

The Oasis of the Chicama Valley: Water Management from the Chimú to the Spaniards (Eleventh to Seventeenth Century AD) on the North Coast of Peru

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Abstract The Chicama Valley is an extremely arid region, irrigated by its eponymous river that forms an oasis. From the eleventh century AD, the Chimú culture developed the irrigation system, extending the limits of this oasis. After the Inca conquest ca. 1470 AD, and especially in 1532 AD with the arrival of the Spaniards, many upheavals (demographic collapse and abandonment of canals) transformed the landscape of the valley. From then on, the exploitation of the Chicama Valley changed dramatically. This raises the question of the management of this oasis by the Chimú, by the Incas and then by the Spaniards. What were the economic policies of land use and allocation of water resources during these three periods? The combination of archaeological data and ethnohistorical information from colonial archives provides an understanding of the processes of economic transformation of this oasis, between the eleventh and seventeenth centuries AD.

Keywords Oasis · Peru · North coast · Chicama · Chimú · Inca · Colonial Period · Irrigation · Agriculture

1 Introduction

The Chicama Valley, located on the north coast of Peru, is an extremely arid region that receives only a few millimetres of rainfall per year. Nevertheless, this aridity is compensated by the presence of the Río Chicama, the eponymous river of the valley that descends from the peaks of the Andes. On the banks of this river, vegetation grows, forming a welcoming oasis where many human cultures, such as the Chimú, have succeeded over the millennia. From the eleventh century AD, the Chimú

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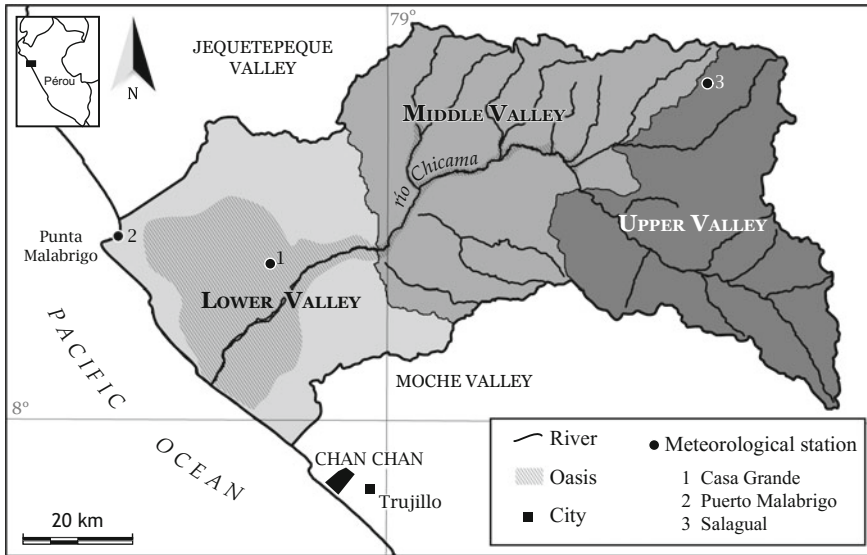


Fig. 1 Map of the Chicama Valley (data from IGN Peru and ONERN 1973)

initiated the expansion of the oasis of Chicama, through irrigation, farming a large area (Fig. 1). The Chimú Kingdom, whose political and social organisation depended on canals, was conquered by the Incas ca. 1470 AD, and then in 1532 AD by the Spaniards. The political, economic and social upheavals that resulted from these two successive conquests, such as a demographic collapse and the abandonment of some irrigation canals, had a direct impact on the oasis of Chicama and its exploitation.

Thus, we will analyse the changes and transformations of the economic management modes of this oasis, between the eleventh century, with the beginning of the Chimú culture in the valley, and the early seventeenth century, during the first hundred years after the Spanish conquest, when the old traditions from pre-hispanic times still survived. After presenting the geographical setting, the Chicama Valley and its oasis, and the history of the region through the Chimú, Inca and Colonial Periods, we discuss the methodology and the results of our ethnohistorical and archaeological studies. Finally, we examine all of these data to understand the evolution of the management and exploitation of this oasis during different periods.

2 The Chicama Valley and Its Oasis

Bordered by the Andes and the Pacific Ocean, the north coast of Peru, where the oasis of Chicama is located, receives only a fraction of the rainfall coming from the east. Other factors, including the temperature inversion caused by the cold waters of

the Humboldt Current in the Pacific Ocean, also contribute to the aridity of this region (Orbegoso 1987). The few millimetres of annual rainfall recorded in the Chicama Valley at low altitude (5 mm at Puerto Malabrigo and 20 mm at Casa Grande; Fig. 1; ONERN 1973) testify to this desert climate. However, the many rivers that flow down the western slopes of the Andes break the aridity and create several oases, such as that of Chicama. The role of these rivers is central as they are often the only source of fresh water on the coast.

The Chicama Valley, bounded in the north by the Jequetepeque Valley (and the Quebrada Cupisnique) and in the south by the Moche Valley, can be divided into three regions: lower, middle and upper (Fig. 1). The lower valley is a broad coastal plain, strewn with small rocky elevations and bordered by the Pacific Ocean and the foothills of the Andes. Today, most of the oasis of Chicama is concentrated in this lower part (ONERN 1973). The middle area is characterised by a hilly landscape, although the bottom of the valley is still relatively wide. The low-altitude (below 1200 m.a.s.l.) desert climate prevents the development of vegetation on the mountain slopes, which are only covered with some cacti (ONERN 1973). However, the various streams, such as the Río Chicama and its tributaries, favour the growth of plants and so the oasis is extended near the rivers. Lastly, in the upper valley, on the hill top rising over 4000 m, the climate is wetter. In fact, this area receives more than 1000 mm of annual rainfall (1130 mm in Salagual; Fig. 1; ONERN 1973), which gives rise to many rivers, including the Río Chicama.

The use of the term “oasis” for the valleys of the Peruvian coast is quite recent. It is found in the reports of scientific explorers of the nineteenth century, like Wiener (2010 [1880]: 105), but the Spanish chroniclers of the sixteenth and seventeenth centuries, such as Garcilaso de la Vega (1982 [1617]) and Cieza de León (2005 [1553]), never used this term. In the case of the Chicama Valley, is it relevant to speak of an “oasis”? There is no doubt that the desert coast contrasts with the plants of the riverbanks, but the vegetation, such as *algarrobals* and *sapotals*—mostly composed of shrubs and trees—survives in areas relatively far from rivers. The landscapes of the arid coast do not always lack flora. Moreover, the oasis of the Chicama Valley is highly anthropised since irrigation helped to cultivate a large part of the plain, extending the area of the oasis.

The Chicama oasis can therefore be defined as a river oasis, enlarged through an extensive network of canals and fields, contrasting this green landscape with the surrounding desert. It is interesting to note that, on one hand, the oasis of Chicama is separated from those of Moche and Jequetepeque by very arid regions but, on the other hand, it is “connected” by its river to the wetter areas of the hills. In this sense, the oasis of Chicama is not completely isolated, as could be the case for a Saharan oasis.

The transformation of the natural oasis by irrigation and its exploitation by human beings show the close relationship maintained with this particular environment by populations who have settled in the Chicama Valley for millennia.

3 From the Chimú Culture to Colonial Times

From the eleventh century AD, the Chimú culture developed in the south of the Chicama Valley, in the Moche Valley, on the site of Chan Chan (Fig. 1). Many archaeologists have shown interest in this major Chimú centre (Rodríguez 1968; Moseley and Day 1982; Topic and Moseley 1983; Moseley and Cordy-Collins 1990; Pillsbury and Leonard 2004; Campana 2006, etc.) and have described the different buildings that composed the twenty square kilometres of Chan Chan. They identified ten monumental adobe buildings, called *ciudadelas*, which are divided into large ceremonial plazas, corridors and courtyards, containing U-shaped structures and storerooms (Day 1982). The funeral platforms of these compounds could have contained the burials of the deceased Chimú rulers (Conrad 1982). These *ciudadelas* probably played the role of ceremonial and administrative palaces, transformed into funeral mausoleums (Moseley and Day 1982; Campana 2006). In addition to these great compounds, intermediary buildings, residences of the elite members (Klymyshyn 1982), small irregular agglutinated rooms (SIAR), and housing specialist craftsmen (Topic 2009) formed the urban network of this site.

The Chimú gradually spread over hundreds of kilometres of coastline, unifying a vast territory, managed through administrative centres, such as Quebrada del Oso in the Chicama Valley (Keatinge 1974) and Farfan in the Jequetepeque Valley Mackey (1987; Fig. 2). The architecture of these buildings is directly inspired from the *ciudadelas* of Chan Chan: courts, corridors, U-shaped structures, and sometimes storerooms are found inside the rectangular compounds of these administrative centres. Therefore, Mackey (1987) proposes an administrative hierarchy with, at the top, the capital palaces, then the major administrative centres, and finally the rural administrative centres, smaller in size. As these rural administrative centres were generally located near canals and agricultural fields, Keatinge (1974) assumed that they were used for irrigation management, an essential task for the Chimú economy based primarily on agriculture. Pozorsky (1979) documented the consumption and cultivation of corn, squash, beans, sweet potatoes, peppers, gourds and cotton, to name only a few species. The presence of some Chimú administrative centres in the oasis of Chicama could help understand how this area was exploited, but all the residential sites, where people working in the oasis lived, must also be taken into account.

Around 1470 AD, the Inca army subdued the Chimú Kingdom and incorporated it into the Inca Empire, the Tawantinsuyu (Rowe 1948). The impact of this conquest remains difficult to perceive through archaeological records and in the Chicama Valley. Some sites, like Chiquitoy Viejo, a *tambo* (roadhouse) studied by Conrad (1977) and PV22-23, in the north of the Chicama Valley (Chauchat et al. 1998; Fig. 3), show the Inca interest in communications. However, identifying the Inca policy in the Chicama oasis is difficult with the current state of knowledge.

Sixty years later, in 1532 AD, the Spaniards conquered the Inca Empire and installed a colonial regime. To this end, they founded cities like Trujillo, in the

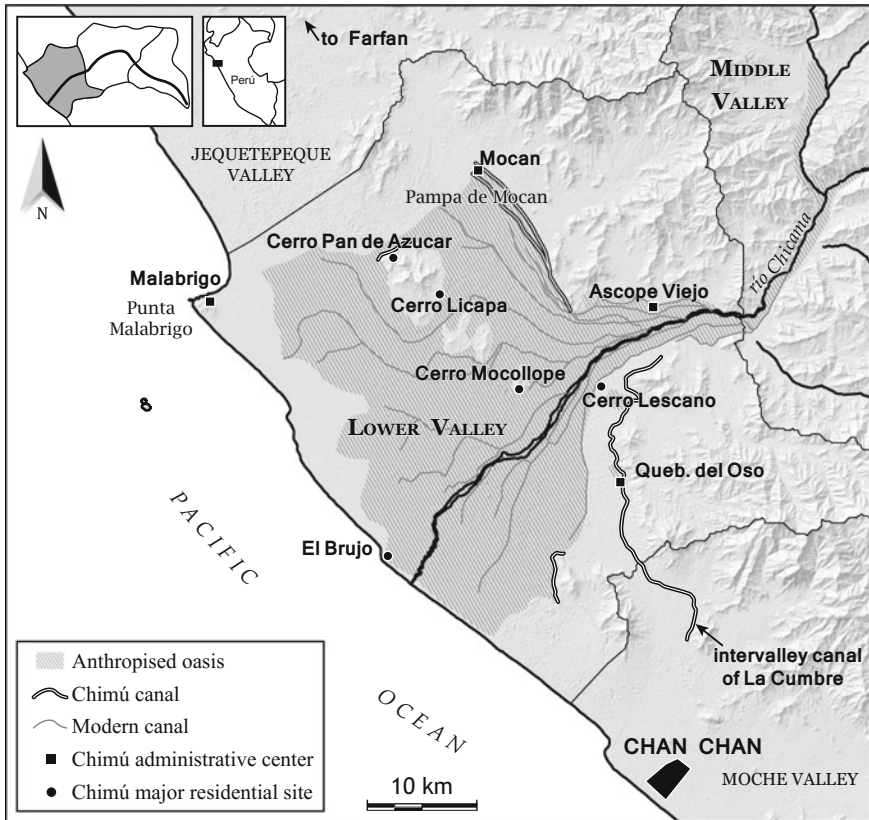


Fig. 2 Map of the oasis of Chicama during the Chimú Period (eleventh century to fifteenth century; data from IGN Peru and Aster GDEM)

Moche Valley near Chan Chan, created *encomiendas*, *repartimientos* and *haciendas*, to grow wheat or sugar cane, and gathered the indigenous declining population into *reducciones* (Duviols 1971: 248). During the sixteenth century AD, the oasis of Chicama and its people underwent profound changes.

The management of this largely anthropised oasis by the Chimú, and then by the Inca and the Spaniards, has evolved over time. What economic policies of exploitation of land and allocation of water resources were put in place? What original pre-hispanic traditions persisted into the Colonial Period, despite the upheavals of the Spanish conquest? We seek to understand the evolution of the oasis of Chicama by taking into account not only the changes but also the persistence of exploitation and social organisation practices in this particular space.

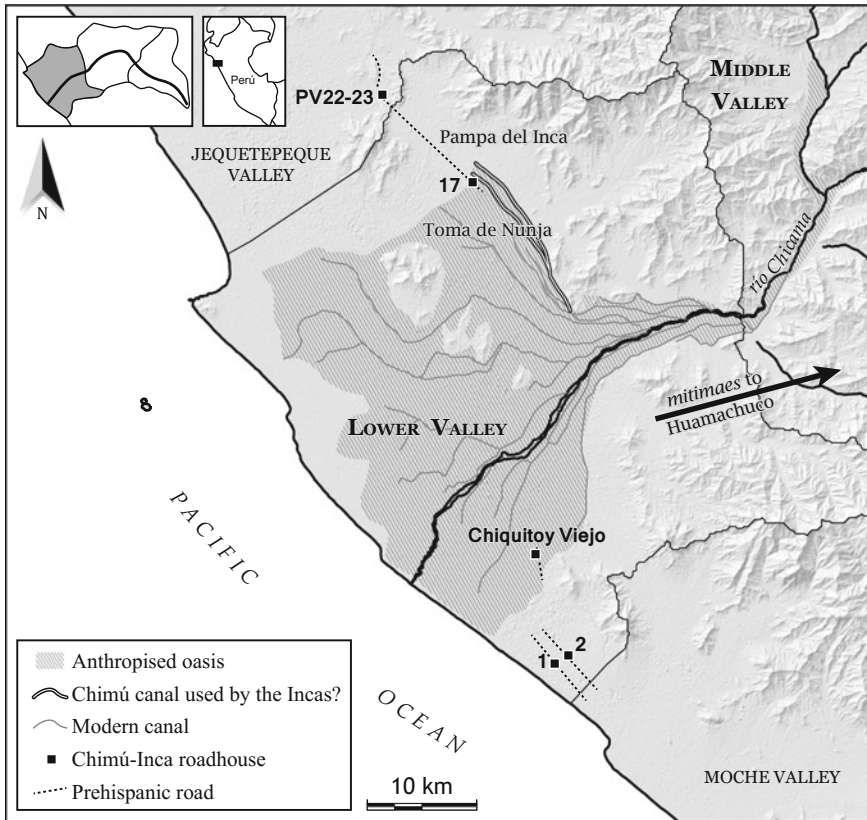


Fig. 3 Map of the oasis of Chicama during the Inca Period (fifteenth century to sixteenth century; data from IGN Peru and Aster GDEM)

4 Studies in the Chicama Valley

The study of these transformations involves data about both pre-hispanic times and the Colonial Period. To understand this process, it is essential to use an innovative multidisciplinary approach including ethnohistory and archaeology.

The situation of the Chicama Valley in the sixteenth century is reflected in the works of ethnohistorians such as Netherly (1977, 1984), Ramirez (1995) and Zevallos Quiñones (1990, 1993). We also consulted documents from the Archivo General de las Indias in Spain, and the Archivo Regional de La Libertad in Peru, for a better understanding of the daily lives of the native population in this oasis, after the Spanish conquest. From all the collected data, it is possible to determine approximately the alleged territories of the local communities of Chicama. However, to observe the oasis during the Chimú and Chimú–Inca Periods, the archaeological data are essential.

Surveys by Chauchat et al. (1998), Leonard and Russell (1992) and Krzanowski (1985) document the occupation of the region during the Late Intermediate Period (900–1470 AD). Studies about Chimú irrigation by Kus (1972), Watson (1979) and Farrington (1983) demonstrate their mastery of hydrology and provide some information on the irrigation network of the oasis. In addition, Google Earth satellite images help to identify more than 400 potential archaeological sites in the lower valley, including many canals, and to draw up draft plans of the vestiges.

Nevertheless, these ethnohistorical, bibliographic and satellite data must be supplemented by field surveys. Between 2010 and early 2013, we carried out several expeditions in 23 zones of the valley, from the desert coast to the hills, along the banks of rivers, identifying a total of 167 archaeological sites (Clément 2015). In addition to analysing the ceramic material in order to date the main phases of occupation of the sites, we also studied the architecture of the various conserved buildings. Some of these sites are mere concentrations of shards scattered on the surface, weak evidence of human activity in the past, while others, in contrast, consist of the ruins of buildings that could correspond to villages. Finally, we were also interested in the ancient roads, some long isolated walls and, of course, the pre-hispanic canals and fields, witnesses of the farming in the oasis of Chicama, centuries ago.

Of these 167 sites, 49 were occupied during the Chimú Period and only 3 during the Chimú–Inca Period. Chimú sites are mostly located near rivers or major irrigation canals and are therefore often related to water (Clément 2014). Some of them, like those of Mocan and Malabrigo (Pozorski 1987; Chauchat et al. 1998), are Chimú administrative centres, whose architecture is directly inspired from the *ciudadelas* of Chan Chan.

Others, such as the site of Cerro Lescano (Fig. 2), are composed of many residential structures built with stones. In these large villages, there are generally imposing buildings with a complex architecture, divided into many parts. Only members of the elite could order the construction of such buildings, and it is reasonable to think that they were residences for high-ranking people (Pillsbury and Leonard 2004). These elite did not appear to be directly linked to the authority of Chan Chan, as these large and complex structures were not derived from the *ciudadelas* of the capital, unlike the administrative centres. As demonstrated by Netherly (1977, 1984) for the Colonial Period, there was probably a small local Chimú nobility who directed the communities of the oasis.

The Chimú canals associated with agricultural fields are mostly located in the desert marginal areas of the coastal plain. Their larger size requires a considerable investment of time and labour and shows the importance of the hydraulic system during the Chimú Period. Finally, we can reconstruct the irrigation system in the currently cultivated areas, since most of the modern canals reuse the routes of the old pre-hispanic ones, as Netherly (1977, 1984) supposed. The irrigation network that once watered the oasis of Chicama emerges through these many clues.

The results of our survey, supplemented by the works of other archaeologists and the survey of satellite images, and associated with information from ethno-historical texts from the sixteenth and early seventeenth centuries, enable us to

understand the evolution of the exploitation of the oasis of Chicama, from the Chimú to the Colonial Period.

5 Interpretations: Exploitation of the Oasis of Chicama

As mentioned above, without anthropogenic infrastructures, the oasis is naturally confined to the banks of the Río Chicama. However, due to irrigation, farming could be developed further, and so the anthropised oasis today extends over a wide area. The canals, and the sites associated with them, thus appear as key indicators for understanding the evolution of the oasis and its management.

5.1 *Exploitation by the Chimú*

The Chimú extended the hydraulic system, pushing the limits of the oasis at its peak, especially in the north, into the Pampa de Mocan (Watson 1979) and to the east, with the inter-valley canal of La Cumbre, which diverted water from the Río Chicama towards the Moche Valley (Kus 1972). Today, the fields of these marginal areas are abandoned and deserted as the cultivated area is smaller than during the Chimú Period. The agricultural production may have been used to feed a growing population in the Chicama Valley or the numerous inhabitants of the nearby capital, Chan Chan.

To manage the resources of the oasis, both water and land, the Chimú built rural administrative centres, such as Quebrada del Oso (Keatinge 1974), Mocan (Pozorski 1987: 116) and Ascope Viejo (Leonard and Russell 1992), all located close to major canals and cultivated areas (Fig. 2). This association supports the hypothesis initially formulated by Keatinge (1974) about their function of controlling the irrigation.

The distribution of water from the canals to the different plots of the fields in turn, described by Garcilaso de la Vega (1982 [1617]), involves training and a major control to avoid abuse. In fact, in the Inca Empire, an official, named *cillquia*, had to ensure the proper distribution of water among the various users (Guaman Poma de Ayala 1980 [1583–1615]). Although ethnohistorical sources tell us nothing about the existence of this system for the Chimú, it is possible that rural administrative centres housed people responsible for this fair distribution of water from the canals to the fields. At the site of Mocan (Fig. 2), a highly complex network of canals, with many ramifications and sometimes meetings of canals, can be observed. The water could therefore take several paths to reach a field and had to be guided with precision by competent people. Thus, agricultural expansion in the oasis of Chicama was made possible by a particular management of water resources in some Chimú administrative centres. However, this administration began upstream in the middle valley where the Chimú were installed to control areas of

confluences and to observe the growth of the flow of the Río Chicama (Clément 2014).

A fourth Chimú administrative centre, named Malabrigo (Fig. 2), is somewhat distant from the oasis. Established in the Punta Malabrigo, overlooking a large sheltered bay, this site seems to have turned towards fishing rather than agriculture. Yet, the guano, a natural fertiliser produced by seabird droppings, accumulated in the Punta Malabrigo, near this site, could also have once been used to improve the cultivated land (Kubler 1948). The contribution of this fertiliser probably had a positive impact on agricultural production in the oasis of Chicama.

These four administrative centres are, at first sight, closely linked to the oasis and farming. However, their location on the margins of the oasis leads us to rethink, in part, their role and importance.

The site of Mocan is located at the end of the irrigation system that extends to the northwest, while Quebrada del Oso is established near the last fields watered by the inter-valley canal in the Chicama Valley (Fig. 2). From these centres, some Chimú functionaries could actually check for water at the end of the irrigation system, but they could not control the distribution of water or supervise the intake of the canals. Only the site of Ascope Viejo (Leonard and Russell 1992) was ideally located to manage irrigation, since it was close to the intakes of some major Chimú canals (Fig. 2). Because of their peripheral and marginal positions, these four administrative centres would not enable the effective control of the kilometres of canals and hectares of fields that constitute the oasis of Chicama.

However, the great residential, administrative and ceremonial sites, such as Cerro Pan de Azucar (Mercado 2002), Cerro Licapa (Netherly 1977), Cerro Mocollope (Leonard and Russell 1992), El Brujo (Tate 2007) and Cerro Lescano (Fig. 2), probably inhabited by members of the local elite, are located in the heart of the coastal plain and the oasis. From these sites, it was possible to manage the irrigation and the cultivated land extending around them. This administrative task had to be led by high-ranking local rulers who lived in these sites, while the population, mainly composed of farmers according to Netherly (1977), worked in the fields.

Therefore, there were two types of management operating in parallel; the marginal areas of the oasis, newly cultivated by the Chimú, were under the indirect control of the leaders of Chan Chan, via administrative centres, while the heart of the oasis was in the hands of local elite members of Chicama, who managed and operated these vast fertile lands from some major villages.

5.2 *Exploitation by the Inca*

After the period of extension of this oasis by the Chimú, the situation changed with the Inca conquest. Unfortunately, the remains of the Chimú–Inca Period, mostly unknown, do not provide a complete understanding of the exploitation of the coastal plain of Chicama. The three Chimú–Inca sites we identified are installed

along roads and may have been roadhouses, similar to the site of Chiquitoy Viejo (Conrad 1977) and PV22-23 (Chauchat et al. 1998; Fig. 3). According to Rowe (1948), the Chimú rulers of Chan Chan lost their power after the Inca conquest, and we can assume that the marginal areas of Chicama they controlled through administrative centres were abandoned, as no Chimú–Inca shards have been found in Quebrada del Oso and the fields of Mocan.

Yet, the presence of an Inca roadhouse in the Pampa de Mocan (site n°17; Fig. 3), south of the Chimú fields, raises questions about the continuity of farming under the Inca domination. The toponyms of the surrounding area, such as the “Pampa del Inca,” which extends to the north, or “toma de Nunja,” associated, according to Zevallos Quiñones (1993: 54), with the “land of the sun,” suggest that the Incas settled in this region. Indeed, the “lands of the sun” were managed by the Inca clergy to worship the sun god Inti (Moore 1973: 24), and their mention might indicate the trace of the Incas. Could the Incas have maintained the Mocan zone under cultivation? Garcilaso de la Vega (1982 [1615] t.2: 65) provided data about the Inca system of land distribution. This author indicates that the Incas were seeking to gain new lands to increase the production, without despoiling the newly conquered communities who often conserved their fields more or less intact. With the recovery of the marginal cultivated areas of Mocan, formerly under the control of the rulers of Chan Chan, the Incas would have enjoyed the many hydraulic infrastructures built during the Chimú period, leaving the local communities to exploit the heart of the oasis. Yet, archaeological data are insufficient to demonstrate the continuity of farming in Mocan, during the Inca Period.

Besides, the texts of the Colonial Period mention the sending of *mitimaes* (settlers) from the Chicama Valley towards the Huamachuco area further east (Fig. 3). Pedro Xalcaguaman, ruler of the *mitimaes* in the early seventeenth century, says that the Incas ordered his grandfather, Augustin Chumbinamo, to go with his community to the mountains, perhaps during the reign of Huayna Capac (ARL leg. 266 exp. 3068 fol. 32r; Espinoza Soriano 1974). These population movements weakened the demographics in the oasis of Chicama. Workers, inevitably fewer, could not exploit all the land that was irrigated in Chimú time.

Data are lacking to explain in detail how the oasis of Chicama was occupied and managed during the Chimú–Inca Period. Although some marginal agricultural areas appear to have been abandoned, others, like Mocan, could have been maintained under cultivation by the Incas, who replaced the authority of the Chimú rulers of Chan Chan. The population movements also contributed to reducing the area of the oasis, given the lack of manpower.

5.3 *The Colonial Exploitation: Upheaval and Survival*

With the arrival of the Spaniards on the north coast of Peru, the landscape of the oasis of Chicama completely changed as a result of the restructuring of the

indigenous society, the demographic collapse suffered by the native population and the introduction of new crops, exogenous domesticated animals, and technologies, like mills (Piel 1975; Cook 1981: 143; Netherly 1977; Castañeda 1996).

The Spaniards tried to reshape the indigenous society to control the population better. In the sixteenth century, the natives of Chicama were initially placed under the responsibility of two *encomenderos*, Don Diego de Mora and Don Francisco Fuentes, who took part of their produce as tribute (Zevallos Quiñones 1990). In 1566, Dr. Cuenca grouped various hamlets into a few villages, the *reducciones*, such as the villages of Paijan, Chocop, Magdalena de Cao and Santiago de Cao (AGI Justicia 457; Fig. 4). These measures facilitated not only the conversion of the inhabitants of the valley to Catholicism, but also their economic control (Duviols 1971).

In the sixteenth century, the population of the north coast and of the oasis of Chicama suffered a dramatic demographic collapse, aggravated by the social and economic changes, and especially by the epidemics that decimated the indigenous

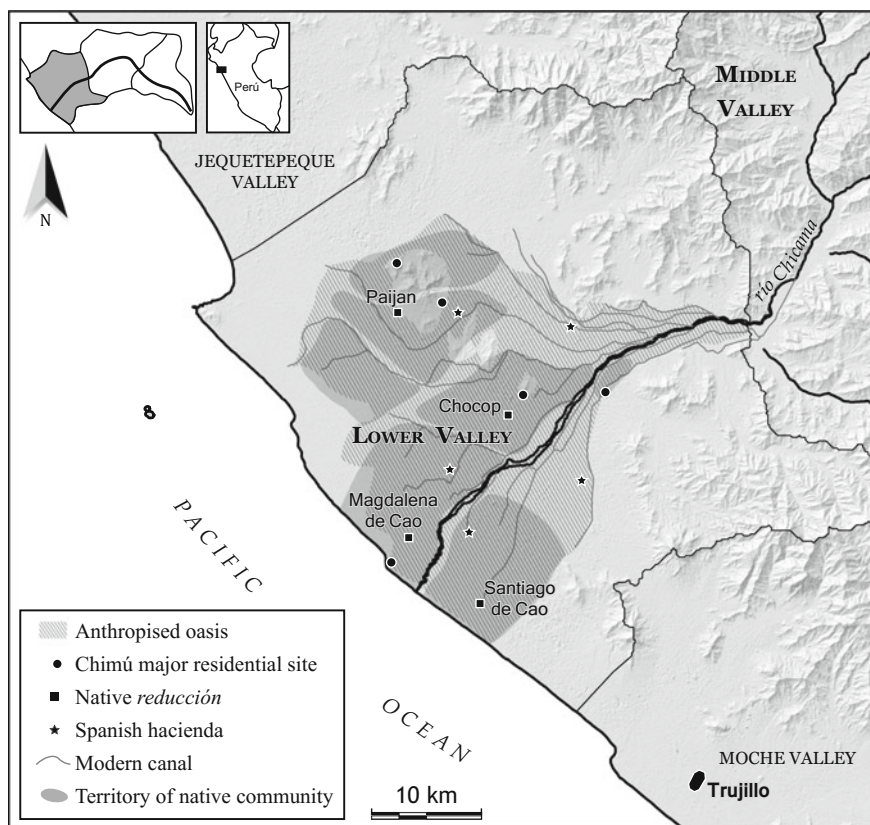


Fig. 4 Map of the oasis of Chicama during the Colonial Period (sixteenth century to seventeenth century; data from IGN Peru and Aster GDEM)

communities, as in 1578 (ARL leg. 266 exp. 3064). The population estimates are difficult to verify, but all authors (Cook 1981; Netherly 1977; Ramírez 1995) agree on the high rate of mortality and the consequences of this decline on the irrigation system. Due to a labour shortage, canal maintenance and exploitation of the extensive fields of the oasis of Chicama could not continue and many areas had to be abandoned, particularly in the marginal zones irrigated by the Chimú, a few centuries previously (Fig. 4). Like for the estimation of the demographic collapse, it is very difficult to assess the reduction in the cultivated area of the oasis.

The landscape was also transformed by the creation of Spanish haciendas dedicated to raising cattle and goats and the cultivation of wheat and sugar cane (Feyjoo de Sosa 1984 [1763]; Castañeda 1996). Sugar cane gradually covered a large area of the oasis and created social problems about water distribution. The archives (ARL leg. 169 exp. 594; ARL leg. 270 exp. 3335) mention conflicts over the misappropriation of water by Spaniards to grow sugar cane, a plant with great water needs, depriving indigenous villages downstream of the canals. From these haciendas, the Spaniards sent wheat flour to the markets of Trujillo and Lima, and exported sugar outside of Peru. The oasis of Chicama was then integrated into a large trade network (Castañeda 1996).

The social and economic transformations that affected the oasis of Chicama during the early Colonial Period were profound. The demographic collapse and the abandonment of cultivated areas, the Spaniards' *reducciones* policy and the newly established haciendas permanently changed the landscape of this oasis. Even today, almost five centuries after its introduction, sugar cane covers most of the irrigated land in Chicama (ONERN 1973).

Despite the upheavals caused by the Spanish exploitation, certain continuities in the structures of the indigenous society and in the agricultural practices can also be observed through the texts of the archives.

First, Netherly (1977, 1984), Zevallos Quiñones (1990) and Ramírez (1995) studied the role of the indigenous leaders of Chicama. Each community, led by its *curaca*, cultivated its land and maintained its canals for its subsistence and to pay the tribute (Netherly 1984; AGI Justicia 457; AGI Justicia 458). The *curacas* played an important role in agricultural activities: their presence was necessary to supervise the native population's activities and to offer corn beer (*chicha*) to the workers (AGI Justicia 457), in accordance with the Andean principle of reciprocity, inherited from pre-Hispanic times (Franklin 1992).

These people, whose role was essential for farming in the oasis of Chicama, presented themselves as the descendants of members of the local Chimú elite (Netherly 1977), who probably lived in the large villages, such as Cerro Pan de Azucar, Licapa, Cerro Mocollope, El Brujo and Cerro Lescano (Figs. 2 and 4). We note that these great Chimú sites fall inside the territories of the various indigenous communities, determined on the basis of ethnohistorical data and toponyms for the sixteenth century. These sites could therefore correspond to the major centres of the communities of the oasis during the Chimú Period. Their inhabitants were later resettled by the Spaniards in *reducciones*, often located close to these important

sites, as has been documented for the *reducción* of Magdalena de Cao and the site of El Brujo (Mujica and Hirose Maio 2007).

Thus, the ethnohistorical data demonstrate continuity, despite the profound changes that marked the sixteenth century. Native communities, led by their *curacas*, continued to cultivate their land, according to traditional Andean principles such as reciprocity and the distribution of *chicha*. The people of the oasis, fewer every year, had to face competition and economic pressure from the Spaniards who settled in the oasis. Lastly, it should be noted that the area of the oasis was reduced, due to the abandonment of canals and marginal lands that have remained deserted until today.

6 Conclusion

In conclusion, we can trace the evolution of the occupation and exploitation of the oasis, which extended to its maximum during the Chimú Period. This oasis is largely based on human infrastructures, such as irrigation canals, and therefore has an anthropogenic nature, which makes this region particularly responsive to changes in human societies.

The expansion of the oasis of Chicama was probably the culmination of a long process that began in previous periods, with the construction of canals, larger each time and irrigating still further (Golte 1980). In the Moche Valley, Moseley et al. (1983) documented the creation of new canals, and also the partial collapse of the irrigation system, at the end of the Chimú Period. These processes probably occurred in other valleys of the north coast. In a region with a desert climate, such agricultural development requires careful management of water resources, which could be carried out from the Chimú administrative centres, such as Quebrada del Oso, Mocan and Ascope Viejo, symbolising the central authority of Chan Chan, the Chimú capital (Keatinge 1974; Pozorski 1987). However, the location of these sites did not allow an effective control over the whole oasis and all the canals. Thereby, the local elite residing in large sites, probably centres of the communities of Chicama, could manage the exploitation of the vast fields, in the heart of the oasis, whereas state functionaries acted from administrative centres in the peripheral zones.

During the Inca Period, the marginal cultivated areas were probably abandoned—although the Incas might have maintained the exploitation in Mocan—but the reduction in the cultivated acreage was most pronounced following the demographic collapse of the sixteenth and seventeenth centuries. As the oasis was reduced, the Spaniards settled there, cultivating new plants, such as wheat and sugar cane, and opening the valley towards a large trade network (Castañeda 1996). Despite the economic and social changes brought about by the Spaniards, such as the *reducciones* and the *encomiendas*, the native population continued to cultivate the oasis, according to ancient pre-hispanic principles, such as reciprocity. The *curacas*, descendants of the local Chimú elite, led their communities while integrating themselves into the new political machinery of the colonial system.

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