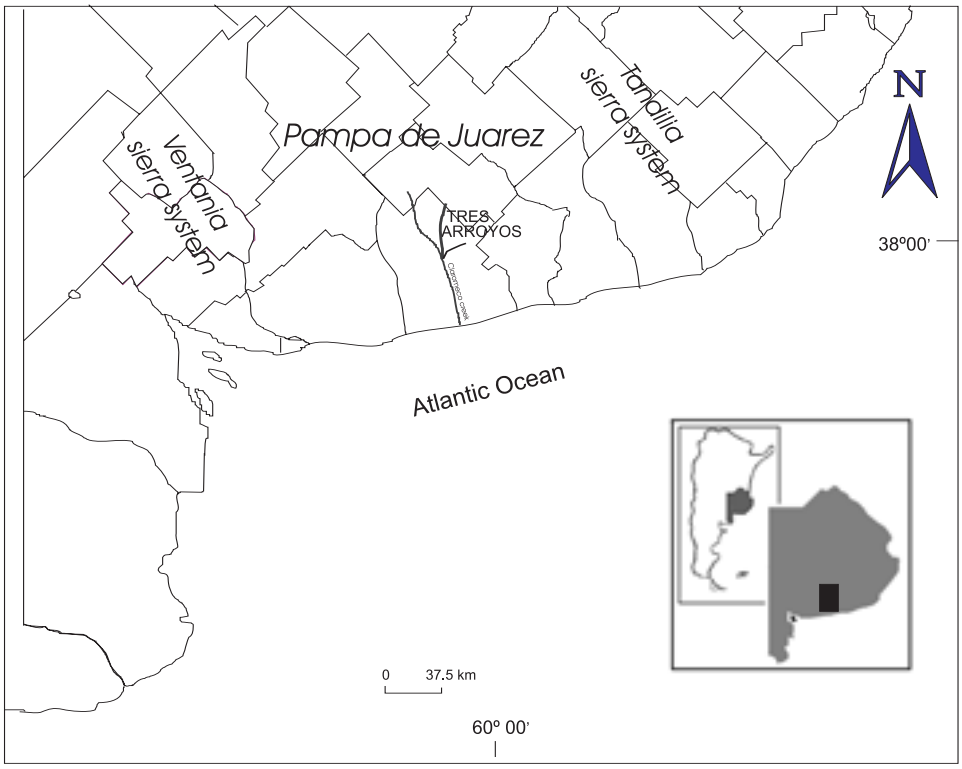

FIGURE 1. The sierras systems of province of Buenos Aires. And location of the. Claromecó creek basin.

creek and its tributaries as well as the perimeter were determined by means of an Eschenbach curvometer. An AKP- 23 polar planimeter was employed to measure the total area of the basin. The fauna and the flora of the basin and the land use were studied by analyzing historical work and by field trips to specific zones of the basin.

3. THE CLAROMECO CREEK BASIN

The hydrographic basin of the Claromeco creek encompasses the centre of the Tres Arroyos district and others, such as Adolfo González Chaves. The main towns located in the Claromeco river basin are Tres Arroyos, Claromecó, Adolfo González Chaves and De La Garma with a population of 44,946, 1,048, 8,472 and 1808 respectively. Therefore the whole district has a total of 56,274 inhabitants (INDEC, 1991).

The basin has an elongated and lobular shape (Jardi, 1985) in its upper portion where the boundaries consist of lagoons and non- defined flooded areas. It is from here that the water courses spring to form this creek (Figure 2). The Claromeco creek results from the confluence of three courses: the Seco or third branch in the west, the Medio or second branch in the middle and the Orellano or first branch in the east-all of which follow a

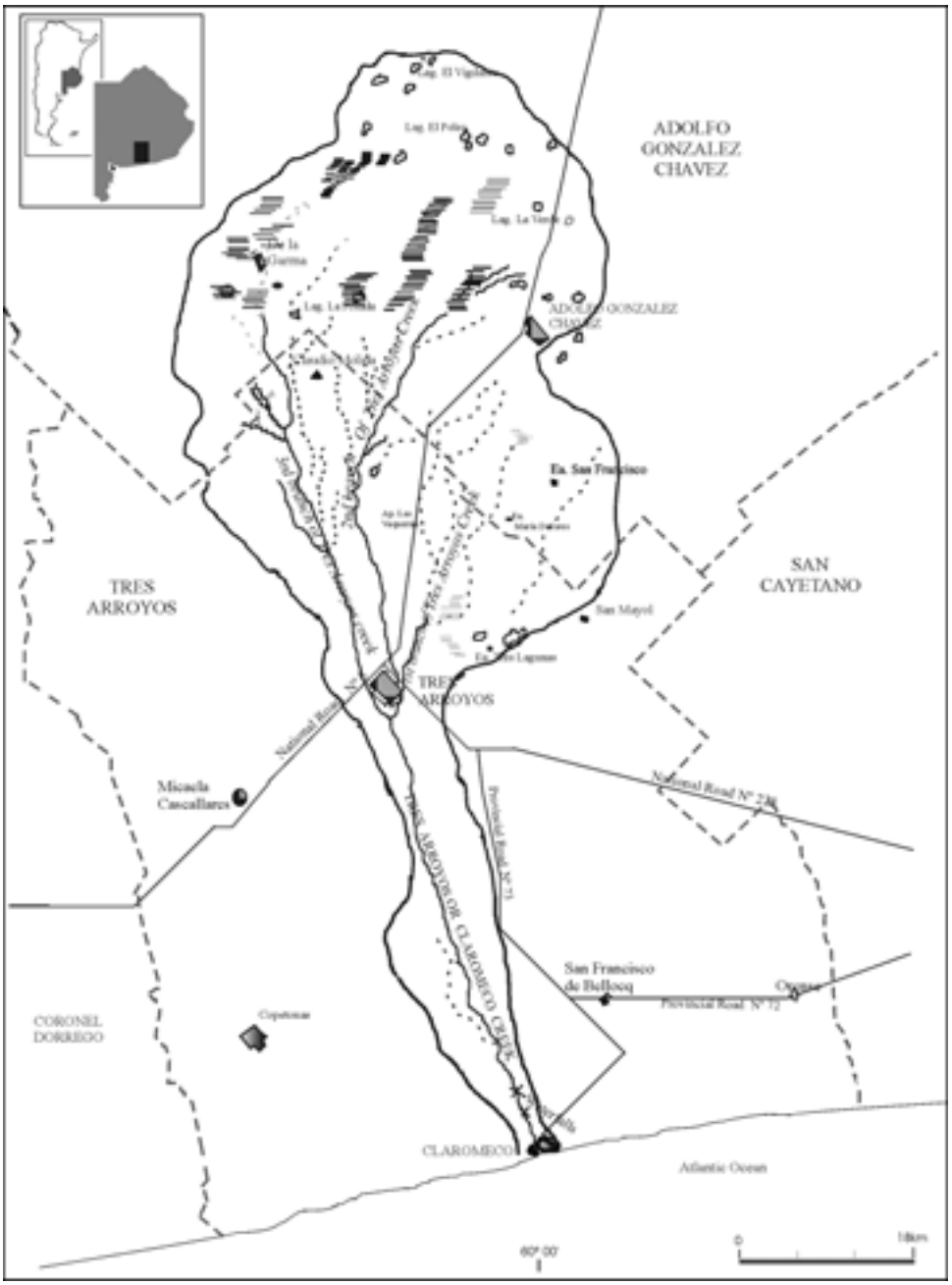

FIGURE 2. Location and boundaries of the Claromecó creek basin.

from its center. It flows from east to west until it reaches a site called La Horqueta in the south of the city. Then it changes its direction to north-south and its name changes to Claromecó. It runs for 51 km and then flows into the Argentine Sea to the west of the town of Claromecó, separating it from the resort area known as Dunamar.

The creeks have all the characteristics of plain creeks, such as a shallow upper basin whose depth increases gradually to the south. This is particularly true of the Claromeco river which is suitable for small boat sailing, canoeing and kayaking. Certain stretches have a seven-meter deep gully.

While the upper and mid-courses present tributaries, such as the Seco Creek, the lower course does not. The most important tributaries are the Second and Third Branches, these are between two and seven meters wide whereas the Claromeco river is ten meters wide. The creek flows in a three meters deep gulley. About 10% of its upper basin presents lagoons. The creeks of this basin are fed by the water descending from the sierra system of Ventania and the Pampa de Juarez plain. Owing to the dynamics of the creek and a gentle slope, rainfalls do not drain in a clearly defined way.

Claromeco derives from the Araucarian word «k'larome-ko» which can be translated as Triple water or Three Creeks or as Three creeks with Jonquils. The Claromeco basin has an area of 3,017.18 km^2 and a perimeter of 285 km. The main course is the Second Branch, which is 135 km long. The first branch measures 67 km and the third one is 113 km long. As far as drainage is concerned, the upper basin presents a disordered or anarchic type while the mid-basin features a dendritic one.

The three courses have their source in lagoons situated in neighboring districts of the so- called Pampa de Juárez a gently sloped area which lies between the sierra systems of Ventania and Tandilia. These characteristics prevent the accurate demarcation of the Claromeco upper basin. The presence of numerous lagoons with a non-defined surface drainage as well as the lack of a distinct topographical control are the main problems of the upper basin area.

There are natural waterfalls 1.7 km away from the mouth of the creek. The 1st is 600 m of the Dunamar bridge, the 2nd is further. Next comes the Iriarte the 3rd waterfall, the 4th Ojo de Agua, the 5th Paso del Búho, the 6th El pozón, the 7th Cascadita. Then there is Grande and finally the Lamberti, which is the highest one. These last two are at 2.7 and 4.5 km respectively from the mouth. The first waterfalls are visible with low tide. Nine kilometers away from the Dunamar bridge the remains of a turbine generator, known as Turbina de Gallegos, can still be seen.

4. CLIMATE

The climate of this area corresponds to a transitional temperate zone (De Martone, 1973). The maximun mean temperature corresponds in January 1978 (29.1 ºC) and the minimun one to July (12.6 ºC). The minimum mean temperature ranges from 15 ºC in January to 3.1 ºC in July.

The mean annual rainfall is 700 millimeters. The maximum precipitation was recorded on March with 90 mm and the minimum one in August 1980 with 40 mm. The prevailing winds are from the N with an annual frequency of 22.8% Winds from the NE have a

frequency of 20.2 % and the corresponding averages for the SE and S winds are 9% and 10.2 % respectively. The mean annual speed is 16 km/h. These weather conditions confirm the suitability of this area both for farming and cattle raising.

5. EDAPHIC CHARACTERISTICS

The features of the soil of the basin, are characterized by a granular structure, that contains a suitable percentage of organic matter (3-5%) and presents a moderate acid reaction (Atlas del Suelo, 1994). The upper basin features Argiacuoles, which are typical of low plains prone to flooding and are crossed by embanked creeks and Natralcuoles. These soils belong to the Molisoles Acuoles group, the Argiacuoles subcategory forms complex soil in association with the Natralcuoles (Atlas del Suelo de Argentina, 1994).

Both the Argiacuoles and the Natralcuoles are members of this typical subgroup. Their drainage is imperfect and their superficial horizon is 20 cm deep. They are provided with enough organic matter, and they possess clayey texture, due to their poor drainage. They are scarcely used for crops although suitable for grazing. The Natralcuoles present a high sodium content on the clayey horizon (Natrium) and usually occupy low, plain areas, and hillocks. The vegetation is formed by hydrophilic species. These soils because of their specific characteristic, are used for grazing. The best soils in the region belong to this group. They are fit for growing wheat, flax, maize and other grains as well as being highly popyphyletic pastures.

The subgroups found in this area include typical Argiudoles where drainage is the limiting condition, Shallow Natralcuoles are frequent in depressed regions. The horizon contains high percentages of organic matter (5-8%) in this area. The soil profile also presents tufa at various depths. These soils are suitable for agriculture except in the northern sector of the middle basin where they are neither deep nor rich enough for tilling. Drainage and depth of the horizon of the soil represent the main hindrances to land use.

6. CHARACTERISTICS OF THE STUDIED AREA

The basin is a gently undulating plain located 108 meters above sea level, separated from the Atlantic Ocean by a 1,000-meter wide sandbank in the subregion of the Pampa de Juarez between the Tandilia and Ventania sierra systems (Figure 1). Since this area belongs to the gramineous steppe of Buenos Aires, its natural features are not varied. In the northern sector, human activity is limited to farming and cattle raising. Although certain sectors are sandy and clayey, the arable land is good in general, as black soil with abundant humus prevails. The overall conditions of the study zone make it suitable for grains and oilseeds, the latter predominating on the higher lands. Where 51.4% of the usable land is devoted to agriculture, 45% is utilized for livestock.

Agriculture thrives with the fine quality of the soil, adequate irrigation and regular rainfall. Owing to these circumstances, the highest crop yields are found among cereals such as wheat, sunflower, oats and barley, while, flax, maize and alpist produce the lowest yields. As regards as cattle, the predominant bovine breeds are Aberdeen Angus,

Shorthorn, Hereford and the milch cow Holando Argentina, while the prevailing ovine breeds are Lincoln and Corriedale.

In the region there are 1421 properties of full-activity land adding up to a total of 582,763 hectares. The average rural properties are between 25 and 1000 hectares big. Other rural activities that characterize the area are dairy industries, poultry breeding, horticulture, etc. Most of the products are used for regional needs. Another significant activity in the zone is apiculture. The area used for farming is 226,026 hectares, while 72,066 hectares are employed for cattle rearing and 235,853 hectares for mixed exportation (Banco de la Provincia de Buenos Aires, 1981) 40.7% of the cultivated land is used for winter crops (wheat, oat, barley) and 37% for summer crops (sunflower, corn and soya). In the basin they also grow crops suitable for a region with low rainfall.

Farming and cattle raising are not the only activities. The economy of the area is highly multifarious. Sand is mined for the building industry. The industrial activity includes a malt factory, five metallurgical firms, leather industry, meta cold- storage plants and two of foodstuff manufacturies. All the industries use the Claromeco river waters.

The predominant vegetation is that of the gramineous steppe belonging to the genus *stipa*, hard grass in tufts around which the soil remains naked most of the year (Figure 3). *Stipas Clarazia, Irichotona, Neesina* and *Lenius* associated with other species, represent the prevailing vegetation. The predominant, shrubs are *Discovia Longispina, Margyricarpus Pinnatus, Bacchavia Vlicina* (Cabrera, 1971) and most herbs are verbenas of the genus *Glandularia and Oxalis*.

Hydrophilic vegetation, such as *Cortaderia* and *Creole Willows* is usually found along the banks of the creeks. *Tupaia, Hyalis Argentea, Terebinth Shrub, Sporobolus Rigens* and *Jonquil* predominate in sandy soils.

FIGURE 3. Predominant vegetation along the Claromecó creek.

Tamarisks, acacias, pines, cypresses, eucalypti, and poplars have been adapted in order to fix the sand banks and sandy soils along the creek banks. In the San Francisco de Bellocq (Figure 1) forest station each of these species was planted individually, although some of them can be found as part of the woodland itself. Seven hundred hectares out of the thousand hectares that make up the station are forested while, the remaining land constitutes a reserve.

The fauna has diminished both in number and species, because the land is used for farming (Fundación Vida Silvestre, 1990). In former times there were all sorts of carnivores, rodents and birds as on the plain of the province of Buenos Aires. Deer, wild cats, ferrets, red foxes, mule armadillos, mofettes, otters, *Ctenomys Porteosi, Microcavia australis*, hares, viscachas, weasels, rheas, lizards, and different varieties of snakes can be found in this zone a long side the almost extinct *Ozotoceros Bezoarticus*.

It is worth mentioning that this coastal area has a unique bird population which includes: *Rhea americana, Eudromia elegans, Nothura maculbsa, Podiceps rolland, Podiceps occipitalis, Diomedea, Euxenura maguari*, *Phoenicopterus chilensis*, *Chauna torquata*, *Cygnus melancoryphus*, *Chloephaga rubidiceps*, *Chloephaga poliocephala*, *Pluvialis dominica*, *Vanellus chilensis, Ixobrychus involucris*, *Pluviali*, *Sterna*, *Tringa flavipes*, *Chionis alba*, *Cyanoliseus patagonus*, *Phalacrocorax olivaceus, Phalacrocorax albiventer, Aramus guarauna, Macronectes giganteus, Coragyps atratus, Circus cinereus, Falco, Milvago chimango, Sterna, Pardirallus sanguinolentus, Haematopus palliatus, Tringa flavipes, Chlorostilbon aureoventris, Athene, Chloraceryle americana, Zonotrichia capensis*. (Centro Editor de America Latina, 1982). As far as the estuary fisheries are concerned, the most important fish varieties are black corvina, conger, sole, whiting, dogfish and brotulid shark, atherines,etc. The coastal fishing continues all year long. Each January, when most people take their summer holidays, an important black corvine fishing tournament takes place in the area.

7. CONCLUSION

The knowledge of the dynamics of watercourses is fundamental because of their influence upon land use and area development. The management and control of basins determine the feasibility of a rational land use and the possibility of diversifying the economic activities according to their morphological features. To achieve those objectives, the basin should be studied from all points of view: physical, climatic edaphic features, population, assets and liabilities.

The relevance of the Claromecó derives from its running across a very important zone of Argentina which produces the bulk of the fine grain crop in the country. Apart from agriculture, the area is also devoted to other activities of the secondary and tertiary sectors. The study of this course enables us to determine the problematic quality of its upper basin due to both its gentle slope and its frequent flooding. Various canals have been constructed in order the provide irrigation and drain flooded roads.

The Claromecó creek basin has an area of 3,017.18 km^2, it is a basin of medium size. It has an elongated and lobular shape. Its perimeter is 285 km. The main course is 135 km long. The drainage design is disordered and anarchic in the upper basin and dentritic in the

middle basin. The three watercourses which form the Claromeco river have a regular regime while the tributaries features an intermittent one. There are seven natural waterfalls along the creek.

According to the data obtained during the first phase of this study it is possible to conclude that, despite its small size, the Claromecó river is significant due to the relevance of the area across which it flows. Moreover, the mouth of the creek offers a popular bathing resort, and is therefore used as a touristic resource.

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