

Estimation Of The Water Supply With Scarce Information In The Strategic Ecosystem Of The Montes De Maria Subregion, Chalán, Sucre

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Abstract.

The Research Area has 7.9 Km² of which 2410 ht, of the total area is equivalent to the Study Area, having 31% of the Microbasin Area that supplies the Municipality. As a main objective, it was proposed to estimate the environmental supply of the water resource and as secondary objectives to estimate the monthly and annual average flow that originates in the system, as well as to estimate the minimum annual flow for different return periods. To achieve these objectives, the "water accounting procedure was used to carry out the detailed water balance according to Holdridge", and the method of regionalization of average characteristics, obtaining as results the average annual precipitation in the entire study area.

Keywords: Human ecology, Ecohydrology, Natural environment, ecosystem services.

INTRODUCTION

Fundamental development for agricultural, social, industrial, health and quality of life progress in general (Samboni, 2011). In addition, it is essential to supply drinking water to rural human populations settled in areas adjacent to ecosystems.

Environmental degradation and pollution have a huge impact on living beings, the conservation of the quality of water resources depends on the ability to improve the interaction between human activities and the physical, chemical and biological environments (PNUM, 2011); therefore, it is essential to know the environmental conditions of the water bodies, carrying out a set of studies that not only determine the quantity and quality of the water, but also the state of its aquatic and terrestrial ecosystems, structure and distribution, for the identification of the main aspects that are related to the natural conditions of a water body and that can introduce changes in the characteristics of one or several elements of the environment.

This article shows the results obtained through the use of the methodology proposed by (leondan otaya Burbano, 2000) in his article "**ESTIMATE THE WATER SUPPLY WITH SCARCE INFORMATION IN STRATEGIC ECOSYSTEMS**" where he proposes the appropriate methods to obtain results in areas of difficult access and scarce meteorological information. According to Vélez (2000), one of the greatest difficulties in Colombia when carrying out studies to estimate the water supply is the lack of information, since there are few climatological and meteorological stations; therefore, the application of models that estimate this water supply using scarce information is very interesting and important to develop

management plans for hydrographic basins and make economic assessments of the water resource offered. This work is carried out in the Protected Reserves Area, which presents a Tropical Dry Forest Biome (BsT) in Cerro Mancamo and has a Tropical Basal floor, in the municipality of Chalan - Sucre, This municipality is presented as a Warm Dry climate Area , with an average temperature of 23°C during the day and 18°C at night, its altitude ranges between 200 and 600 meters above sea level.

The climatic data used is subject to the records of the PRIMATES meteorological station located in the Municipality of Coloso in the Protected Natural Reserve of Coraza which adjoins the Municipality less than 50 km from the Cabecera de Chalan and with a height difference not greater than 300 meters from it.

The Municipality of Chalán is located on the Colombian Caribbean Coast, exactly in the northeastern area of the Department of Sucre, located on the sides of the Serranía de San Jacinto Mountain System in the Montes de María subsystem. The municipal capital is located at coordinates 75° 18' 58" west longitude and 9° 32' 57" north latitude at a distance of 40 kilometers from Sincelejo, the capital of the Department. It has an area of about 7,690 hectares and is undulating. with steep slopes in most of the territory. (Chalan A. d., 2016)



Location Municipality of Chalan - Sucre (Own elaboration).

For many years this municipality of Chalan was hit by the armed conflict in charge of the outlaw group called FARC, resulting in a massive outflow of the municipal territory around 90. The levels of quality of life and the little attraction in the productivity of the area, make the population go out to look for new life alternatives, better education, greater opportunities for

generating income, among others; Being the young people and women, the first ones involved, making the field long-lived. Likewise, the little natal reproduction despite the fact that population growth occurs in rural areas. Given this, a strong projection towards the rural is required that encourages productive projects, formalize properties, generate productive infrastructure, alternative educational offers (Chalan, 2020)

The Municipality of Chalan has a population of 3,041 inhabitants in the Urban Area and 3,041 inhabitants in the Rural Area of the Municipality, thus obtaining a total of 5,418 inhabitants. (DANE, 2018), the Municipality has an Area of 7.9 Km² of which 2410 ha, 24.1 km² of the total area is equivalent to the Study Area of this work, thus having 31% of the Micro-basin Area that supplies the Municipality of Chalan which is supplied by surface water through catchment. (Sucre AM, 2018)

The Municipality has an average annual rainfall of 1.6334.4 mm, its relative humidity in the area directly affects the phenomena of evapotranspiration, climatic sensation and dew point, which affect the processes of water exchange of plants and epidermal exchange of animals, its annual average is 79.3% (-Sucre). (ENA, 2018)

OBJECTIVE

GENERAL OBJECTIVE

- Estimate sustainable water supply from both surface and underground sources of the system.

SPECIFIC OBJECTIVES

- Estimate the annual flows of groundwater available in the Municipality of Chalan Sucre.
- Estimate annual flows of surface water in the Municipality of Chalan Sucre.
- Estimate available water supply in the Municipality of Chalan Sucre.

METHODOLOGY

Taking the Primates, Universidad de Sucre and Chalan stations as a source of information, the "water accounting procedure is used to carry out the detailed water balance according to Holdridge" and the method of regionalization of average characteristics. As a result, rainfall in m³/year and an average annual runoff in m³/year are determined for the study area. Obtaining a runoff coefficient in %, which establishes what % of the precipitation that becomes runoff and what % is lost by evapotranspiration (Medellin, 2008) (Chalan AM, 2016).

RESULT.

The condensed data in table 1 were obtained as results using the method proposed by (Leonora Burbano, 2000). Taking into account the proposed variables, with values obtained from the PRIMATES Meteorological Station of the Municipality of Coloso - Sucre.

VARIABLE	JA N	FE B	M AR	AP R	M AY	JU N	JU L	AU G	SE P	OC T	NO V	DE C	ANN UAL
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Biotope temperature (°C)	27	27.3	27.3	27.3	26.9	27	27.1	26.9	26.6	26.4	26.4	26.7	26.9
Evapotranspiration (mm)	135	123.4	136.5	132.1	134.5	130.6	135.5	134.5	128.7	132	127.7	133.5	132.0
Precipitation (mm)	21.6	31.7	80.5	117.1	163.8	143.1	158.7	159.8	175.1	119	51.9	1285.3	
Real Evapotranspiration (mm)	44.98	44.9	44.9	44.9	134.5	130.6	135.5	134.5	128.7	132	44.9	44.9	1065.7
Excess water (mm)				14.4	33.1	7.6	24.2	31.0	43.1				128.5
Soil water recharge (mm)					33.1	7.6	24.2	31.0	43.1				
Soil water reduction (mm)	38.55	38.5	38.5	38.5	38.55						38.5	38.5	
Soil moisture at the end of the month (mm)	44.98	44.9	44.9	44.9	128.5	128.5	128.5	128.5	128.5	128.5	44.7	44.8	
Total runoff (mm)				14.4	33.1	7.6	24.2	31.0	43.1				153.4
Soil Moisture Deficit at the end of the month (mm)	106.9	118.8	-97	48.9	11.4						-9.5	-76.6	
Soil precipitation deficit at the end of the month (mm)	113.4	113.9	-105	52.0	17.4	33.1	7.6	24.2	31.0	43.1	-8.7	-81.6	11153.2
Total moisture deficit (mm)	220.3	232.5	-202	100.4	28.8						-18.2	-158.2	
Monthly flow (Mm³/month)	0	0	0	0	34.7	798.1	18.3	58.3	74.8	103.8	0	0	

Table 1. Detailed water balance according to Holdridge (Own elaboration)

Having the results of table 1. It was obtained that the average annual rainfall in the entire study area was 1285.3 mm/year; content in this way, lower results than the average annual precipitation of Colombia (3,000 mm) and higher than the annual average of South America (1,600 mm). Accordingly, the average annual rainfall in the study area is 0.031 km³.

RESULTS AND DISCUSSION FINAL BALANCE CHECKING:

Taking the sum of the 12 real evapotranspiration values, plus the sum of the 12 runoff values, these are approximated to the total annual precipitation value (Medellin, 2008)

∑ Real Evapotranspiration (mm)	1065.6
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∑ Runoff (mm)	153, 5
∑ Total	1,219.2
annual precipitation (mm)	1,231.4
Difference	12.1
Difference % (admissible error)	1%

Table 2. Final Verification (Own Preparation)

Having the final verification, it can be observed that the admissible difference is 1%, obtained by the sum of the 12 months of runoff plus the 12 months of real evapotranspiration and this was subtracted with the precipitation, which yielded the results of table 1, obtaining in this way:

Average temperature: It was determined that the study area It has average heights between 200 and 600 meters above sea level, with a height of 543.0 meters above sea level on top of Cerro Mancamo, birthplace of the sereno, Ojito, Chalan and Joney currents. At such heights correspond annual average temperatures of 23°C during the day and 18°C in winter; the average average temperature is 26.9°C in summer.

Average precipitation: As can be seen in Table 1, the average annual precipitation for the entire area is 1,285.3 mm/year; It is observed that it is less than both the average annual rainfall in Colombia (3000 mm) and the average annual rainfall in South America (1600 mm). Relating the average annual rainfall to the surface under study, we have an annual volume of precipitation of 0.031 Km³, which is not even 1x100 of the volume of annual precipitation in the country. Average flows: Table 1 shows the average monthly and annual flows, with the month of July being the one with the lowest value 1 6.84 (m³/sg) and the month of October the month with the highest value 38.78 (m³/sg)

Water balance summary: In Table 1, which has been prepared using the "water accounting procedure to carry out the detailed water balance according to Holdridge" and the method of regionalization of average characteristics, the following results were obtained:

1. Precipitation of 1285 .3 (mm) equivalent to 30,968,500 m³/year
2. Real evapotranspiration 25,685,057 m³/year
3. Average annual runoff of 3,699,350 m³/year. Based on the above, a runoff coefficient of 12% is obtained, which means that 12% of the precipitation becomes runoff and the remaining 88% is lost through evapotranspiration.
4. Groundwater: The potential source is the Morroa aquifer, which would only have natural recharge from 371.3 mm/year of precipitation. Between Chalan and Coloso the static levels are between 25 and 70 mt. They are bicarbonated, calcium-sodium and some sulfated fresh waters with total hardness greater than 240 ml/lit, which requires conventional treatment to remove hardness, reduce alkalinity and precipitate iron. 20 L*sec could be extracted to purify and supply the entire population with 630,720 m³ per year; Based on the RAS-2017, the total population requires 692,150 m³ per year of

drinking water, based on a gross provision for warm weather of 140 L/Inhab.day considering a loss in the system of 40% (Sucre AM, 2002) (RAS, 2017).

CONCLUSIONS

Once the water supply was evaluated by means of the water accounting procedure to carry out the detailed water balance according to Holdridge" and the method of regionalization of average characteristics, it was obtained as a result that in the Municipality of Chalan Sucre the Precipitation is 30,968. 500 m³/year, the real evapotranspiration has a value of 25,685,057 m³/year and the average annual runoff is 3,699,350 m³/year, in terms of groundwater, the amount of m³ is viable, but this option requires hydraulic infrastructure and of conventional drinking water very complex in terms of its operation and maintenance, it is recommended to supply it with non-conventional energy; Regarding the surface water supply, it is substantially greater than the demand for human consumption, it only reaches 20%, the remaining runoff contains the ecological flows and flows available to supply the agricultural sector in accordance with what is established in guide manuals and standards.

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