

# Governance issues around agricultural land use and water demand for irrigation in the Vinces river basin (Ecuador)

## Problemas de gobernanza en torno al uso agrícola del suelo y la demanda de agua para riego en la cuenca del río Vinces (Ecuador)

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### ABSTRACT

*The Vinces river basin has a high agricultural aptitude, this has allowed the intensive development of agricultural crops that provide a significant amount of foreign exchange for the country at the cost of strong pressure on the water resource for irrigation and that have displaced important native vegetation. In this context, it is necessary to exercise governance in such a way as to guarantee the management and territorial development of the basin. The objective of this work is to identify the governance problems related to the agricultural use of the land and the demand for water for irrigation of crops in the Vinces river basin. The present investigation entailed the analysis of the current situation of the general administration of the water basins in Ecuador and especially of this important basin in the center of the country, the analysis of the conceptual frameworks of governance and the compilation of digital geoinformation with its subsequent processing in Geographic Information Systems, the tabulation of official statistical information and field verification of the management of agricultural crops. The main agricultural coverage of the basin under study expressed by the agricultural crops of banana, cocoa and oil palm exert great pressure for the space and water of the basin for irrigation in the long period of summer drought. The figures collected from the historical water concessions for irrigation of the basin by the environmental authority do not reflect the true volume used by the agricultural sector*

**Keywords:** Basin, Hydrographic Demarcation, Agricultural Crops, Governance, GIS.

### RESUMEN

La cuenca del río Vinces presenta una alta aptitud agrícola, esto ha permitido el desarrollo intensivo cultivos agrícolas que aportan una cantidad importante de divisas para el país a costo de una fuerte presión sobre el recurso hídrico para su riego y que han desplazado importante vegetación nativa. En este contexto es necesario ejercer una gobernanza de forma tal que garantice el manejo y desarrollo territorial de la cuenca. El presente trabajo tiene por objetivo identificar los problemas de gobernanza relacionados con el uso agrícola del suelo y la demanda de agua para riego de los cultivos en la cuenca del río Vinces. La presente investigación conllevó el análisis de la situación actual de la administración general de las cuencas hídricas en Ecuador y de manera especial de esta importante cuenca del centro del país, el análisis de los marcos conceptuales de gobernanza y la recopilación de geoinformación digital con su posterior procesamiento en Sistemas de Información Geográfica, la tabulación de información estadística oficial y verificación en terreno del manejo de los cultivos agrícolas. Las coberturas agrícolas principales de la cuenca en estudio expresadas por los cultivos agrícolas de banano, cacao y palma aceitera ejercen gran presión por el espacio y el agua de la cuenca para el riego en el largo periodo de estiaje de verano. Las cifras que recoge las concesiones históricas de agua para riego de la cuenca por parte de la autoridad ambiental no reflejan el verdadero volumen empleado por el sector agrícola.

**Palabras clave:** Cuenca, Demarcación Hidrográfica, Cultivos Agrícolas, Gobernanza, SIG.

**INTRODUCTION**

In a first approximation, governance is a way of governing, that is, a process that favors state-society interactions. As is known, the state space is not its only field of application or meaning. In general, the notion of governance designates the set of institutional procedures, power relations and modes of management, public or private, formal and informal, that regulate the action of political bodies (Mazurek et al., 2009).

Governance is defined as the process of interaction between strategic actors, with a more sociological and political key due to the play of institutions and organizations, according to (Leca, 1996: 339), it is "the interaction of a plurality of governing actors who are not all state or even public", being the criteria of good governance transparency, participation and accountability, thus opening the possibility of carrying out transactions in an environment where collective rules are elaborated, decided, legitimized, implemented and controlled by these actors.

According to Albo and Falconi (2009), it is the intermediate level of decentralization that allows a better systemic and intersectoral vision of public management at the territorial level. For this, they define four axes of actions: i) the coordination and articulation of the demand at an integrated territorial level such as the hydrographic basin; ii) administration of public resources to achieve territorial economic development; iii) the articulation of power between actors in the territory; iv) the construction of a shared territorial vision. The construction of a territorial social pact, spaces for agreement and dialogue are essential conditions for the generation of governability. The ultimate goal lies in promoting territorial competitiveness and sustainable human development. This brief introduction allows to establish an analysis grid that helps a deeper understanding of water problems. Similar to the proposal by the Integrated Management of Water Resources assuming its postulates but emphasizing the multiple actors and agents involved.

In Ecuador, the existence of self-sufficient public organizations is evident, with a low degree of coordination of actions among themselves and no coordination with private actors and civil society. Municipalities, universities, unions, the provincial council, private companies, ministerial directorates, act without seeking coordination with other actors, which generates inefficiency and duplication

of efforts. Hence, strengthening the intermediate level of government is key, so that development policies and projects do not remain isolated initiatives and/or documents that are not executed.

In the definition of intermediate government, the territorial vision is highly relevant. This concept is what contributes to the systemic and intersectoral vision of public management at the territorial level. In this sense, the territory is defined as the space of human fulfillment, of social construction; with cultural, political, social and economic ties, which is not limited to the political division of the State. In this definition, it should be noted that the construction of territories is not restricted to the provincial or local administrative sphere, but that actors can be articulated to intervene and manage a space based on hydrographic basins, commonwealths, ecological regions (paramos, mangroves, etc.), cultural and political affinities.

Through Executive Decree No. 90, it is established that the integrated management of water resources will be exercised in a decentralized manner by hydrographic demarcations, basins or sub-basins, through the water resources management agencies by hydrographic basin and their respective authority, which will be established by the National Secretary of Water and its functions, attributions and competences will be established in the functional organic regulation of the entity (SENAGUA, 2010).

The objective of this work is to identify the governance problems related to the agricultural use of the land and the demand for water for irrigation of crops in the Vices river basin.

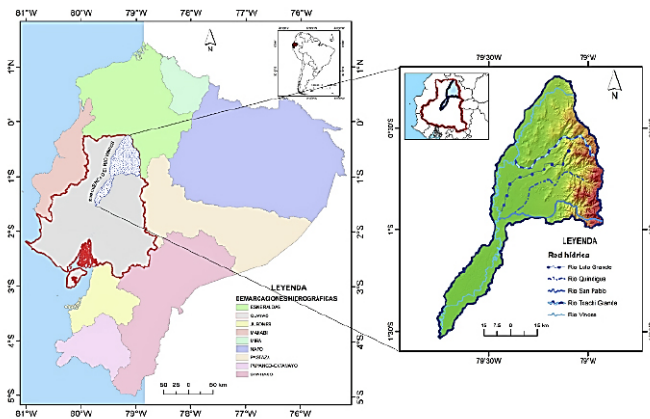
**MATERIALS AND METHODS**

Study area

Through Agreement No. 2010-66, the National Secretary for Water establishes and delimits nine hydrographic demarcations, within which is the Guayas Hydrographic Demarcation (Figure 1a) whose limits are: a) NORTH: Latitude 0°14'48.29" S; Longitude 79°22'37.55" W; b) SOUTH: Latitude 2°51'7.52" S; Longitude 79°18'11.51" W; c) EAST: Latitude 2°6'35.75" S; Longitude 78°37'20.26" W; and, d) WEST: Latitude 2°11'6.87" S; Longitude 81° 0'31.57" W. The Guayas Demarcation will have the Quevedo Zonal Center that will be in charge of: the lower, middle and upper basin of the Juján River , lower, middle and upper

basin of the Vinces river (Figure 1b), upper basin of the Bahahoyo river, basin of the Quevedo river, basins of the Los Amarillos, La Soledad, San Antonio, San Pablo, Lulú, Toachi Grande, Baba, Las Juntas, Catarama, Simbe, Lechugal, Umbe and the Ñauza, Convento, Chilintomo Grande and Las Saibas estuaries.

**Figure 1. a) Guayas Hydrographic Demarcation and b) Vinces river basin.**



The Vinces river basin is located from the center to the north-east of the Guayas hydrographic demarcation, with an area of 426,800 hectares, covering 267.96 km of distance in its main water axis, running north-south (Figure 1b). The Baba, Lulo and San Pablo rivers flow towards it. Administratively, the basin includes the provinces of Santo Domingo de los Tsáchilas, Cotopaxi and Los Ríos, it has an eminently agricultural land use with the presence of tropical and subtropical export crops such as abacá, rice, bananas, coffee, cocoa, corn, oil palm among others.

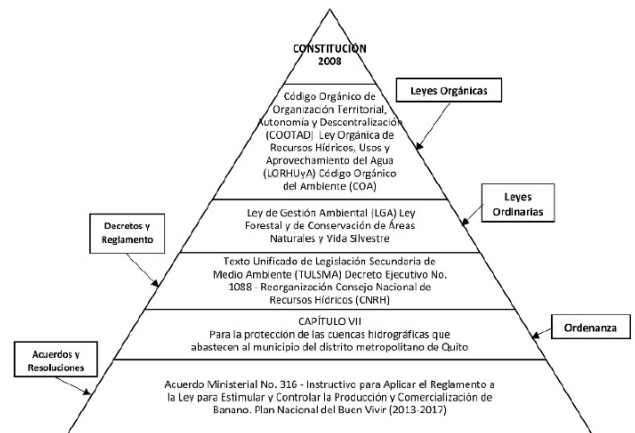
The analysis of the problem of governance of the use of agricultural land in the basin will be addressed by analyzing the map of actors and the current regulations related to the management of watersheds in Ecuador, then the conceptual framework of governance that must be applied will be defined. to the management of the Vinces river basin. The current use of the soil in the study area will be carried out based on the MAGAP project (2014), estimating the demand for water for irrigation by the main agricultural crops in the basin based on the analysis of the concessions granted to the users of the basin by the Secretariat of Water (SENAGUA) in recent decades. Data were also taken from the Regional Hydraulic Plan of the Guayas Hy-

drographic Demarcation (CISPDR, 2016) corresponding to the water supply and demand for irrigation of agricultural crops in the basin under study, data that will be analyzed together with the surface of the main crops. of the Vinces river basin (MAGAP, 2014) considering the irrigation requirements per ha/year, especially in the summer season, which required extensive verification in the field.

**RESULTS**

The regulations for watershed management in Ecuador applied the Kelsen scheme (Reyes, 2013). This scheme is based on the hierarchy of legal norms as established by the 2018 Constitution, followed by the different legal bodies applicable to the issue of watershed management in Ecuador (Figure 2).

**Figure 2. Kelsen's pyramid of the applicable legal framework in Ecuador.**



Within the legal regulations in force in Ecuador, the one that stands out for its relationship with the agricultural use of the Vinces river basin is the Ministerial Agreement No. 316 of April 16, 2004, which includes the Codification of the Law to Stimulate and Control the Production and Marketing of Banana, Plantain (Barraganete) and other related musaceae intended for export, in this regard Chapter V in its General Provisions in Article 25 states:

It is prohibited to carry out new plantings of bananas. Its transgression will give rise to the application of the sanction contemplated in the Reformatory Law to the Law to Stimulate and Control the Production and Commercialization of Bananas, Plantains (barraganete) and other related

mushrooms destined for export. The sanction will be one hundred and fifty (150) minimum general living wages per hectare, as provided by the law issued on July 24, 1997 and published in Official Gazette No. 124 of August 6, 1997. Reference is made to the fact that banana plantations classified as organic, planted until the date of issuance of these regulations, will be registered with the area planted to date and will not be the subject of any sanction.

The Municipal GAD (Decentralized Autonomous Government) of the canton of Valencia, whose jurisdiction is entirely within the Vinces river basin, stands out from the rest of the cantonal GADs of the basin for having in force the reform of the ordinance that declares the protection and management of hydrographic basins and micro-basins of the Valencia canton so that in the rural sector a protection

zone or protection strip is declared and no type of construction is allowed according to the following category: Rivers 30 meters; Flow estuaries in winter and summer 15 meters; Flow estuaries only in winter 10 meters; Medium flow estuary 9 meters; Estuary of little flow 6 meters; Rising stream (stream) 3 meters; Ravines 10 meters; Large sink slope 50 meters in diameter around; Small sink slopes (water hole) 25 meters in diameter around; Lagoons and lakes 10 meters from its shore.

The Ordinance mentions that the aforementioned protection margins must be planted by native species, for which a tax exemption will be applied from the property taxes of those protected areas but if, on the contrary, those strips are occupied with banana or African palm crops, the surcharge will be 300% on property taxes.

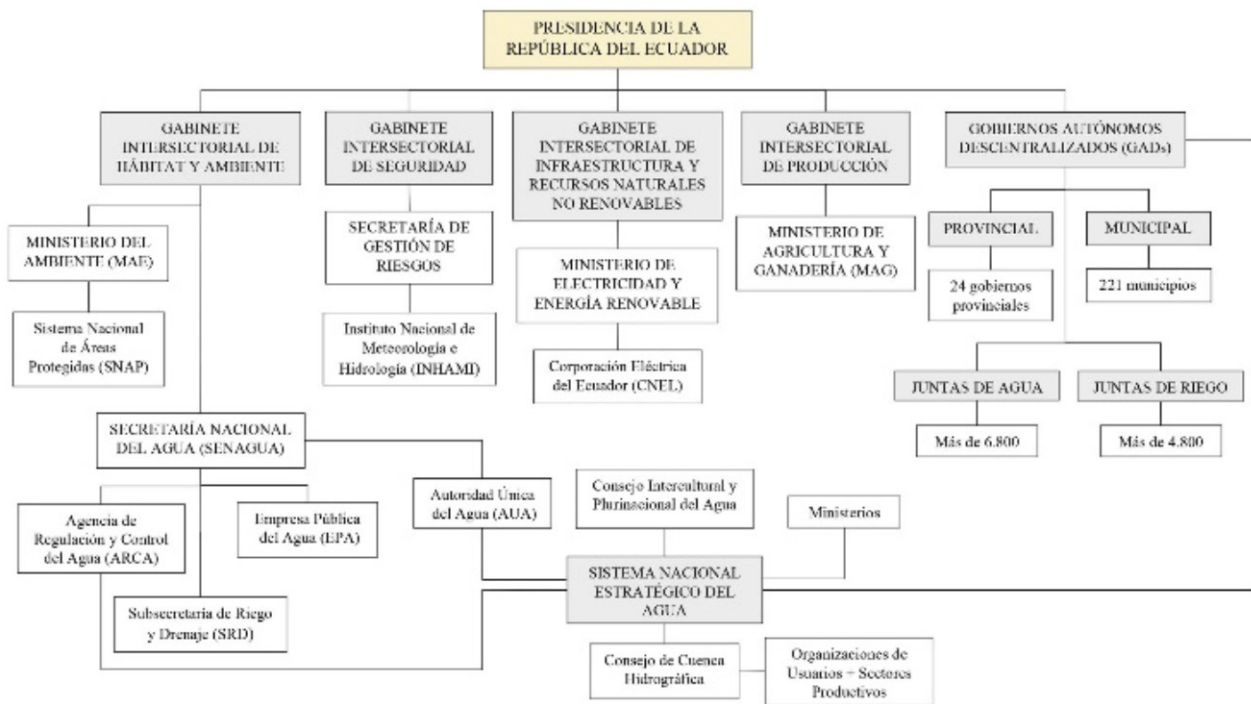


Figura 3. Mapa de actores políticos actuales en la administración de las cuencas hidrográficas en Ecuador.

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According to the PPRD (2016) the legal frameworks ratify the Secretary of Water, as the sole authority of the country's Water Resources, through its EPA and ARCA agencies, while the Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), through the Undersecretary of Irrigation and Drainage (SRD), is designated as responsible at the national level for the use of Water Resources in Irrigation and Drainage, oriented to parcel irrigation at the national level, productive promotion and food sovereignty, in the same way The MAE assumes the responsibility of directing environmental regulations, and in emergencies, the General Secretary of Risks will assume leadership.

In the current scheme of political actors linked to the management of hydrographic basins from the point of view of the use of water resources in the Vinces river basin, institutions such as the MAE, MAGAP, the provincial GADs and the cantonal GADs have direct influence. However, regarding the management of agricultural land use in the Vinces river basin (Figure 5, Table 1), there is currently no institution that is fully in charge of this aspect.

For the lack of governance in the management of agricultural land use in the Vinces river basin, we will start from the concept of governance with a territorial ordering framework. According to Mazurek (2009), decentralization opens the doors to the concept of territory and land use planning, posing new challenges. Firstly, to have a territorial vision, secondly, to have governance and governance instruments for the territory, and thirdly, to implement a territorial development strategy.

According to Abdo - Falconi (2019), the reform of the State must include the institutionalization and strengthening of the role of the intermediate level of government, necessary to advance the development of the country from the territories, promoting the construction of a new model of provincial decentralized public management. , territorial

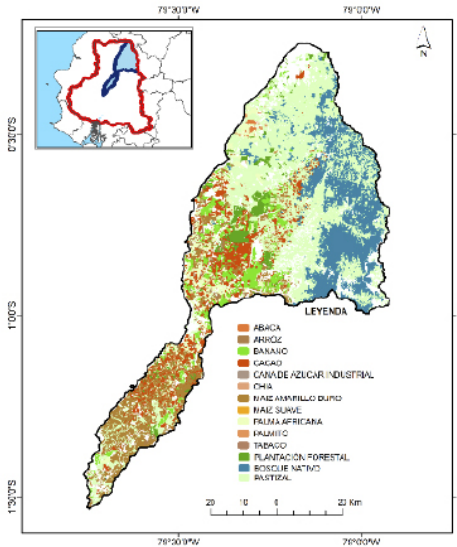
and national because modern democracy not only requires effective and active decentralization, but also efficient management and accountability to society.

In Ecuador, at least 18 of the 22 provincial GAD Provincial Autonomous Governments have provincial development plans at different levels, most of which have not been implemented, and it is necessary for their execution to strengthen the institutional capacities of the territories and decisively promote decentralization and state reform.

In order for the Provincial Autonomous Government of Los Ríos, GPDLR, to be able to apply efficient governance on agricultural land use in the Vinces river basin, it is necessary to empower this intermediate government, for this purpose CONCOPE, which is the representative political organization responsible for promoting the development of the province, through the formulation of public policies, the management of the territory, the construction of governance between actors and levels of government, the promotion of Economic Development and Sustainable Human Development, this objective image of CONCOPE in practice it is not fulfilled, therefore the solution is to promote certain strategic processes that support the approval of a new Provincial Regime Law; progressively assume new roles and competencies through the decentralization process; institutional strengthening; and, advance in the challenge of a new State structure, based on a decentralized public management model.

The GPDLR, in its capacity as intermediate government, must comply with four lines of action: The first includes the management of hydrographic basins and micro-basins, where its function is to order and articulate an adequate use and preservation of water resources; additionally, the management of natural resources and provincial information systems. The second axis is to manage public resources and provide quality services, for which it must manage revenues transparently and provide quick and timely solutions to complaints about the administration and operation of cantonal councils. The third axis is the articulation of power, one of the most relevant; For this, it will be necessary to gradually transfer the provision of services to the closest level of management, and that the provincial governments focus on the horizontal and vertical articulation of actors, between different levels of government and between actors in the territory. . The fourth axis is related to the direction of development and the construction of governability from the territories, through employment

generation and redistribution policies; the implementation of provincial participatory planning systems and the consensual construction of provincial agendas.



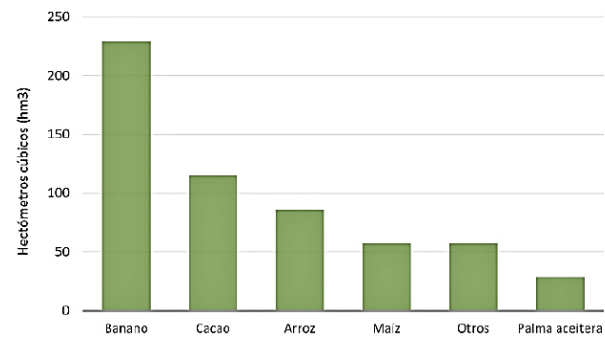
**Figura 4.** Uso agrícola de la cuenca del río Vinces (MAGAP, 2014).

CULTIVO	SUPERFICIE (HA)	%
MAIZ SUAVE	0.180	0.0001
PALMITO	22.020	0.0173
CANA DE AZÚCAR INDUSTRIAL	27.820	0.0218
CHIA	58.130	0.0456
ABACA	87.860	0.0690
MAIZ AMARILLO DURO	159.580	0.1253
CACAO	242.400	0.1903
ABACA	507.810	0.3988
BANANO	681.980	0.5355
PALMITO	740.590	0.5816
CACAO	753.800	0.5919
PALMA AFRICANA	1034.500	0.8124
TABACO	1368.510	1.0746
BANANO	2280.880	1.7911
MAIZ AMARILLO DURO	2366.380	1.8582
ARROZ	3444.170	2.7046
PALMA AFRICANA	4537.450	3.5631
PALMA AFRICANA	14971.510	11.7566
BANANO	20969.230	16.4664
CACAO	35132.820	27.5885
MAIZ AMARILLO DURO	37958.080	29.8071
TOTAL	127.345,700	100.0000

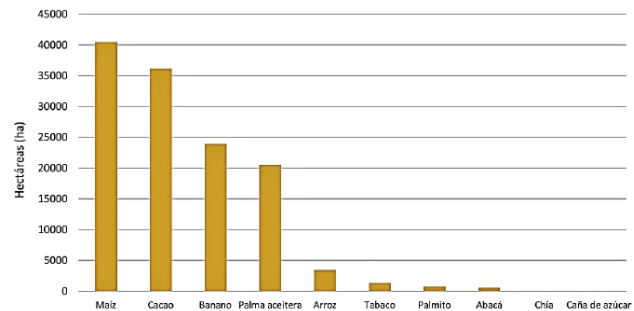
**Tabla 1:** Superficie por cultivos agrícolas de la cuenca del río Vinces

**Demanda de agua para riego**

El volumen de agua para riego de cultivos agrícolas, para la cuenca del río Vinces corresponde a 573,06 hm<sup>3</sup> según CISPDR (2016) (Fig. 5). Este volumen fue distribuido de acuerdo a los cultivos agrícolas existentes en la cuenca del río Vinces (Fig. 6).

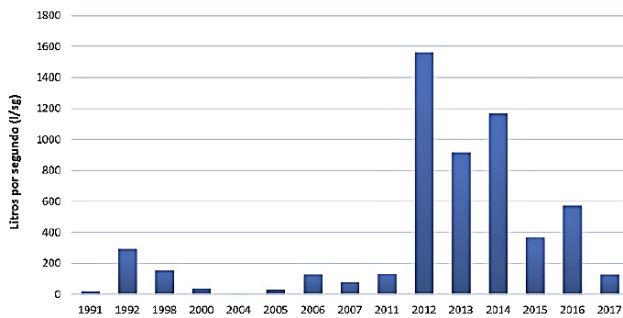


**Figura 5.** Distribución de 573,06 Hm<sup>3</sup> agua para riego de cultivos agrícolas en cuenca del río Vinces



**Figura 6.** Distribución de cultivos agrícolas en 127.345,70 ha en cuenca del río Vinces (MAGAP, 2014).

La Secretaría Nacional el Agua (SENAGUA) ha otorgado concesiones de agua para riego en el período comprendido entre los años 1980 – 2018 para la cuenca del río Vinces de acuerdo a lo indicado en la figura 7.



**Figura 7. Concesiones de agua (l/seg) para riego de cultivos agrícolas en cuenca del río Vinces, período 1980 - 2018.**

En la figura 7, se observa una importante variación interanual de las concesiones de agua por parte de la Secretaría Nacional del Agua debido a que en el período comprendido entre los años 1991 y 2011 no hubo mayor control para los usuarios agrícolas por la dificultad que le significaba esta labor a los órganos de control de carácter centralizado, propiciándose que de manera clandestina se abusara del recurso hídrico para el riego agrícola. A partir del 2008, luego que por decreto ejecutivo 1088 se creó la Secretaría Nacional del Agua (SENAGUA), esta situación cambió gracias a la puesta en funcionamiento de las oficinas descentralizadas de atención a la ciudadanía, como es el caso de la oficina de atención al cliente de Quevedo, la misma que inició con un proceso de emisión y control de concesiones de agua para riego de manera equitativa en la cuenca del río Vinces de acuerdo a la extensión de superficie de terrenos de los productores agrícolas (SENAGUA, 2011).

**DISCUSSION**

Territorial governance demands the creation of a decentralized planning system, where national planning functions fall to the central government, provincial planning functions to the intermediate level, and cantonal planning to the municipalities; establishing feedback and articulation mechanisms between the different levels. The intermediate or provincial governments must assume the administration and territorial management of their redoubt, applying successful territorial initiatives and leading participatory planning processes. In this context, INCLAM

(2012) points out that in the Chira-Piura basin, in accordance with the provisions of the Organic Law of Municipalities (LOM, Law No. 27972), local governments play very important roles in the management of water resources. , as a consequence of its powers in terms of organization of physical space and land use (article 70 of the LOM) and in matters of sanitation, sanitation and health (article 80 of the LOM).

Ingo Gentes (2008) mentions that water management systems arise from a basic need for distribution and conservation of water resources among the different actors, therefore integrated water management requires a stable political-institutional system that articulates the different hierarchical levels of administration, in this part the local level is fundamental for the process of control and monitoring since there are systems of communication and social control at the local level, decisive for an integrated management of water resources despite the fact that the technical information and hydrological comes mainly from national instances (on land use, effective distribution of use rights among the actors, etc.).

The customer service center of the Secretary of Water, SENAGUA for the Vinces river basin, according to its statistics, states that water concessions are currently granted according to the extension of the crops, being 1.2 l/sg for the banana cultivation, 0.8 l/sg for oil palm and 0.6 l/sg for cocoa, unfortunately not all banana producers have water meters and it should also be noted that the irrigation rate on banana producing farms is quite low reaching USD 250 per 100 ha of cultivation, which prevents generating resources to improve controls in agricultural irrigation activity, to this Gaybor, (2008) indicates that for example the San Carlos sugar mill dedicated to the production of cane sugar for the 8,250 l/s that it has in concessions in 2007 paid the derisory sum of approximately USD 15,000 per year, REYBANPAC, producer of bananas for 4,740 l/s, paid approximately USD 8,700 while the peasants of he Daulle-Peripa system that grows rice for national consumption in several cantons of the province of Guayas pays USD 120/ha annually, that is, an amount 65 times higher than what San Carlos and REYBANPAC pay, or must pay, for each hectare .

Banana producers in Ecuador are unaware of the volumes of water they use through sprinkler irrigation since it is

always irrigated until the soil is saturated (Erika Zarate & Derk Kuiper, 2013) despite the fact that the ideal would be 27,500 m<sup>3</sup> of water for irrigation per ha/year. Ecuadorian producers point out that in the basins where bananas are produced, the decrease in water availability in the dry season is evident, causing changes in the hydrology of the rivers due to factors such as deforestation and inappropriate land use. (Erika Zarate & Derk Kuiper, 2013) state that the situation in Peru is not different since one annual hectare of banana in production requires 28,500 m<sup>3</sup> of water for irrigation and in light of minimum rainfall there is a scenario of increased water stress for years to come, since minimum environmental flows are currently not respected.

## CONCLUSIONS

At present, the legal frameworks in force in Ecuador ratify the National Secretary of Water as the sole authority of the country's Water Resources, while the Provincial Decentralized Autonomous Governments, GADP receive the social mandate of the powers in planning, construction, operation, maintenance and rehabilitation of irrigation and drainage systems, at the provincial level without having any competence over the management of land use in the basins, as is the case of the Vinces River basin.

The application of irrigation water is an imperative need to obtain high and stable production yields in banana, cocoa and oil palm crops in the Vinces river basin. In these territories, the large agricultural monopolies use much more volume of water than is granted to them, the controls carried out by the local technical office of SENAGUA being limited, evidencing this reality a need for the management

and control of the intermediate government represented by the provincial government of The Rivers (GPDLR).

Payment rates for water concessions for irrigation per hectare in the Vinces river basin are very low, limiting the development of projects that improve the development of the basin both in terms of agricultural land use management and in terms of agricultural irrigation activity.

An attempt has been made to exemplify only one conflicting aspect of governance as part of a larger analysis scheme that is being developed and that will cover a wide range of relationships to consider in the search for balanced governance that ensures respectful governance of common resources. Including these in the context of territorial development interpreted as a dynamic and complex process, where three types of spheres of action can be identified, with different logics constituting specific fields. Different forms of governance applicable to specific development situations arise from their different forms of interaction (Bustos C. 2014).

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