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Quality of Life and Pollution Sources in the Higueras River Basin in Huánuco

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Abstract

The purpose of the study was to verify that there was a high and positive relationship between the sources of pollution and the quality of life of the inhabitants of the Higueras river basin, Huánuco 2022; For this, a correlational type research and non-experimental design was developed; we worked with a sample of 221 neighbors per district; The data was collected with a test evaluated and designed with four dimensions for the first variable; the instrument to collect data for the second variable was designed without dimensions and with ten items; In the processing of the data, simple linear regression statistics were used, obtaining the following result and conclusion: Ho is rejected since 0.9259≥0.164, and it is concluded that there is a high positive relationship between the sources of contamination and the quality of life in the inhabitants of Las Higueras. River Basin, Huanuco 2022.; concluding that the determination of the sources of contamination has a high explanatory power on the quality of life in the inhabitants of the Higueras river basin, Huánuco 2022.

Keywords: *Pollution sources; Quality of life; ecosystem services.*

INTRODUCTION

The Higueras River basin is located in the Department of Huanuco on the eastern slope of the Andes Mountains of Peru, between the geographical parallels: 09° 48' and 10° 09' south latitude and meridians 76° 14' 30" and 76° 30' west longitude, with respect to the Greenwich meridian, forming part of the Huallaga river basin (MINAGRI, 1981).

In its route it covers the entire district of Yarumayo, a good part of the districts: Margos, San Pedro de Chaulán, Huancapallac, Huánuco and Jacas Chico. It is bordered on the north by the Conchumayo River basin, on the south by the Cayrán and Huertas River basin, on the west by the Marañón River basin, and on the east by the Huallaga River. (Ponce, 2018). The study has considered five districts with greater territorial roots, with the exception of the district of Huanuco, which deserves a separate study, in these districts it has been sought to determine the sources of pollution on the ecosystem services enjoyed by the inhabitants of the basin and whose management is a direct function with the quality of life they can enjoy in the medium and long term.

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The Higueras River and its tributaries in its route form small and medium valleys, in some parts there are deep ravines generated by the erosion process of thousands or millions of years; However, many of its tributaries can be built irrigation canals and for the consumption of the inhabitants, also, has as an access road a road with permanent flow of means of transport back and forth, in addition, the capitals of the districts and some larger population centers have educational institutions, health services, basic sanitation and some other State services and enjoy ecosystem services with or without knowledge of how to manage them.

A study was made of the polluting foci of the Higueras river basin, linked to the social, economic, physical and geomorphological characteristics, in that sense, the evaluation of existing resources allowed to know the polluting pressure they exert on the ecosystem services of the basin; its knowledge allows us to propose alternative solutions to mitigate the frequency of pollutants on the Higueras River (Galicians, 2015).

The basin under study has an approximate extension of 720 square kilometers and for the study has been geographically subdivided into sub-basins: Chaulán, Magos, Yarumayo, Huancapallac and Jacas Chico. The population burden of the Higueras River Basin fluctuates due to internal and external migration (Bibot, 2015). The infrastructure of services such as: housing, health and education, only in district capitals there are features of modernity and sufficiency, however, there is high absenteeism because students are dedicated to agricultural work (Sanchez, 2020).

In cultural manifestations such as language, most of the inhabitants are bilingual, that is, the interaction with the personnel of Public Institutions such as agriculture, health, banking and others, they do it with Spanish, and among them they do it with Quechua. In folklore stands out the Huayno, Muliza and the Dance of the Negritos, and practice crafts, and have main festivities such as the dance of the Negrito in January, Anniversary of Huanuco on August 15, among others (Apple tree, 2018).

In the basin the main use of water is in agriculture for irrigation and drinking and non-potable population consumption, the capital city Huanuco is the main producer of drinking water in its production centers of Cabrito Pampa and Canchán, as noted, all take the waters of the Higueras River and there lies the importance of proper management of the basin, Since it is vital for the inhabitants, however, the deterioration is progressive due to the mismanagement on the part of the inhabitants and the permissible passivity of the competent authorities. (Aiquipa, et al 2018).

Economic development based on agriculture is impactful of direct function to its development on terminal resources, small-scale livestock has its share of negative impact, the hydraulic works the only existing one is in the Kotosh sub-basin that carries water for human consumption of the inhabitants of Cayhuayna in Pillco Marca. The inlets for agriculture are artisanal (Fennell, 2013). The inhabitants under the pretext of modernity are modifying cultural patterns, such as the care and preservation of natural resources such as pastures, moyas, rivers, and mineralogical resources; and, water and sewage services are being built inadequately generating pollution, with pipes that lead sewage and contaminated water directly to the river without prior treatment causing pollution and degradation of ecological niches and cultivation areas, evidencing with facts the inadequate management of this important basin under study. (Garcia, 2018).

The local environmental crisis adds to the environmental crisis on the planet, mitigation implies a joint action from several fronts that allows to perceive the complex interaction of anthropic, biophysical, economic, political, social factors, involved in inadequate environmental management (Dominguez, et al, 2019). The change of the environmental reality implies modifying ethical positions, reordering the educational framework and promoting coherent human relations with the environment, and from these terms promoting a planned development for the inhabitants of the basin under study. (Severiche, et al 2016).

Encourage feature change Anthropocentric by the biocentric or of life, mitigating degrading styles of economic and social development for an environmentally desirable and sustainable one. Environmental deterioration is a complex problem of a sociological, anthropological, psychological, economic nature, because it is men who extinguish species, destroy non-renewable resources, exercise power abusively as the dominant species on planet Earth, and are causing an environmental crisis, uncontrollable knowing that they will also be affected. (Pines, 2018).

The basins must be managed integrally to control the collection of water and promote its purification (Caisa, J. A. 2013), in addition, the protection and conservation of resources in order to improve the quality of life of the inhabitants (Torrecillas, 2016); In that sense, the end is verify that there is a positive relationship between the sources of pollution and the quality of life of the inhabitants of the basin of the Higueras River in Huánuco, because every person requires drinking water for consumption since it is an indispensable resource for human existence (Fennell, 2013).

The poor management of the watersheds produces erosion of slopes and channels, sediments, deforestation, deterioration of water quality, garbage deposits, residual sludge, wastewater and rainwater discharges, physical barriers, presence of weeds on the banks of the channels (Torrecillas, 2016), therefore, the actions and management processes undertaken to recover the ecosystem sustainability of the territory (Marin, 2015), must be coordinated between local, regional authorities and basin dwellers (Cholán, 2013), prior strategic planning for the conservation, recovery, protection and integral management of water in the Higueras river basin (Muñoz, 2020).

Man is turning water on the planet into a focus of diseases and tragedies, then, he does not assume his responsibility and blames these acts on third parties, such as nature, showing his egocentrism; human development has always been next to a body of water or in its area of influence, because it is a vital and indispensable liquid to carry out the development activities of every society, for its food, health actions, for the irrigation of its food during production, for the drinking of its livestock and other services (Caisa, 2013); the Latin American context is no exception, as watersheds have sustained the development of cities and towns such as Lima along the Rimac River, Santiago de Chile along the Mapocho River, Huanuco at the confluence of the Huallaga River and the Higueras River; and, as they grow, they support more cities, as the Huallaga River supports Huariaca, San Rafael, Ambo, Huánuco, Tingo María and others of less development (Céliz, 2020).

As long as man does not change his attitude in Latin America, the basins will continue to serve as sewers and sewers of large, medium or small cities, since all of them point their drains without any treatment to the river of the wing, as is the case of the Higueras and Huallaga rivers; Sewage is one of the vectors of pollution and solid waste that is thrown into the river in its organic form, plastics, paper, glass, metals, chemical waste, hospital, oil and its derivatives thrown by mechanics and car washers, remains of soaps, detergents and other pollutants that saturate the waters until it becomes a dead river. (Garcia, 2018); In that sense, global warming is the product of the mismanagement of natural resources by man and affects coastal or continental peoples equally, the competent authorities must assume their responsibility and draw up a very aggressive environmental education policy and apply it in coordination in order to mitigate the increasingly aggressive environmental impacts, generating sustainable development and leaving a legacy to at least five more generations (Macias, & Paredes, 2017).

The inhabitants of the basin of the river Higueras, most have houses of rammed earth with thatched roof, tiles or calaminas, are composed of two environments, one for storage and the other for domestic uses and used as a bedroom, the drinking water service does not exist in any of the districts, except for some reservoir such as Chaulán with some degree of treatment, Then, the water supply for domestic use is supplied by springs and

rivers, and they lack drainage services, this failure becomes a source of pollution for the basin under study. (Perez, & Perez, 2016). The infrastructure for health services is deficient, the district capitals have a medical post attended by a health professional from SERUM, so the inhabitants of remote villages hardly access this vital service, this failure causes other sources of contamination (Panti, 2019).

In education, the district capitals have the initial, primary and secondary levels and access to this service for remote inhabitants is somewhat difficult, so there is a large amount of school absenteeism, and children from an early age are dedicated to field work; in higher education the inhabitants of the basin have the influence of the Hermilio Valdizán National University, and due to multiple factors very few access becoming a polluting focus for the basin (Rye, & Huamani, 2016). The public institutions in the capital of department with little work of extension towards the communities, the authorities of Huánuco apply the centralist criterion that applies the great capital Lima, and require the authorities of the populated centers to present investment projects for them to approve them, because of this, many needs remain as a verbal request, or some office or other document, consequently, the budget of the Regional Government are not applied pertinently, lending themselves to inappropriate applications; and, it also becomes a polluting focus for the Higueras River Basin (Merino, 2010).

The Higueras River Basin is located in the Department of Huanuco between the parallels 09 ° 48 'and 10 ° 09' South Latitude, and the meridians 76 ° 14' 30 " and 76 ° 30 'West Longitude, is part of the great Huallaga basin, and runs through the districts of Yarumayo, Margos, Chaulán, Yarumayo, Huancapallac, Jacas Chico and Huánuco (Bustamante, & Paragua, 2022), and the component population is from zero to fifteen years, the elderly migrate internally for work to the capital, and externally for the commercial activity of their products, constituting a seasonal migration (Jimenez, 2020).

The use of ecosystem services is in charge of the inhabitants who are reluctant to collective management and each person tries to get the most out of a resource for himself, ignoring the communal or collective property that can be managed from the communal perspective, prioritizing individual private property as the only way to use resources. (Street, 2011), however, they manage by custom some communal properties such as ditches, basins, roads and others, because their use favors the development of the community, consequently, community use is based on customs that translate into rules that shape local social norms (Arozena, 2015). The planned modernization of the villages is necessary, making infrastructures minimizing the impacts on the natural, cultural environment and especially the river, implementing an environmental education promoting a friendly attitude with water resources, flora and fauna in the Higueras River Basin (Rivers, 2012).

The social implies a set of individuals who share the same culture and who interact with each other to form a community (Moore, 2014), and share the notion of social coexistence in the basin of the river Higueras subdivided into sub-basins, sharing the way of living together of each sub-basin, such as the social pressure they exert on the natural resource river (Oliva, & Villa, 2014), in that sense, modernity alters the balance between inhabitant and natural resource affecting the use of soil and water, unbalancing the social organization of the sub-basin and the basin in general. (Mayor, 2020), freshwater should be understood as a finite and vulnerable resource, sustaining life, development and the environment; Therefore, water has an economic value in the diversity of its use, so it should be recognized as a social and economic good. (Guerrero, 2019).

In the Andean vision Water management is incorporated into communal culture and considered as a divine being that fertilizes Mother Earth and reproduces life; and, allows the integration of humans through the articulation between nature and society (Cholán, 2013), therefore, its distribution must be equitable and depending on time, climate and topography, because its availability is a function of natural laws, seasonal cycles and the

conditions of the territory. (Colta, 2016), innovative rational management would rationalize the use of water and other natural resources by articulating the social and cultural networks located in the Higueras basin (Market, 2016), consolidating the relevant authority for water resources management (Barrientos, 2011), avoiding excessive irrigation under the pretext of intensive production, because artificial erosion of agricultural land is generated by landslides in the agricultural area generating erosions that can be mitigated with the raway that are furrow techniques to prevent erosion and regulate drainage in cultivation spaces (Paragua, et al., 2022).

Human activity as a social process takes place in a territorial space subject to various mediations, such as: distance, resource endowment and centrality (Spindola, 2016), distance conditions access to markets, so national, regional and local spaces must have economic, social and productive articulation and integration (Timaná & Castañeda, 2019), seeking a sustainable growth that is somewhat utopian, by growth produce environmental imbalances that humans are not prepared to mitigate (Elizalde, 1996), in that sense, the basin is a hydrological and geophysical unit, in addition, the altitudinal floors condition the possibilities of communication in the physical space and the distribution patterns of the population in the territory (ECLAC, 2013), sustainable development constitutes a multidimensional concept that involves economic, social and environmental dimensions that will continue to evolve over time, with the feeling of a threatened environment. (De la Paz, 2017).

Through environmental education, ecological awareness must be promoted, such as equal access to resources, combating absolute and extreme poverty, and improving access to land, education and social services that make up the economic dimension. (Paragua, et al., 2022), (Paragua, et al, 2021), thus, the economic-social aspect of sustainable development improves the quality of life, reduces urban migration, mitigates the consequences of urbanization, and the environmental dimension favors the efficient use of water supplies and farmland, avoiding the excessive use of chemical fertilizers and pesticides, conserving water and reducing or stopping the destruction of small forests in the Higueras river basin. (Alarcón, 2021).

In the hydrological cycle, incoming rainfall alters the outflow runoff, because the geomorphology of the basin intervenes (Gómez, & Paytán, 2018), because the type of relief of a given area is made according to geological evolution, where endogenous processes and orogenesis give rise to mountain ranges, in addition to other surface modeling agents (Vergara, 2017), the lands of the Higueras river basin, have been formed during geological time intervals (Di Nicolo, 2018).

Basins process and condition human development and quality of life, linking it with the integrated management of water and other resources, because it sustains all forms of life and activities on the planet, reducing poverty and infant mortality, and improving health and education. (Gaspari, & Senisterra, 2016), therefore,, Inefficient management of water and other watershed resources leads to deterioration of food, health and housing affecting human development (Sanchez, 2017), in this sense, watersheds provide opportunities and capabilities to their inhabitants, and satisfaction of environmental demands (Child, 2019), however, our esteem for water has declined increasingly, it is likely that the next wars will be for access to this liquid element. (Ploskonka, 2010).

In the basins, the waters flow through the natural causes producing filtrations to the interior of the soil and maintain with water the skirts of the hills that are used in agriculture, it is also used for human consumption, animal and irrigation, but, modernity allows to build reservoirs and irrigation channels with cement coating, preventing the filtration of water into the subsoil, As a result, green areas are disappearing, giving way to desertification. (Rhodes, 2015), in addition, the inhabitants of the basin due to lack of guidance and environmental education are deforesting the flora and fauna, and causes permanent erosion to the productive areas (Escalona, 2009).

METHODOLOGY

The projected research is correlational (Paragua, et al., 2022) (Paragua, M. 2014), during its development the independent variable is not manipulated, only the level of correlation and the degree of dependence of the variable are sought. Quality of life of the inhabitants of the Higueras river basin, with respect to the variable Sources of contamination. The fieldwork does not imply the manipulation of the independent variable, consequently, the research design is non-experimental (Paragua, et al, 2021).

The population approximately living in the Higueras River Basin, based on the 1972 Population Census shows a total population of approximately 22444 inhabitants living in the Higueras River Basin. The type of sampling assumed is non-random, in that sense, the last two figures were removed from each total per district, and the sum of all of them was assigned to them for each district; The data collection was according to how people were located until completing the quota of 221 for each district, distributed as follows:

Table 1. Approximate urban and rural population of the Higueras River Basin, Huánuco 2022

Districts	Population	Process	Sample
Huancapallac	3789	37	221
Yarumayo	1915	19	221
Margos	10982	109	221
Chaulan	3961	39	221
Jacas Chico	1797	17	221
TOTAL	22444	221	1205

Source: Base population census 1972

Design: Researchers

Data collection on sources of contamination was done with the instrument Valued test, with four dimensions and each with five measurement indicators (Paragua, et al., 2022), which was validated by lower variability, for this it was applied up to three times to three pilot samples (n = 10), to these results the experts found the Standard Deviation and issued the expert judgment of validity of the data collection instrument for lower variability (Paragua, M. 2012), the same process was done for data collection on Quality of life of the inhabitants of the Higueras basin, with a Valued test without any dimension and with ten measurement indicators.

RESULTS

The results of the level of relationship, the degree of dependence and the mathematical model between the variables foci of pollution and quality of life of the inhabitants of the Higueras river basin, on average, are presented.

Table 2. Degree of dependence and level of relationship between the variables sources of pollution and quality of life of the inhabitants of the five districts under study of the Higueras river basin in Huánuco

Statistical	Jacas Chico	Huancapallac	Yarumayo	Margos	Chaulan	Average
Correlation coefficient (r)	0,9001	0,8912	0,9646	0,9454	0,9283	0,9259
Degree of dependency $(r^2\%)$	81,02%	79,42%	93,05%	89,38%	86,17%	85,73%
Interception (b)	9,57	7,35	3,04	5,60	6,18	6,35
(Quality of life) (a)	0,32	0,33	0,38	0,35	0,35	0,35
n	221,00	221,00	221,00	221,00	221,00	221,00
	$y = ax + b \rightarrow y = 0{,}35x + 6{,}35$					

Source: Data Collection Instrument, Annex 2

Design and statistical process: Researchers

Table 3 shows the regression statistics of the link established between the variables sources of pollution and quality of life and the respective average of the five districts under study, then, the variable sources of pollutionGrado de dependencia=85,73% explains the variability of quality of life of the inhabitants in the indicated percentage, and the difference 14.27% subsist without explanation or are revealed by other factors, with such information the authorities can make better preventive decisions in relation to the maintenance and preservation of ecosystem services, otherwise it would produce the environmental imbalance in the jurisdiction of the Higueras river basin.

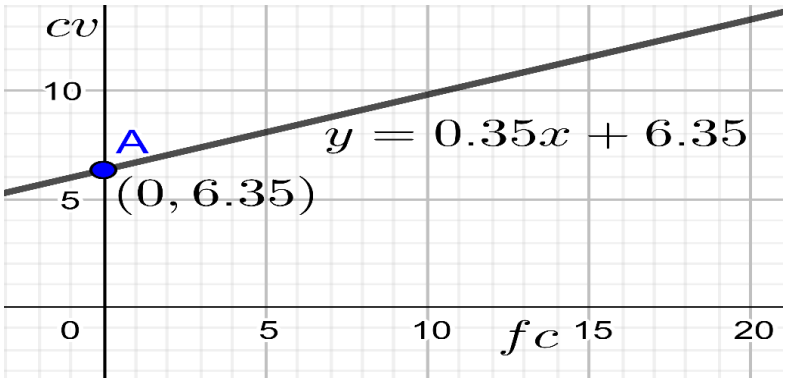

Figure 1. Degree of dependence and level of relationship between the variables sources of pollution and quality of life of the inhabitants of the five districts under study of the Higueras river basin in Huánuco

Source: Data Collection Instrument

Design and statistical process: Researchers

There is a high and effective correlation that establishes a degree of dependence of 85.73%, and the unexplained variability of 14.27% is low compared to the explained proportion, therefore, based on the result achieved, it is asserted that the quality of life depends on the management of pollution sources; In this sense, the graph above shows that the dispersion of the points generated by the variables under study and the forecast line that best groups these points is given from the general equation of the following line: , which suggests a reading of the graph: the more determination of y=ax+b →y=0,35x+6,35sources of pollution, the better the quality of life of the inhabitants of the Higueras river basin, Huanuco 2022.

The study allowed to understand that the random variables, product of the observation were together in a bivariate distribution generating a cloud of points (x,yx, y) that linearly establish a high positive correlation, and this allowed: verify that there is a high positive relationship between the sources of pollution and the quality of life of the inhabitants of the Higueras River Basin, Huanuco 2022.

The test statistic"r" is , and the condition is to reject the null hypothesis (Ho) if, in additionr≥r_0,05 r_0,05=0,1645gl=220, the value of for and the value of allow the following test: and inequality is a truth; then sr=0,9259r≥r_0,05→0,9259≥0,1645e rejects Ho since 0,9259≥0,1645, concluding that there is a high positive relationship and the determination of pollution sources has high explanatory power on quality of life in the inhabitants of the Higueras River Basin, Huánuco 2022.

DISCUSSION OF RESULTS

The management and knowledge for the improvement of ecosystem services in the Higueras river basin, implies a necessary awareness of the supply, regulation, support and cultural services that nature provides to the population as a whole located in the vicinity of the Higueras river basin (Paragua, et al., 2022), (Trujillo, 2018), then, it must be

understood that the environment exists and develops without the human being, but the human being does not subsist and even less develop without him., because from their early stages of evolution they have interacted with ecosystems to cover all their needs, until reaching the current stage (Rodriguez & Quintanilla, 2019).

The relationship between human and the environment can be analyzed from several perspectives, the study corresponds from the point of view of ecosystem services that constitute the sources of pollution whose mistreatment leads to the deterioration of the quality of life of the population, therefore the link between nature and society must be balanced, and not asymmetrical as imposed by humans to the detriment of the environment (Paragua, et al., 2022), (Mizerit & Red, 2021), therefore, the end of the study was to verify that there was a high and positive relationship between the ecosystem services that constituted the sources of pollution and the quality of life of the inhabitants of the Higueras river basin, finding a high correlation between the variables under study, which implied a degree of dependence on average of 85.73%; That is, the indicated average percentage of variability in the quality of life of the inhabitants was explained by the variable sources of contamination. (Bustamante & Paragua, 2022).

The disarticulation of human beings with the environment is producing the challenge of confronting their extinction and that of the rest of the living organisms that share the planet, due to the excessive burden of ecosystem and environmental services. (ECLAC, 2003), (Perez, 2015), therefore, it is important the relations of the population with its environment in the basin of the Higueras River, however, the insufficiency in education, health, economic, and others, cause the imbalance between the demand for subsistence and ecosystem services, creating the need to raise awareness about the population vision before the impacts it maintains against nature (Perez & Welsh, 2021), (Cardinals, 2013), it is urgent to understand and analyze the relationship of the population with its environment and from there identify the existing ecosystem services in the Higueras river basin and analyze the impacts generated towards the basin from the management that opted for ecosystem services (Sunyer, 2010).

It has been noted the overload on high mountain forest resources by the implementation of farmland, housing and livestock turning moderate slope land into sliding that impoverishes the land, then, require adequate management of soil, water and air to promote a sustainable and sustainable development of the aforementioned resources and improve the quality of life (Müller et al., 2014). Arable land is a non-renewable natural resource, its global degradation is a threat to the supply capacity of ecosystem resources, putting sustainable agriculture, food security and the supply of ecosystem services in a critical situation and therefore the deterioration of quality of life 2022 (Bolivar, 2011).

The general purpose was to verify that there is a positive relationship between the sources of pollution and the quality of life of the inhabitants of the basin under study; in that sense, the condition was to reject the null hypothesis and(Ho) si r≥r_0,05 r_0,05=0,1645, the value of , in addition, e l value , allowed to make the test: , which fulfills the condition, then, sr=0,9259r≥r_0,05→0,9259≥0,1645e rejects Ho since0,9259≥0,1645, and concludes by saying that the determination of pollution sources has high explanatory power on the quality of life in the inhabitants of the Higueras River Basin, Huánuco 2022 because it establishes a degree of dependence of 85.73%.

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