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Waterscapes and Cities in the Amazonia of Peru

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This paper should be cited as follows:

Rondon, G. (2016). **"Waterscapes and Cities in the Amazonia of Peru",** Athens: ATINER'S Conference Paper Series, No: **PLA2016-1963.**

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URL Conference Papers Series: www.atiner.gr/papers.htm

ISSN: 2241-2891
07/09/2016

Waterscapes and Cities in the Amazonia of Peru

Gustavo Rondon

Abstract

Throughout history, water has always been more than a natural resource. In almost all civilizations and cultures, its meaning has been the origin of life. However, in recent decades the significance of water has been transformed due to the development of an extractive economic-production model, becoming essentially a resource to satisfy different human needs. In this context, new theoretical approaches that seek to explain the relationship between water and society appear, understanding that water management not only involves a natural resource management but also the understanding of the society that manages this resource. Concepts such as waterscapes are helping to better understand this relationship between nature and society reflected in the landscape. This article presents a first analysis of the waterscapes in the city of Lamas, in the Amazon region of Peru as a clear example of how an abundant resource can become scarce for the various uses and how this management is reflected in the territory in general and particularly in the landscape. It represents a first effort to understand the territorial impacts that water management has in an Amazonian city for the territory and for landscapes that comprise it.

Keywords: Amazonia, Lamas, Urban water cycle, Waterscapes.

Acknowledgments: The author would like to thank the “Proyecto TRANSVERSAL”, the Université Catholique de Louvain and the Pontifical Catholic University of Peru who have funded this research and his presence in the "6th Annual International Conference on Urban Studies & Planning".

Introduction

Nowhere in the world water is only considered a natural resource, all the cultures around the world have always assigned it transcendental values (Cabrera, 2014). In Western cultures as Eastern, Andean and Amazonian, water has been more than an element of the territory; it has often been seen as divinity, source of life and origin of civilizations. Therefore, it is a divinity that is present in lakes, lagoons, sea, rivers and all water sources (Collazos, 2003). However, at present, both water use in particular, and the use of natural resources in general, invited to reflect on the loss of this ancestral respect and care. This loss of the value of water is generating that an abundant resource becomes scarce by not being to manage it in a sustainable way.

The Amazonian Territorial Context

It is common to read or hear that Peru has an asymmetry in the availability of water resources (De la Torre, 2012). The 97.27% of the physical availability of water is in the Atlantic watershed (where 30% of the national population lives), 2.18% in the Pacific watershed (where 66% of the national population lives) and only 0.56% is in the Lake Titicaca watershed (where 4% of the national population lives).

However, despite the physical availability of water, the Amazon is the region where there is less access to drinking water and sanitation. For example, access to drinking water in the house on the coast presents average values of 80% of households with access to this service (ANA, 2013). By contrast, in the Amazon and the Andes regions, where the physical availability of water is above average, the percentage of households with access to drinking water is slightly above 40% (ANA, 2013). Regarding access to sanitation at a household level, the situation is similar. In the coastal area, the average is over 70% -the regions of Lima, Callao and Tacna more than 90% - of the population with access to sanitation. In the case of the Amazon, the average values of households with access to sanitation is between 30% and 60% (ANA, 2013).

Moreover, in recent years, due to the growth of the country's population, rapid urbanization and the economic development model based on the export of raw materials, water quality has deteriorated rapidly throughout the Peruvian territory and particularly in the Amazon due to the lack of wastewater treatment added to oil spills that are not uncommon (De la Torre, 2012).

Finally, added to water problems (quantity and quality), in the Amazon there is an overlap of timber concessions, mining concessions and oil concessions with areas of native communities, territorial reserves and protected natural areas. This overlay context allows the development of social conflicts closely linked to water management and land use rights.

Theoretical Approach

Even though in recent years theories as proposed by Brenner (2013) with its "urban planetary development" may become necessary to understand the new urban dynamics that manifest in the territories, we cannot deny that local realities and even regional realities are often

particular case studies. Returning to Brenner (2013), if we are effectively in an urbanization of the entire planet Earth, the Amazon is clearly located on the periphery of this urbanization. For although it is not a virgin territory, it has a low-dense occupation marked by a dichotomy between concentration in small, medium and large cities versus the dispersal of native communities and rural population centers. However, as we have seen in the Amazonian context, there are problems between the population and the management of natural resources, especially water. How to understand the urban in this particular context? It is evident that a holistic and comprehensive perspective is needed.

This article will focus on understanding the waterscapes in a micro-region of the Peruvian Amazon. It is therefore important to define what the waterscapes are. According to Cigdem (2015), water is one of the most significant components of open spaces. Water is one of the most important elements of the urban and rural landscape ecosystem, including natural and cultural landscape elements (Bulut et al., 2010). For Forman and Grodon (1986) the landscape is “a heterogeneous territory composed of a group of ecosystems that interact and similarly repeat all over it”. Varga and Vila (2005), add that current landscapes are the result of past and present interaction society-environment and of the dialectic that has been generated around the exploitation of natural resources over time. Authors working in the area of “Landscape Ecology” commonly use the definitions listed above on the landscape, however, from another branch of ecology (politics) the concept of "waterscapes" is supplemented.

Political ecology interrogates the relationship between the environment and human activities, focusing on power relations both material and discursive, which are behind the processes of socio-environmental change (Budds and Hinojosa, 2012). Swyngedouw (2004) proposes a framework within the tradition of political ecology to analyze the production of waterscapes from a conceptual link between water, capital and power, in which he states that water acts as a "lubricant” of the process of capital accumulation.

According to Larsimont and Grosso (2014), there are three ways of understanding the waterscapes: on the one hand reflect the hybrid nature that helps us understand the interactions between the physical process, material practices, cultural practices and ideological constructions on the value of water. On the other hand, waterscape is the result of the circulation interlocking water, capital and power that is reflected in the modes of control, ownership and means of managing externalities produced around the resource (shortages, floods, pollution and environmental degradation). Finally, waterscape can also be understood depending on the scale of study: at a national level it allows the reconstruction of power relations, at a regional level it can be used to study how water governance is reconfigured, one could even study the waterscapes at the neighborhood level to identify the role of water in the generation of landscapes. Therefore, to understand the waterscapes in the study area, it is necessary to understand the territory as a network and waterscapes as the product of the relationships between the physical environment, the built environment and society.

Study Area

Figure 1. *Needed Time to Get to Tarapoto-Lamas by Road from the Main Cities of Northern Peru*

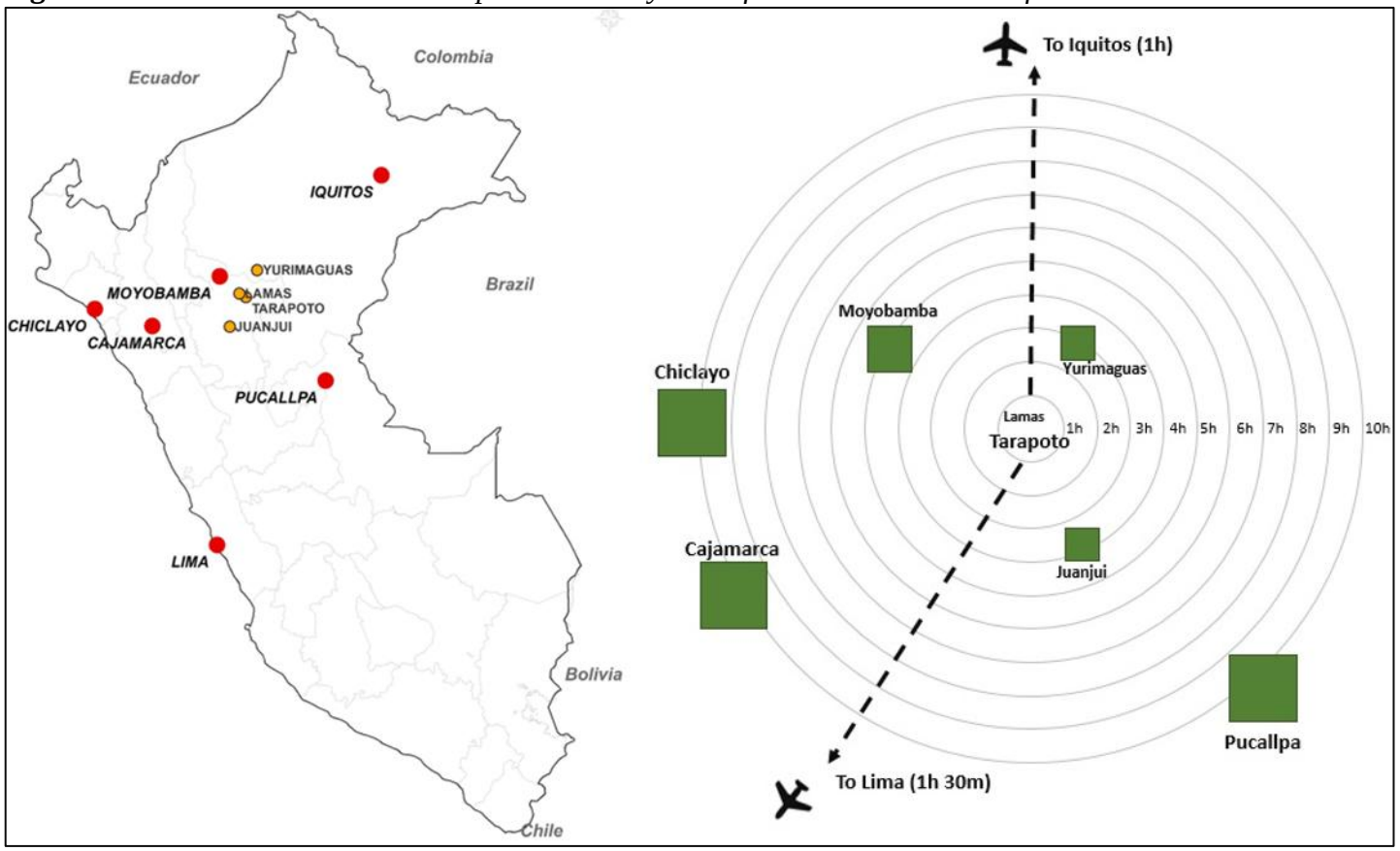


Figure 2. *Location of the Department of San Martin and the Mayo River Basin*

Research Objectives

The aim of this article is to answer the following questions: What are the waterscapes in the territory of study? What or who produce these waterscapes? For this, different waterscapes in the study area will be analyzed and an initial typology of them will be carried out.

Administratively, the city of Lamas is the capital of the province of the same name (department of San Martin), located in the northern Amazon of Peru. The city of Lamas is part of a network of smaller towns and rural population centers that are articulated by the city of Tarapoto, the economic capital of the region and is connected with Lima through air and land (see Figure 1).

Climatic and Hydrographic Features

The climate is slightly humid and semi-warm, with average temperatures of 23°C throughout the year and an average annual rainfall of 1470 mm with frequent rainfall in any season (Municipalidad Provincial de Lamas, 2012). However, although precipitation can occur in any month of the year, between the months of October to April (rainy season), the river´s flow increases rapidly due to increased rainfall; which can cause floods (INGEMMET, 2010). At a watershed level, the city of Lamas is located in the lower part of the Mayo River basin (see Figure 2). From its headwaters it takes a shape gradually widened to half its course. Downstream, the riverbed narrows to coalesce with the Huallaga River (SENAMHI, 2009). The Huallaga River, many kilometers ahead becomes one of the tributaries of the Marañón River, which is also part of the Amazonas River.

Social and Economic Features

According to the 2007 Census, the city of Lamas has 8883 inhabitants. If we consider that the total population of the district is 13173 inhabitants (where 82% is considered urban population), Lamas concentrates more than half of the district's urban population (68% approx.). This information might suggest that the territory is predominantly urban, but if we analyze the population data census at the provincial level, we note that of the total population (79,075 inhabitants), 53% is rural population.

The main characteristic of the urban area of the city of Lamas is the presence of an indigenous neighborhood called Wayku, which groups the "quechua-lamista" population. This population is constant interaction with the mestiza's areas of the city. The "quechua-lamistas" are a native group that has occupied the territory of Lamas from the pre-Inca times and are characterized mainly by keeping some customs such as clothing, holidays, traditions, etc.

Economical activities (Macedo, 2010) vary if we compare the capital (provincial or district) and smaller rural population centers. In the capitals, where State services are installed, there is a small group of people working in the public sector, an important group (25-30%) working in secondary activities related to trade and services and another group working as laborers (15%). However, we cannot ignore the fact that many of these secondary economic activities (mainly trade) are linked to an economic chain of agricultural products as the sale of crops and products supporting farming (fertilizers,

insecticides) or services of the agricultural activity (installation of irrigation systems, renting and leasing of agricultural machinery). In small population centers, farming is the main economic activity. These centers (urban or rural) base their economy on the sale of these agricultural products to major centers and part of its production is for family consumption.

The Problem in the Management of Natural Resources in Lamas

The Problems of Quantity and Quality of Water

In the city of Lamas, the rainy season instead of being a period with greater water availability is a period when there is least access to water: the infrastructure of water catchment is filled with sediments and tree branches which generates an outage for maintenance of such infrastructure or a very low quality of water reaching the houses (due to suspended sediment). Regarding the disposal of water, the problems at a micro scale reflect a national reality: once the water is used in urban areas: there is no treatment of wastewaters and these are returned directly to the environment. Although Lamas households have a drainage network, after they are collected, they are discharged directly into streams and ravines.

Changes in Land Use

Though at the Amazonia level there is an abundance of water resources, at a local level there are processes of deforestation in areas near rivers, streams and *puquios* that decrease the flow of water sources. These deforestation processes are taking place in Lamas (San Martin department) with a major impact. A study on land cover carried out in the province of Lamas indicated that the forest cover for 1989 was 320 182.16 hectares, which represented 67% of total coverage of the province; and that by 2010 the forest cover decreased to 64 918.6 ha, only 20% (Proyecto Especial Huallaga Central y Bajo Mayo, 2011). The deforestation process generates drying and disappearance of springs, reducing the flow of rivers and streams, and erosion on terrain slopes. This is because the upper parts of the basin and areas near rivers, streams and springs are deforested to maximize the availability of land.

The other change in land use occurs in the urban area of the city of Lamas. One could speak of an urban expansion and/or an urban consolidation in the city of Lamas, which has different impacts. The urban consolidation brings more order to the city because the roads structure the space better. However, this process also represents an increase in water demand for new urban population and services (hotels and restaurants), which have also increased in number.

Local Stakeholders and their Influence in the Use of Natural Resources

In the area of study there is a multiplicity of actors and uses; the differences and similarities between uses in urban and rural areas has generated various conflicts that occur in both areas, are of different magnitudes and influence differently in the territory. These conflicts have been mentioned by different authorities and users, and can be divided into conflicts over:

- The amount of water (water for irrigation or for the population? population increase, decrease of water availability, poor water supply infrastructure),
- The quality of water (agricultural pollution by pesticides or herbicides, human waste dumping into water sources without treatment) and
- The overlapping of institutions roles (expansion of coffee and cocoa crops policy vs. forest conservation policy).

Methodology

Since waterscapes are a relatively new concept there is no defined methodology which can be consulted or replicated. This methodology is based on the sciences of Geography and Ecology oriented to the discipline of urbanism. Methodological techniques are a combination of quantitative and qualitative methods between fieldwork and deskwork.

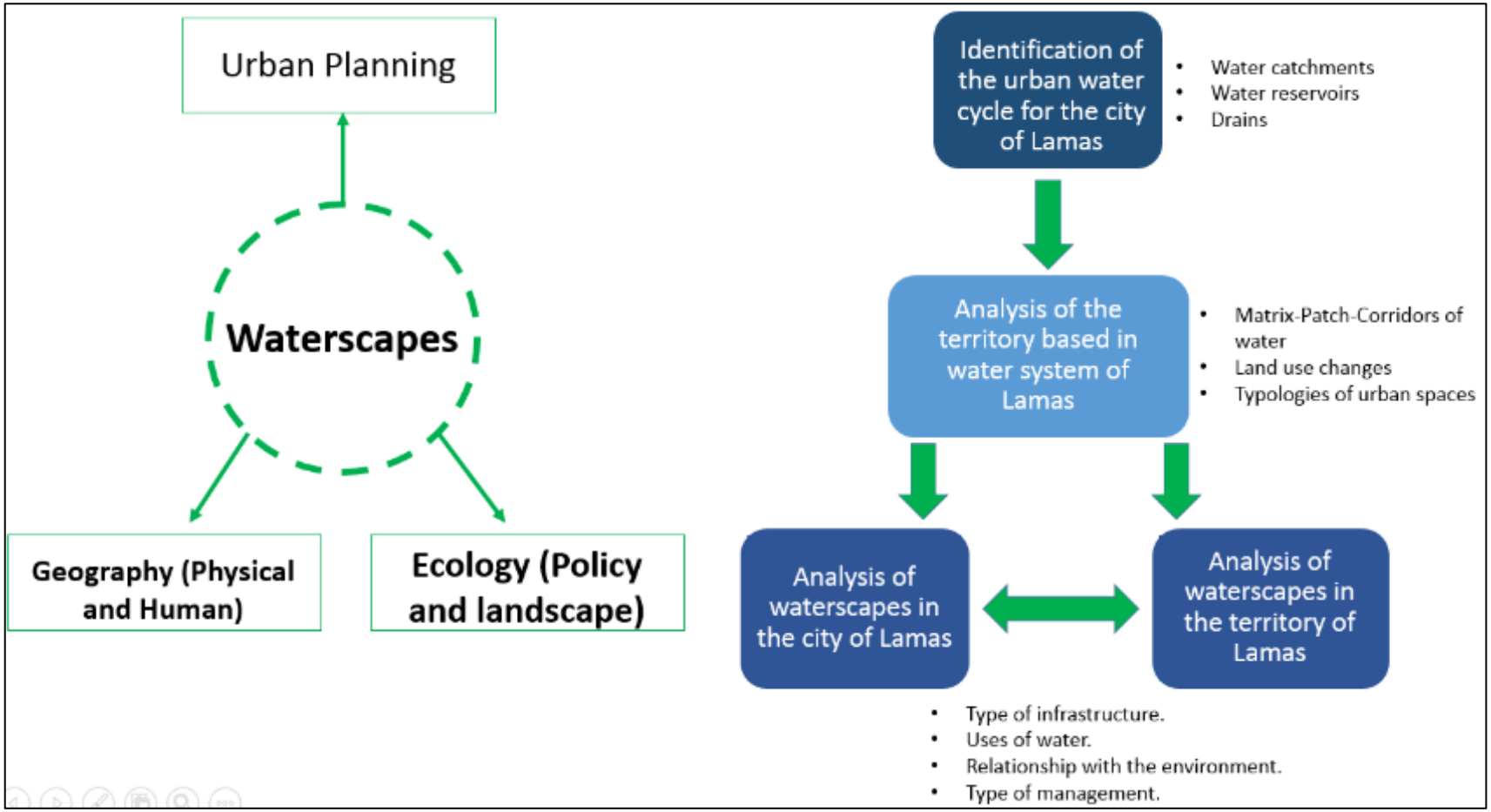
The first stage consisted in the field information collection held during the month of August 2015. In this fieldwork, GPS points (Garmin eTrex GPS) of the entire water network infrastructure for the city of Lamas were taken: water catchments, reservoirs and drains. This implied long walks of approximately 3-4 hours from the city of Lamas towards the water catchments, accompanied by an official designated by the authorities. This walks also allowed us to collect information through small conversations with farmers and residents of those areas. In addition, interviews were conducted in the city of Lamas with municipal authorities in charge of water management to contrast perceptions about how well the water system in Lamas is functioning.

The second stage was a kind of "landscape classification" based on abiotic factors since they are durable and relatively constant at human life scales (Bunce et al., 1996). By using the basic principles of Landscape Ecology, the attention is focused on three characteristics: the structure, function and change (Forman and Grodon, 1986) oriented to the water system. To analyze these characteristics, three kinds of elements are identified in the landscape mosaic: fragments, corridors and the matrix (Varga et al., 2006). The landscape classification was performed using Landsat satellite images from 2006 and 2014, plus a PLEIADES 2014 satellite image to have more detail in the city of Lamas. In addition, this landscape classification allowed us to identify changes in land use in areas adjacent to water catchments. Finally, a typology of urban and rural areas of the study area was also defined.

The last stage was the analysis of waterscapes. For this analysis, six photographs taken during the fieldwork were selected, which allowed an

analysis of double entry: first images were visually analyzed and then the analysis was complemented with all the information collected in the small conversations and interviews with the actors. The analysis was performed on two scales: a territorial to analyze water catchments and drains, and an urban one to analyze the role of water within the city.

Figure 3. *Methodological Framework*



Results

Figure 4. *Water Catchments, Reservoirs and Drains in Lamas*

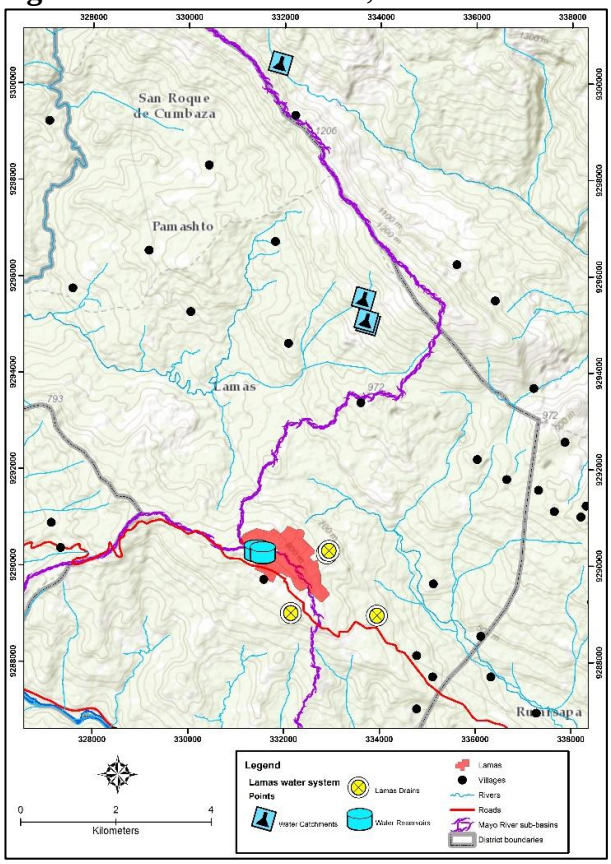


Figure 4 shows the main elements of the drinking water supply system of Lamas. The main water catchments are located in two streams (Chontal and Juanjuicillo), the two reservoirs, where water purification is performed, are located in the upper part of the city and there are four channels that after having collected all the drainage systems of the houses dumped directly into the environment without treatment. This system involves three sub-basins of the Mayo River basin and in an administrative level two districts. The Provincial Municipality is responsible for the management of potable water and sanitation through a local company called EMAPA Lamas[1].

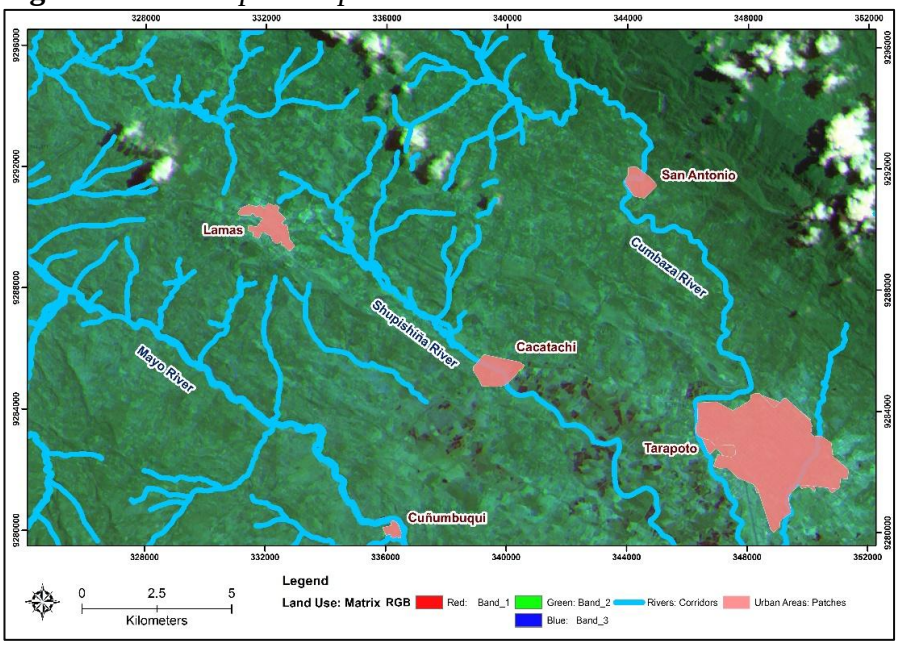
Figure 5 shows the first results regarding the landscape classification based on the water system of Lamas. The criteria to define the area of analysis was based on the mapping system water in Figure 4. All the main rivers involved in the water supply for the city of Lamas and the urban centers that are affected by this network were analyzed whether they were downstream of water catchments or of the drain's channels.

The landscape matrix (see Table 1) is the Amazon forest, which is the predominant land cover. This forest can be primary or secondary and

[1] Municipal Enterprise of Drinking Water and Sewerage.

represents 65% of the landscape. However, as we saw in the problematic, in recent years this forest cover has been replaced by crops (coffee, cocoa and rice are the most important), which currently represent 20% of the landscape matrix.

Figure 5. *Landscape Composition and Elements*



Regarding the corridors, although there are several waterways between rivers and streams representing 5% of the landscape, three are directly affected by water catchments and channel drains of the city of Lamas. The Mayo River is the main river of the landscape for being the largest one. However, it is only navigable for small boats and for tourist companies to perform water sports such as canoeing or kayaking. This river receives the waters of the other waterways that structure the landscape of the water territories: the rivers Cumbaza and Shupishiña. The Cumbaza River is very important for water consumption for the city of Tarapoto and the towns located in the lower part of its course. The Shupishiña stream is a special case: receives wastewater from a chicken farm located in Lamas and from some channel drains of the city, but as well supplies downstream a number of population centers and rice crops in the area of Cacatachi.

Finally, regarding the landscape patches, there are of all sizes and therefore with their own urban dynamics. The city of Tarapoto is the economic capital of the region and therefore the larger patch and the one demanding more water. Then there is the city of Lamas, the axis of this analysis, which has an intermediate size within the patches located in this territorial system and has the conditioning of the terrain to expand. Finally, a third group of patches are the villages of Cuñumbuqui, San Antonio and Cacatachi, which are located on the riverbanks of the three major water corridors of the landscape analyzed.

Table 1. *Analysis of Landscape Elements*

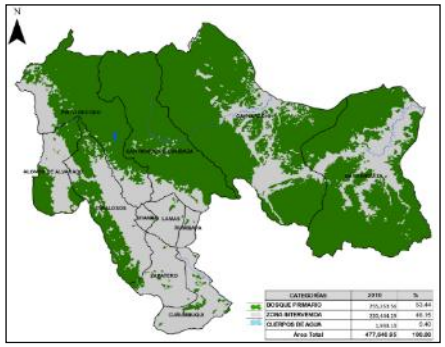
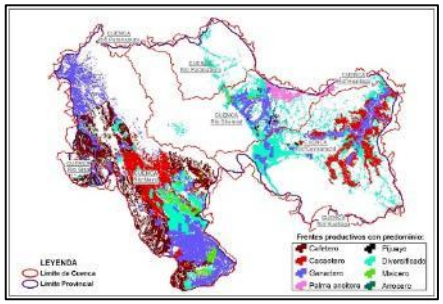
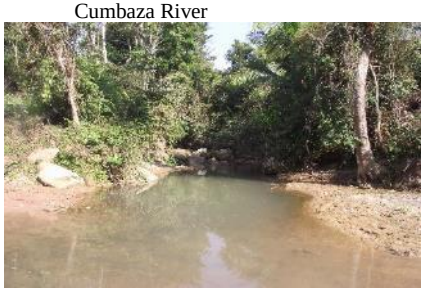
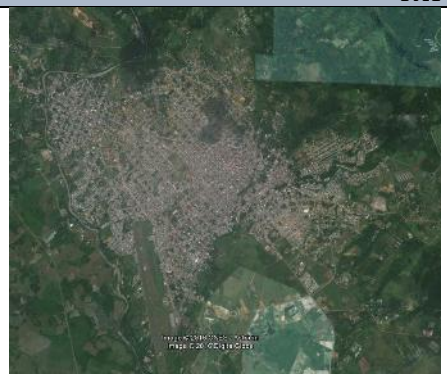
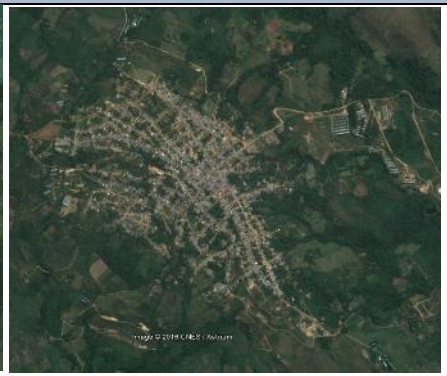
MATRIX	CORRIDORS	PATCHES
Forest Cover 2010  Productive Fronts 2010  *Source: ZEE of Lamas.	 Mayo River  Cumbaza River  Shupishiña River	 Tarapoto City  Lamas City    Cacatachi Village San Antonio Village Cuñumbuqui Village

Table 2. *Analysis of Waterscapes in Lamas*

	**Chontal water catchment:** Main water catchment of Lamas city. Located in the stream of the same name, it has an infrastructure of cement and iron installed by EMAPA Lamas. The maintenance of this water catchment is in charge of the Provincial Municipality of Lamas. Although it is true that the water catchment is for the drinking water system for the city of Lamas, the stream also serves to supply different populations downstream, such as San Antonio or Tarapoto. In terms of land use, the Municipality of Lamas rented the surrounding areas to avoid deforestation.
	**Water reservoir 1:** Located in the highest part of the city. In this reservoir, water becomes drinkable. Stands out for its proximity to the tourist area known as "*El Mirador*" and its decor. This makes it an "attraction" of the city of Lamas (It has painted the meeting of the Spanish culture with the indigenous culture).
	**Barranco drainage channel:** This drainage channel is the only that pours the drains of the Lamas city towards the main channel of the Mayo River. It is located on the outskirts of the city, in an area, which is currently surrounded by farmland. Although the level of discharges does not pollute the water at present, the exposure of towns like Cuñumbuqui, located on the riverbanks of the Mayo River, could be affected in the future if the discharge of this channel increases.
	**Natural Springs of Wayku neighborhood:** Water also generates public spaces. In the indigenous Wayku neighborhood in the city of Lamas, there are five natural springs for public use where people wash their clothes, bathe or just sit and talk. Although the neighborhood has water connections in most homes, these springs are widely used. The associated infrastructure is very varied: some are completely natural, others have concrete cover. The common thread: they generate territoriality within the city.

	
	**Ruptured of drinking water pipe on the periphery of Lamas:** During a fieldwork (2014) a broken water pipe was found, which remained like that about 8 hours before EMAPA Lamas could begin to solve the problem.
	**Swimming pool of Sachamama Lodge:** The management of this lodge is done privately and allows to have a swimming pool that does not use any chemicals for cleaning, it is done through a process of phytopurification.

Conclusions

This first analysis of waterscapes (see Table 2) in the town of Lamas reveals some specific conclusions. It is clear that the urban water cycle, comprising four infrastructures (catchment reservoirs, distribution and return of wastewater) transcends urban areas. If we consider that the city of Lamas is in a highly sensitive environment for its biodiversity environmental, the impacts are greater.

Water catchments for the city of Lamas carry the water to the city from two streams that belong to two different sub-basins and are generating conflicts due to the need for water of the populations located downstream of these two catchments. Meanwhile, drains city also contaminate two other streams, which are then used as a source of water catchment for other villages or farmlands. Moreover, land use is changing from forest to some crops (coffee or cacao). This causes that the soil loses its ability to retain moisture; this impact is even greater when the change occurs in areas near natural springs and rivers.

Finally, it is clear that analyzing waterscapes with a holistic perspective that seeks to understand the power relations over the control of water is very important. It can be stated that the water system for the city of Lamas is dominant over smaller populations that are affected by the reduction in water

quantity or quality. Moreover, while it is true that there is a public administration in charge of water management, the springs in the neighborhood of Wayku are an example of that parallel to this public administration there is a communal management that creates public spaces around the water, being a producer of spaces within the city. The challenge is to articulate properly water management to prevent that the benefits remain only inside the city limits and negative externalities outside the city.

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