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Conflicts Over Water in 'The Little Drought Age' in Central México

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SUMMARY

México represents one of the most climatically sensitive regions of the world. Over the Colonial period, prolonged drought episodes had severe impacts on all sectors of society, particularly indigenous rural populations. This paper employs a variety of colonial historical records to document the nature and extent of these impacts within the context of prevailing social, political and economic conditions. It is clear that access to water has long been a source of contention especially during drought episodes. Resource monopolisation by individuals and institutions such as the church served to exacerbate this situation particularly during the 18th century.

INTRODUCTION

Drought and the unpredictability of water supplies in México provide a constant threat and source of concern to a society whose economic base is and has been for over 3000 years predominantly agrarian. That water should play a particularly significant and symbolic role in the lifeways of peoples accustomed to its scarcity, is perhaps to be expected, and of the many gods worshipped by prehispanic cultures, those associated with water ranked amongst the most important. The Aztecs, for instance, made human sacrifices to the rain god Tlaloc in order to make appeasement or to have requests of water granted (Caso, 1937). The profound significance of water as a key resource is also indicated by various Purépecha myths¹ relating to water origins, diminishing and vanishing sources, and localisation and discovery of new supplies (García, 1995). Such preoccupation with water is not surprising given that México lies in an area of extreme climatic sensitivity (Wallen, 1955; Kutzbach and Street-Perrott, 1985; Liverman, 1993) and has experienced climatic change on both the long (10^3) (Heine, 1988; Bradbury, 1989; Metcalfe *et al.*, 1991) and short (10^{1-2}) (García, 1974; Jauregui and Klaus, 1976; Jauregui, 1979; Metcalfe, 1987; O'Hara and Metcalfe, 1995) timescales.

Relatively detailed climatic records covering the post-conquest period indicate that annual rainfall has varied considerably (Florescano, 1972, 1980; O'Hara and Metcalfe, 1995) and will have undoubtedly influenced water availability. Some insights as to the nature of human response to such changes can be gained from the vast body of archival material pertaining to México. Disputes (*pleitos*) over water, irrigation pledges and diversion programmes, for example, can all represent responses to variations in rainfall and access to and supply of water, while law suits over newly emerged or submerged territory may be the result of climatically-driven lake level changes.

West central México is the most climatically sensitive area of the country. Rainfall decreases along a south-north gradient from ca.1000 mm/yr in the highlands to <400 mm/yr towards the sub-tropical desert. Despite extreme variation in mean annual precipitation (Wallen, 1955), this area proved attractive to the Spanish who, like prehispanic populations, established settlements in the many closed lake basins of the Neo Volcanic Axis (NVA) (see fig.1). Consequently, there is a rich archival legacy for this area, detailing past landscape characteristics and land use activity and which provides a unique window through which to view the nature and impacts of environmental change following the conquest. It is the aim of this paper to employ such historical sources to assess the impact of changing water supplies in west-central México and to address the question of climate change and water security during the colonial period. (Sites and locations referred to in the text are illustrated in figs. 2 and 3).



FIGURE 1. Map showing the location of west-central México

THE CLIMATE OF MÉXICO SINCE THE CONQUEST

At present, most of México comes under the influence of two major features of the atmospheric circulation: the Trade Winds and the Sub-Tropical High Pressure belt. During the northern hemisphere summer, the Intertropical Convergence Zone (ITCZ) moves north accompanied by the semi-permanent Bermuda Azores and the East Pacific Highs. The flow brings the main rains to the country between April and October in a monsoon type circulation. In the northern hemisphere winter, the ITCZ is displaced equatorwards and the country comes under the influence of the sub-tropical high pressure belt with westerly flows aloft. This results in stable dry conditions over much of the country. In those years when the monsoon is enhanced, the country receives above average rainfall for the year, but when it is suppressed, drought conditions are widespread. It is clear, for example, that the period prior to and following the arrival of the Spanish, ca. 1350-1590, was relatively wet, although central México experienced short-lived drought episodes, such as in the 1440s and 1550s. Beginning in the 1590s, however, the number and intensity of drought periods increased significantly and, by the latter part of the 1600s, the region suffered a series of dry years which had serious implications for the agricultural potential of this region (Florescano, 1972, 1980). With the exception of a generally wetter period around the 1730s and 1740s, drought continued until at least the 1820s (O'Hara and Metcalfe, 1995), being most severe in the mid to late 1700s. Within this general dry phase, certain years stand out as being particularly severe. Gibson (1964) for instance, considered the drought of 1624 to be the worst of the post-conquest period, while the famine which resulted from the 1785-6 drought stimulated considerable economic and social distress (Florescano, 1980).

Although the availability of records from which to infer climatic characteristics becomes more limited during the 1800s, it would appear that the dry conditions characteristic of the early 19th century and which were to culminate with the civil unrest that led to the War of Independence, were superseded by generally wetter conditions. By the 1880s, however, the region was once again in the grips of a severe and devastating drought and between 1875 and 1910, 29 cases of drought have been identified (Florescano, 1972). Beginning in the 1920s, however, there appears to have been a shift to generally wetter conditions, and although the region continues to experience years of abnormally dry conditions, the number and intensity of these events has declined.

A general trend of climatic drying, punctuated by short-lived wetter periods, can be ascertained over the course of the colonial period (O'Hara and Metcalfe, 1995), the severe droughts noted for the later 16th, 17th and 18th centuries perhaps reflecting the impacts in the tropics of the changes associated with the Little Ice Age.

DISPUTES OVER WATER BODIES AND SOURCES:

There is a range of archival material which detail land and water disputes since the arrival of the Spanish.² More than a thousand such documents have been studied³ and from these it is evident that disputes over land ownership dominate the early colonial period with water and access to water becomes a major source of contention during the 1700s. The relatively few documents that do deal with problems associated with water during the 16th and 17th century, however, seem to coincide with periods of drought. In 1550, for example, there was evident concern over the permanent water body of San Gregorio (also known as Guani or Guipo) a major water source for the town of Pátzcuaro,⁴ which was apparently drying up at this time. A year later a dispute occurred between the indigenous residents of Santa Fe de la Laguna to the north east of Lake Pátzcuaro, and the Franciscan friars.⁵

Surprisingly little evidence of actual water disputes has emerged from what was recognised to have been a particularly severe drought at the close of the 16th century, although Melville (1990,1994) noted the drying up of springs at this time in the Valle del Mesquital,⁶ and documents and accompanying maps

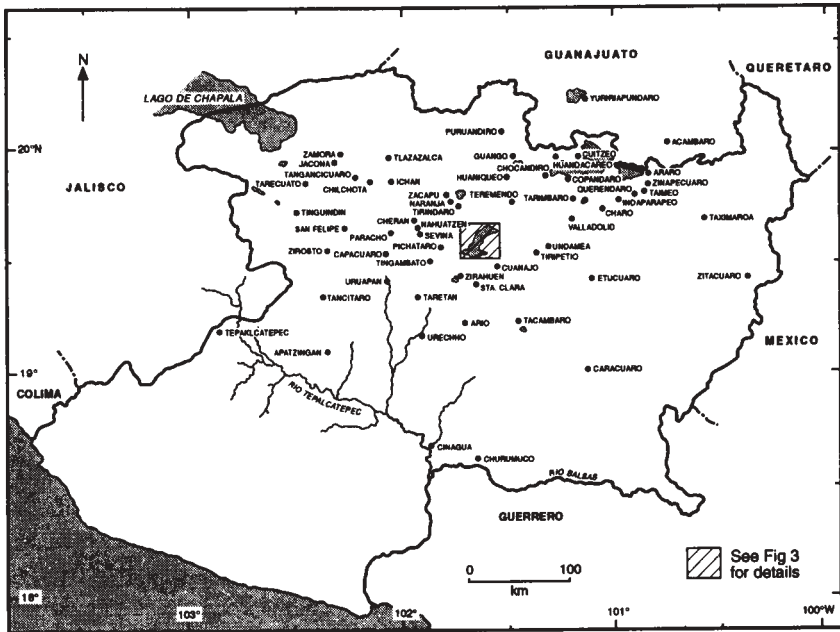


FIGURE 2. Michoacán and sites referred to in the text

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(*pinturas*) detail the desiccation of Lake Cuitzeo at this time.⁷ By the turn of the century, however, issues relating to water availability become more frequently referred to. In 1607, for instance, there was a dispute between the residents of the *barrio*⁸ of San Salvador, in the Basin of Cuitzeo and the Jesuits: the latter having taken possession of the *naturales*⁹ main source of water.¹⁰ During the first decade of the 17th century there is evidence from the southern part of the state in the *tierra caliente*,¹¹ that many *arroyos* (or ephemeral streams) had dried up, and that in 1605 one permanent river had ceased to flow 'from the month of March onwards'.¹² That problems of water shortage continued into the second decade of the century is indicated by a document dated 1612 which refers to the drying up of rivers close to the Jesuit run hacienda of Tareta, near to Sanabria on the eastern shore of the lower arc of Lake Pátzcuaro.¹³

No direct mention of water has been found in documents dating to the mid 1600s and it is not until 1675 that water again emerges as a point of contention. In this year, Francisco Balas and Fabian Martinez were involved in lawsuit over land and the source of water called Viroto, located near to the former town of San Miguel, Pátzcuaro. Based on his survey of the lands in question Balas notes that 'where once I found water, now is dry'.¹⁴ Around the same time, *arroyos* in the north and western part of the province also seemed to be suffering from desiccation. In Cuitzeo, for example, a small *arroyo* 'of very little water' formed the basis of a *pleito* between the *naturales* and Don Gaspar Salgado,¹⁵ while a document dating to 1691 mentions a stream in La Palma, Chilchota, whose water level varied, but which at this point in time was found to be dry.¹⁶ Reports indicating the drying up of water source continue into the 1700s. One document dated 1706, for instance, describes the drying up an *arroyo* located in San Francisco Uricho, on the western shore of Lake Pátzcuaro, while a short time after this (1708), the source at San Gregorio was described as being no more than a bog or swamp.¹⁷

A shortage of water to the north of the province also seems to have stimulated a spate of disputes. In 1712, for example, there was a *pleito* recorded between the convent of San Nicolas Yuririapundaro and Joseph de Guzman, within a document detailing a survey of the lands known as Las Carretas in the vicinity of the town of Yuririapundaro with references to dried up *arroyos*, *cañadas*¹⁸ and *cañadillas*.¹⁹ While at the same time in Chilchota, to the northwest of the province, Sebastian Paresco was presenting evidence on behalf of the *naturales* of San Francisco Acachuen in an ongoing court case to ensure rights of possession of the spring of water at San Juan Carapan.²⁰

In the second decade of the century, the number of disputes between *naturales* and *hacendados*²¹ rose significantly, and with them references to water shortages and insufficiency of lands for the indigenous population. A *pleito* dated 1718, for example, between the *naturales* of Indaparapeo (to the south east of Lake Cuitzeo) and the hacienda of Los Naranjas, over the use of the River

Canapetequaro, highlights tension over water at this time.²² The document outlines the progressive moves by the hacienda to monopolise lands and resources since the 1650s, though the increasing lack of water had been causing concern to both landowners and the *naturales*. By 1718 the situation had reached a critical point and the *naturales* were left with no other option than to 'travel a long way to access other water'. The *hacendado*, Don Nicolás de Villaseñor, was willing to reach a compromise and pay for temporal use of the river that the *naturales* traditionally used to irrigate their lands. The water shortage was a problem for the whole town, however, and supplies had become insufficient not only for the sowing of crops but also for more general, domestic purposes. Moreover, the document states that due to the lack of water 'there had been a deterioration' of the town and its lands. Similar disputes were taking place throughout the region at this time.²³ *Hacendados* were being held responsible for changing the natural courses of rivers in order to redirect waters to their lands,²⁴ but while the wealthy landowners were more often than not the accused in these cases, being the more persuasive in terms of administrative power, they frequently emerged as the victors.

Landscape descriptions also highlight the perceived lack of water during the second decade of the century. *Arroyos* are described as having very little water or as being totally dried out, while there is mention of former shallow lakes becoming nothing more than 'big salt flats'.²⁵ The continuation of these dry conditions into the 1720s led to a series of requests to exploit water sources for irrigation purposes. In 1723, for example, a *pleito* between the Jesuits of Pátzcuaro, owners of the monastery of San Augustin de Tiripetio, and Don Francisco Gallegas, dealt with the use of the waters of the River Necotlán. At the time, the convent held possession of the waters, though Don Francisco de Gallegas was petitioning for this monopoly to end, threatening to build a dam to divert the water for the benefit of his own lands.²⁶ A short time later in Zinapécuaro further north, a dispute between the Jesuits of Valladolid and the *naturales* of Querendaro over the use of the River Parral (later called the Rio Querendaro) again focused on the needs of both parties for irrigation water.

In the fourth decade of the 18th century, the water source at San Gregorio was again the centre of concern according to a *pleito* dating to 1734. The communities of the nearby *barrios* of San Bernadino, San Salvador were apparently accustomed to exploiting the source and were dependent upon the use of the waters. Don Pedro Ibarra, the owner of the hacienda of San Nicolas de la Laguna, had, it seemed, petitioned for a grant to divert the water course to 'feed' his hacienda. Such was the nature of the case that a series of *testigos* were brought in to impartially adjudicate, reinforcing the *naturales*' case, and adding that the nature of the soils in this area, being particularly porous, had exacerbated the problem of water shortage.²⁷ That water was a significantly valued commodity at this time is also suggested by a more domestic level dispute that took place three years

later in June 1739 in Pátzcuaro town centre, between neighbours Don Pedro Zagredo and Don Andres Pimentel over a communal water supply and drainage system.²⁸

There is an apparent decline in disputes over water in the 1740s and 1750s, with all those documented occurring to the more northerly part of the region²⁹ – an area considered to be more susceptible to drought. Towards the close of the 1760s, however, there is a resumption in *naturales*' claims for reinstatement of their land³⁰ and the need for irrigation water. The townspeople of Queneo, for example, were claiming access to waters in the jurisdiction of Pátzcuaro for irrigation purposes,³¹ while the 'baths' known as 'Agua Calientes' in the district of Zinapécuaro formed the basis of a *pleito* between the owner of the Bartolilla Ranch and the *naturales* of the town.³² The water was being used to run a mill and to irrigate croplands on the ranch, dispossessing the *naturales* of any water they had formerly had access to. At this time there were a number of petitions by individuals to increase withdrawals from more permanent water bodies. Capitan Don Miguel Gomez de Sonuitas of Irapuato for instance, made a request to the viceroy to withdraw waters from the River Irapuato for irrigation purposes, given that the river at this time was not 'being put to good use'.³³

The drought years that culminated in the so called 'Year of Great Hunger', 1785-6 have been well documented (Florescano, 1981; Swan, 1981). Drought induced crop failure³⁴ stimulated famine,³⁵ epidemic disease³⁶ and death,³⁷ economic retardation³⁸ and may have contributed to the later migrations of labour gangs to work in the sugar plantations of the *tierra caliente* lands.³⁹ That drought conditions should be reflected in water disputes is to be expected. A long standing dispute, for example, between the Augustins and the *naturales* of Taretán south of the Basin of Pátzcuaro over lands and water access, came to a head in 1785. The two groups were fighting over the use of the river that ran through the town; the *naturales* of the town stating in no uncertain terms that their access to the water body should be protected.⁴⁰ Although rainfall increased in the summer of 1786 general drought conditions prevailed, the lack of water exacerbating the poor quality of indigenous lands which tended to lack irrigation, be covered by *tepetate*⁴¹ and were thus regarded as infertile.⁴²

At the close of the 18th century the number of water disputes decrease once again, although archival references to climatically induced famine, plagues and pestilence,⁴³ desiccation⁴⁴ and heavy rains⁴⁵ suggest that there was considerable regional climatic variability over this time. Drought conditions were to prevail into the 19th century, yet it was the social and political upheaval associated with this period of climatic perturbation, and which stimulated the Independence movement, that could well account for the scarce archival documentation of water disputes at this time. Clearly, other nationally based issues had taken precedence.

THE IMPACT OF CHANGING LAKE LEVELS

In addition to disputes over access to water, the archives provide some insights as to the implications of climatically driven lake level fluctuations on populations located along lake shores. The majority of evidence comes from the Basin of Pátzcuaro (see fig. 3), which during the prehispanic period formed the heartland of the Purepecha culture, and continued to be of importance to these people following the conquest. In common with evidence of water disputes, relatively little information is available for the 16th century. Snippets of useful information, however, can be gleaned from some sale and litigation documents. A drop in the level of Lake Pátzcuaro in the 1550s-1560s, for example, is inferred from documents relating to the case against Don Pedro, Governor of Cirosto, 1560-1564 which states:

... the said lands were lake, and when it dried out he ploughed the land
(cited in O'Hara, 1993).

Further evidence of land conflict at this time is provided in documents relating to a dispute between the *naturales* of the Island of La Pacanda and the heirs of Juan Paruata and Beatrice de Castilleja (1609-1612) over the emergence of new lands as a result of falling lake levels which occurred after the death of Don Antonio Huitzimengari in 1562 (Alvarez and Gasca, 1952). A decline in the level of Lake Pátzcuaro at the close of the 16th century, resulted in two *citaquas*⁴⁶ of land being exposed in the vicinity of the former island of Apupato, on the south east shore of the lake in a location 'where the lake used to be but is now dry'.⁴⁷ The lands were subsequently sold by Francisco Tziztiqui, resident of the island, to Diego de Casteñeda for the sum of twenty pieces of gold in January, 1597.

Land disputes dominate litigation documents for this area during the latter part of the colonial period. In 1714, for example, the *naturales* of the towns of Jarácuaro, Toquaro and Arocutín fought over the newly emerged island of Copujo, (at present connected to the mainland in the south western part of the Basin of Pátzcuaro).⁴⁸ During 1783, lands on the island of Copujo again formed the basis for a *pleito*, relating to the emergence of additional lands around the island.⁴⁹ Equally significant to lake side communities, however, was the inundation of land by rising lake waters. In 1760, for example, the *naturales* of the town of San Pedro Pareo claimed the rights to five *caballerias*⁵⁰ of land from the Hacienda of Charahuen, but as the *hacendado* stated:

over the course of the past twenty years, the level of the lake water has increased so much that the water is now right next to the northern part of the city, and that the ancient walls that the indios had as a division of their territories are now a long way under the lake water.⁵¹

Because the *naturales* had effectively lost their territory to the rising lake waters, their claim could not really be justified.

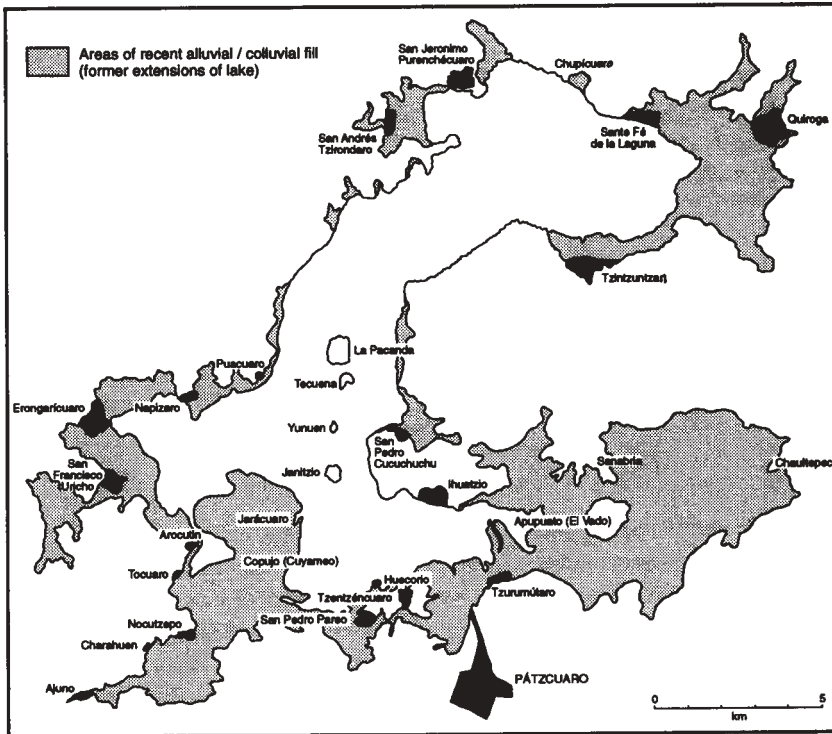


FIGURE 3. Map of the Basin of Pátzcuaro

Definitive evidence of drought impacts, in contrast, is provided by a document dated to 1773, in which it is stated that lands near to Erongaríquaro were in a state of deterioration having been 'brought from the lake'.⁵² This may well imply that the lake level had receded to reveal lands, regarded as infertile, but whose ownership had, in consequence, come into question.

That lake level changes were frequent phenomena is suggested by a *pleito* dated to 1783 between the indigenous residents of Tzuntzénquaro and the owners of the haciendas of Aranjuez and San Nicolás de la Laguna. According to the townspeople, lands in their possession were considered to be 'stony, covered in tepetate and infertile'. Moreover, to the west were lands presently 'left by the lake', but which during the rainy season 'become the lake'. To the south, although lands were considered to be cultivable, they were 'salt encrusted', while to the north, lands were flat and cultivable but subject to flooding by lake waters during the rainy season.⁵³ As experience had obviously shown, the lands were wont to be submerged on occasions by rising lake levels, which is perhaps to be expected, given the annual lake level variations that will have inevitably taken place. Those lands that emerged after lake waters had receded were

regarded as inadequate for cultivation. Clearly, the impacts of such fluctuations were quite significant from a social and economic sense, given that the lake shore lands, necessary means of survival for the indigenous land owners at least, could be unpredictably withdrawn.

Some longer term trends and impacts of climatic change become identifiable from the archival records dealing with indigenous claims for land restitution. A document dated 1791, for example, charts a drop in the level of Lake Pátzcuaro. According to a *pleito* between the people of the towns of San Pedro Bartolomé and San Pedro Pareo,⁵⁴ falling lake levels had resulted in the emergence of a land area known as Tinguintzequaro, to the north of the island of Jarácuaro, the possession of the lands consequently coming into question. While in 1793 there was a dispute between the town of San Pedro Pareo on the southern shore of Lake Pátzcuaro and the residents of Island of Jaracuaro over:

... a piece of land that has been uncovered by the lake called Pa(t)zcuaro as a result of the scarcity of rains in the last few years... (cited in O'Hara, 1993).

The antithesis of this argument, however, is presented in a document dated to 1793 which discusses the territory of the *naturales* of San Pedro Pareo, which covered five *caballerias* in 1718, but which, at the time of writing amounted to only one.⁵⁵ A case is made that all the rest of their former territory was then lying submerged beneath the lake. Clearly, there is some contention as to the changing level of the lake waters, though the increase in the level of the lake from 1718 could be possible, given that the water level was probably very low during the drought periods of the first two decades of the century, and as we have seen it is quite possible that a very small change in the level of the lake water could result in the emergence of quite a sizable tract of land such as that to the north of Jarácuaro.

The relative lack of documentation detailing potential impacts of climatic change during the 19th century stands as marked contrast to the previous 150 years. That indigenous communities and individuals continued to make claims for land restitution in a context of rising population and climatic deterioration, however, is exemplified by a document dating back to 1802/3 in which the residents of San Pedro Tzurumútaró claim to have insufficient lands of good quality with which to support themselves. To the north, they claim that, although they were in possession of the stipulated 600 *varas*,⁵⁶ the territory was regarded as:

sandy, lacking in trees and vegetation, because the lands represent former lake bed that has been revealed by receding lake waters.⁵⁷

Though it is not possible to identify exactly when this lake level change occurred, nor to assess whether the changes were gradual, the case made by the *naturales* leaves little doubt as to the impacts of such changes on lake shore communities such as those in the Basin of Pátzcuaro.

WATER AS A KEY RESOURCE: SOCIAL REACTION, ECONOMIC RESPONSE AND ADAPTATION TO CLIMATIC VAGARY

Variations in annual precipitation over the colonial period appears to have been an important factor in land and water disputes in west-central México. The severity of such changes, however, is variable with northerly regions being more susceptible to drought. Dry conditions in the 1550s, for example, had significant social consequences (Florescano, 1972) and there is evidence of civil unrest in the northern *Chichimeca* borderlands at this time accompanied by southward migrations to better watered central regions (Queretaro, Yuriria and Cuitzeo). Admittedly, this upheaval could also reflect the expansion northwards of the Spanish frontier of settlement, particularly with respect to the mining industry and the spread of livestock ranching, and the consequent aggravation with Chichimecas thus stimulated (Israel, 1975). There was, however, concern, over the number of people leaving the towns of Huango and Yuririapúndaro and moving south to settle around the Basin of Cuitzeo at this time,⁵⁸ an indication perhaps of climatically induced strife in the more northerly areas (Armillas, 1969).

As already noted relatively few disputes occur during the early to mid 1600s a period of apparent dry conditions. This may reflect a number of factors. Firstly, that the severity of drought might be regionally variable – the north being more likely to be affected. Secondly, although drought reduces crop yields it may not necessarily have been sufficiently intense to have had a widespread impact on water resources *per se*, and thirdly, given the poverty of many of the *naturales*, it is perhaps to be expected that some cases will have been settled without recourse to adjudication, or may merely have been disregarded. Few individual *naturales* will have been able to support the costs that court cases will have incurred, and unless voiced from a community stance, such cases may have never been aired. By the 1700s, there is a marked increase in the number of law suits dealing with water access and acquisition, reflecting perhaps the impacts of changed water supplies in a context of increasingly severe drought conditions, though rising indigenous population levels and progressive land and resource usurpation from indigenous hands may well have contributed to the unrest.

Yet the social hierarchy of the colonial era seems also to have influenced the degree of impact resulting from climatically induced changes in the water supply. The exploitative nature of the economy, social inequality and the monopolisation of lands and resources by individuals or institutions, were ultimately catalysts in a climate change-impact equation, the lower classes nearly always bearing the brunt of a particular climatic induced calamity. Tribute loadings were, for example, apparently maintained even when there was drought induced crop failure, and desiccation had reduced the ability to satisfy demands. With the almost complete desiccation of Lake Cuitzeo in 1543 following a move to drier conditions (Butzer and Butzer, 1993), there were pleas from the *Indios*

of Zinapécuaro, a *barrio* to the south of the lake, for the tribute loadings to be reduced (Escobar-Olmedo, 1986:40). This reaction is perhaps to be expected given that fish, unavailable following the desiccation of the lake, formed the principal tribute commodity of this community. The situation seems to have changed little during later severe drought periods, such as that of 1785-6, when tribute demands were again proving similarly impossible to fulfill.⁵⁹

From archival descriptions it seems that indigenous territory, relative to that of haciendas, suffered more from the impacts of drought,⁶⁰ though often descriptions of deteriorating and degraded landscapes in *Indio* territory date from the latter half of the 18th century – a time when the indigenous population had recovered to such an extent to be in a position to petition for land reinstatement. Yet it was climatic drying, combined with insufficient territory for subsistence purposes,⁶¹ and food shortages that would stimulate civil unrest, culminating in the Wars of Independence during the first decade of the 19th century. A century later climatic vagary would similarly act as a stimulus to the Revolutionary uprising.

Butzer and Butzer (1993) suggest that the level of Lake Cuitzeo was higher or at least as high as the present day level during the late 1570s and 1580s judging by the *Tierras* documents and accompanying maps (*pinturas*). The *Relación de Cuitzeo de la Laguna* makes no specific reference to dry conditions and although the salinity of the water is commented on, that fish still provide the mainstay of the economy at this time is indeed an indication that there is water in the lake at this time (Acuña, 1987). There are, moreover, other references that would tend to support the view that this period was not one of climatically induced strife. There are, for example, references to plentiful waters and 'water overflowing in the roads during the summer months' in Chocandiro,⁶² and the swamps and *arroyos* in Zinapécuaro are at this time described as 'impossible to pass' (Ciudad Real, 1585, in Quintana and Ferreras, 1976). This period seems to have been one of wetter climatic conditions, perhaps accounting for the apparent socio-economic complacency at this time.

The situation becomes very different by the late 16th century, however, and especially during the first few years of the final decade of that century, for as *pinturas* and documents illustrate there was a distinct drying tendency at this time as illustrated by the desiccation of Lake Cuitzeo to a 'big swamp'⁶³ and depicted as such.⁶⁴ Moreover, there was evident concern over the livelihood of the townships surrounding the lake who were dependent on the lake for its, now depleted, fishing resources. Indeed, such was the level of administrative concern, that orders were given to involve the local people in the diversion of waters of the Rivers Guayangareo⁶⁵ and Indaparapeo⁶⁶ to Lake Cuitzeo in order to raise the water level.

Dramatic and detrimental as the impacts of climatic change could be, the adaptations and strategies that such perturbations were to stimulate often resulted in the exploitation of a bad situation. The description of a clearly desiccated Cuitzeo Basin by Fray Diego de Basalencue in 1644 leaves little

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doubt as to the degree of impact that climatic drying tendencies had on the area (Moreno, 1985). But the fact that the 'lake did not cover the land' was not perceived to be an altogether negative phenomenon. As Basalenque went on to notice, on the desiccated lake floor grew a very useful source of fuel (Nuñez, 1982), a grass:

that they call barilla.....and while this grows in other lake bed areas, it is better quality from here (Moreno, 1985:130).

The general drying tendency characteristic of the early 1700s was to yield similarly good and bad impacts. While there was desiccation of former swamps and wells in an area of Tiripetio, to the south east of Valladolid (Morelia), east of Lake Pátzcuaro, called Oporo,⁶⁷ the impact of the drying up of the water source by 1741 appears to have been capitalised on, given its conversion to a wheat field. Similarly, during the agricultural crisis of 1785-6, the growth of a grass species in the district of Zamora, northwest Michoacán, capable of surviving drought, provided cattle fodder where all other species failed. In consequence, during a particularly severe drought, there was said to be 'more milk than water' in this location.⁶⁸ Moreover, it was the impacts of this latter drought period that were to stimulate the development of more extensive irrigation systems in the *tierra fría* and *caliente* lands.⁶⁹ A certain level of adaptation to changing environmental circumstances seems, therefore, to have taken place throughout the colonial period.

Clearly, European contact was to have profound repercussions at all socio-economic and political levels of New Spain. As land was gradually usurped from indigenous hands, a practice facilitated by the indigenous depopulation of the 16th and early 17th centuries, the resources within that land also fell into private possession. With the rise of the church and powerful haciendas during the course of the 17th and 18th centuries, many of the water sources traditionally used by indigenous communities and families became inaccessible. Water became a contentious issue, and ultimately a saleable commodity (Musset, 1992). Only with the regeneration of the indigenous population were claims for restitution and or compensation really heard.⁷⁰ It would be a little too presumptuous, therefore, to assume that the increase in the number of documents dealing with water disputes during the course of the 18th century reflects anything other than a rise in the indigenous population, and a consequent increase in claims for land restitution and access to water. In addition, it should be remembered that not all claims were necessarily legitimate, considering the potential for both deliberate and accidental bias in documents dealing with law suits over territory and resources. Nevertheless, there is a good deal of correlation between *pleitos* over water and lands and known periods of drought or water scarcity (or at least indirect references to water shortages).

There are, however, cases where repercussions of climatic fluctuation clearly go unrecognised in the archival and documentary evidence, given that, more often than not, only those events resulting in more negative impacts would be

recorded. The perceived severity of the impact, therefore, determines the likelihood of its inclusion in the records. It should be appreciated that the archives we have at our disposal represent at best only an incomplete record of the changes taking place in the water supply. The series of droughts registered for the period between the 1620s and 1650s (Florescano, 1972; O'Hara and Metcalfe, 1995), for example, seem not to have stimulated any tension over water in west central México, at least as can be identified from archival sources, even though the culmination of such drought periods is known to have contributed to several periods of agricultural and economic crisis during the 1630s, 1640s and 1650s (Pastor and Frizzi, 1989).

From the evidence presented here, however, it is suggested that a general trend of climatic drying can be ascertained from the late 16th century through to the 18th, and it is tempting to interpret the increased body of land and water disputes as a reaction to the changes wrought by the climatic perturbations of this era. If this is the case, we could well be dealing with the impacts of a 'Little Drought Age', a tropical manifestation of the 'Little Ice Age' in Europe.

NOTES

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¹ The Purépecha were one of the most significant Postclassic (850-350 years BP) culture groups in prehispanic central México, establishing their heartland in the Basin of Pátzcuaro.

² Different document sets were consulted in the various national and regional archives:

Archivo General de la Nación: (México City)

AGNM AGN Ramo de *Mercedes* (land grant documents)

AGNT AGN Ramo de *Tierras* (litigation records)

AGNI AGN Ramo de *Indios* (indigenous affairs)

Also consulted in AGN:

Ramo *Alhóndigas* (crop records)

Ramo *Historia* (documents dealing with local historical information)

Ramo *Tributos* (tribute listings)

Archivo de las Notorias, Morelia, Michoacán

Ramos: Tierras y Aguas (de la Epoca Colonial) (disputes over lands and waters)

Leg 1, 2,3 etc: legajo number.

TI: Tomo I/II etc.

Lib. 4: book 4 etc.

Archivo Historico de la Ciudad de Pátzcuaro:

P (Pátzcuaro), Caja (box) folder (folder no.).Fs. (foja).

Exp: (expediente); Fs: fojas (page no.).

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Published Sources:

Acuña, R. (1987) *Relaciones Geográficas del Siglo XVI: Michoacan*. Universidad Nacional Autónoma de México

Florescano, E (coord) (1981) *Fuentes para la Historia de la Crisis Agrícola de 1785-1786*. Archivo General de la Nación.

Kraus and Ayer Collections in: Paredes, C. (ed) (1995) *Y por mi Visto: mandamientos, ordenanzas, licencias y otras disposiciones*. Centro de Investigaciones y Estudios Superiores. México.

³ This research has been undertaken as part of a doctoral thesis focusing on an archival reconstruction of environmental change in central México since the conquest.

⁴ AGNM 3, exp. 495, fs. 204.

⁵ Kraus Collection.

⁶ Melville (1983, 1990, 1994) attributes the drying up of springs in the Valle del Mesquital at the close of the 16th century reflects a change in the vegetation cover resulting from 'irruptions' in the sheep population during the later 16th century.

⁷ Refer to AGNM 13, fs. 242; AGNI 3, exp. 745; AGNI 5, exp. 192, exp 522, for references to the desiccation of Lake Cuitzeo at this time.

⁸ Township dependent upon the *cabecera* or head town, in this case Cuitzeo.

⁹ '*Naturales*' here refers to the indigenous population of an area, though the use of the term *Indios* is commonly employed in archival documents.

¹⁰ AGNT 2953 exp. 6.

¹¹ Relación de La Guacana, 1605.

¹² Relación de La Guacana: Quiringuichuaguapo.

¹³ AGNT 445, exp. 1.

¹⁴ AGNT 189, exp. 2.

¹⁵ AGNT 151, exp. 5.

¹⁶ Tierras y Aguas, leg. 6. TI. exp. 39.

¹⁷ AGNM 67, fs. 114f–114v.

¹⁸ *Cañada*: described as a low lying wet place or a gully.

¹⁹ AGNT 2987, exp. 3.

²⁰ AGNT 283, exp. 5.

²¹ *Hacendado*: proprietor of hacienda

²² AGNT 354, exp. 6.

²³ AGNT 389, exp. 1.

²⁴ AGNT 488, exp. 2.

²⁵ Tierras y Aguas, leg. 5, TII, exp. 58; exp. 57.

²⁶ AGNT 417, exp. 2.

²⁷ P.Caja 30C.

²⁸ P.Caja. 29B.

²⁹ AGNT 1449, exp. 1; AGNT 824, exp. 3; AGNT 711, exp. 1.

³⁰ AGNT 916, exp. 5.

³¹ Tierras y Aguas, leg. 5. TII, exp. 59.

³² AGNT 1177, exp. 1.

³³ AGNM 75, fs. 225-226.

³⁴ Alhóndigas 10: Yuririapundaro.

³⁵ Alhóndigas 15, exp. 1; Alhóndigas 10; Tributos 20, exp. 15.

³⁶ Tributos 20, exp. 15, exp. 1; Reales Cédulas 134, exp. 179; Gazeta de México TII, no. 13, no 17.

- ³⁷ Tributos 2, exp. 5.
- ³⁸ Gazeta de México TII, no. 13.
- ³⁹ Historia 73.
- ⁴⁰ AGNT 1085, exp. 1; see also AGNT 1048, exp. 4.
- ⁴¹ *Tepetate*: hardpan layer, caliche, carbonate crust.
- ⁴² Alhóndigas 15, exp. 1.
- ⁴³ Historia 72.
- ⁴⁴ Historia 9.
- ⁴⁵ Caminos y Calzadas 3, exp. 13. fs. 304-312.
- ⁴⁶ *Citaqua*: measure of land.
- ⁴⁷ AGNT 3448 (unico).
- ⁴⁸ Tierras y Aguas, Leg 1, TI exp. 48.
- ⁴⁹ Caja 56f. folder, I. fs. 1-206.
- ⁵⁰ *Caballeria*: unit of agricultural land, approximately 42.5 hectares.
- ⁵¹ P.Caja 44A.
- ⁵² P.Caja 49B, folder 3.
- ⁵³ AGNT 1095, exp. 1.
- ⁵⁴ AGNT 1231, exp. 3.
- ⁵⁵ P.Caja. 58A. Folder 3. fs. 454- 674.
- ⁵⁶ Legislation established during the *congregacion* policy era stipulates that each Indio town should be in possession of 500 *varas* (one *vara* is approximately equivalent to one yard) of land in each wind direction, north, east, west and south from the centre of the town which was usually the church. The allotment was increased to 600 *varas* (504 meters) according to a decree dated to 1687, known as the 'legal fund' of the indigenous towns as measured from the last house in the town and 'in all four wind directions'. The Real Cedula of 1695, modified the location from where these stipulated measurements were made. Instead of the measurements starting from the last house on the town the land measures now began from the church, normally located in the centre of the town (Florescano, 1976). See also: Fabila, M (1941) *Cinco siglos de legislacion agraria* (1493-1940). México.
- ⁵⁷ AGNT 1322, exp. 2.
- ⁵⁸ Ayer Collection: fs.352v-353r..
- ⁵⁹ Tributos 20, exp. 15.
- ⁶⁰ AGNT 867, exp.8; AGNT 1095, exp. 1; AGNT 916, exp. 5; Alhóndigas 15, exp. 1.
- ⁶¹ Historia 72
- ⁶² Relaciones Geográficas, 1579: Chocandiran. Source: Acuña, 1987.
- ⁶³ AGNT 2375, exp. 11; AGNT 2721.
- ⁶⁴ AGNT 2682, exp. 19-23.
- ⁶⁵ AGNI 3, exp. 745, fs. 174v. AGNI 5, exp. 192, fs. 53v-r.
- ⁶⁶ AGNI 5 exp. 522, fs. 144v-r
- ⁶⁷ AGNT 621, exp. 3.
- ⁶⁸ Alhóndigas 15, exp. 1.
- ⁶⁹ Alhóndigas 15, exp. 1.
- ⁷⁰ Indigenous population levels were never to match their precontact proportions Even by 1959, the Indio population in Michoacan amounted to 96,913 (Cook and Borah, 1960), representing a reduction of 92% from its pre-conquest level.

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REFERENCES

- Acuña, R. (1987) *Relaciones Geográficas del Siglo XVI: Michoacán*. Universidad Nacional Autónoma de México.
- Alvarez and Gasca, P. (1952) La Isla de Pacanda y los descendientes de Calzontzin en los primeros años del siglo VXII (1609-1612). *Anales del Instituto Nacional de Antropología e Historia, Tomo IV, México*: 99-114.
- Armillas, P. (1969) The arid frontier of Mexican civilisation. *Transactions of the New York Academy of Sciences*, section of anthropology: 697-704.
- Bradbury, J.P. (1989) Late Quaternary lacustrine palaeoenvironments in the Cuenca de México. *Quaternary Science Reviews* 8: 75-100.
- Butzer, K. W. and Butzer, E.K (1993) The sixteenth century environment of the central Mexican Bajío: archival reconstruction from colonial land grants and the question of ecological impact. In Mathewson, K. (ed) *Culture, Form and Place*. Baton Rouge, L.A. Louisiana State University. Geoscience and Man.
- Caso, A. (1937) *The religion of the Aztecs*. Popular Library of Mexican Culture. México City.
- Ciudad Real, A. (1976) *Tratado curioso y docto de las grandezas de la Nueva España*. In edition by Quintana, J.G and Farreras, C.M. (eds). Universidad Autónoma de México. Instituto Investigaciones Historicas, Mexico City.
- Cook, S. and Borah, W. (1960) The Indian population of central México, 1531-1610. Berkeley, University of California, *Iberoamericana*: 44.
- Escobar-Olmedo, R.M (1986) La encomienda y el encomendero de Cuitzeo: siglo XVI. In *Boletín*, no. 10. Coordinación de la Investigación Científica. Universidad Michoacana: 32- 40.
- Fabila, M. (1941) *Cinco siglos de legislación agraria (1493-1940)*. México.
- Florescano, E. (ed) (1972) *Analysis historico de las sequias en México*. Comisión del Plan Nacional Hidráulico. México.
- Florescano (1976) *Origen y desarrollo de los problemas agrarios de México (1500-1821)*. Colección Problemas de México. Ediciones Era.
- Florescano, E. (1980) Una historia olvidada: la sequía en México. *Nexos*, 32: 9-18.
- Florescano, E. (ed) (1981) *Fuentes para la Historia de la Crisis Agrícola de 1785-1786*. Archivo General de la Nación.
- García, E. (1974) Situaciones climáticas durante el auge y la caída de la cultura Teotihuacana. *Boletín del Instituto de Geografía*, UNAM 5:35-69.
- García, P.A. (1995) La mitología P'urhépecha y la estrategia sociocultural de uso y manejo ecológico del agua. El caso de la Meseta P'urhépecha. *Estudios Michoacanos* VI. El Colegio de Michoacán.
- Gibson, C. (1964) *The Aztecs Under Spanish Rule*. California: Stanford University Press.
- Heine, K. (1988) Late Quaternary glacial chronology of the Mexican volcanoes. *Die Geowissenschaften* 7: 197-205.
- Israel, J.I. (1975) *Race, Class and Politics in Colonial México, 1610-1670*. Oxford University Press.
- Jauregui, E. (1979) Algunos aspectos de las fluctuaciones pluviométricas en México en los últimos cien años. *Boletín del Instituto de Geografía*, UNAM 9: 39-64.
- Jauregui, E. and Klaus, D. (1976) Some aspects of climate fluctuations in México in relation to drought. *Geofísica Internacional* 16: 45-61.

- Kutzbach, J.E. and Street-Perrott, F.A. (1985) Milankovitch forcing in the level of Tropical Lakes from 18 to 0Kyr BP. *Nature* 317: 130-134.
- Liverman, D.M.(1993) The regional impact of global warming in México: uncertainty, vulnerability and response. In Schmandt, J. and Clarkson, J. (eds) *The Regions and Global Warming.*, Oxford. Oxford University Press.
- Melville, E.G.K. (1983) *The Pastoral Economy and Environmental Degradation in Highland Central México, 1530-1600*. PhD. dissertation. University of Michigan.
- Melville, E.G.K. (1990) Environmental and social change in the Valle del Mesquital, México (1521-1600). *Comparative Studies in Society and History* 32:1: 24-53.
- Melville, E.G.K. (1994) *A Plague of Sheep. Environmental Consequences of the Conquest of México*. Cambridge University Press.
- Metcalf, S.E. (1987) Historical data and climatic change in México. *The Geographical Journal* 153: 211-222.
- Metcalf, S.E., Street-Perrott, F.A., Perrott, F.A. and Harkness, D.D. (1991) Palaeolimnology of the Upper Lerma Basin, Central México: A record of climatic change and anthropogenic disturbance since 11,600 years BP. *Journal of Palaeolimnology* 5: 197-218.
- Moreno, H.(1985) *Los Augustinos, aquellos misionarios hacendados*. SEP. Cultura.
- Musset, A. (1992) *El agua en el Valle de México: siglos XVI-XVIII*. México: Portico de la Ciudad de México /CEMCA.
- Núñez, J.C. (1982) Cronistas novohispanicas de Michoacán. In *Humanistas novohispanicas de Michoacán*. Universidad Michoacana: 29-36.
- O'Hara, S.L. (1993) Historical evidence of fluctuations in the level of Lake Pátzcuaro, Michoacán, México over the last 600 years. *The Geographical Journal*, 159:48-51.
- O'Hara, S.L. and Metcalfe, S.E. (1995). Reconstructing the climate of México from historical records. *The Holocene*, 5,4:485-490.
- Pastor, R. and Frizzi, R.M. (1989) Expansion economica e integracion cultural. In Florescano, E. (coord) *Historia General de Michoacán: VOL II Colonia*. Gobierno del Estado de Michoacán. Instituto Michoacano de Cultura.
- Paredes Martinez, C. (ed) (1995) *Y Por Mi Visto: mandamientos, ordenanzas, licencias y otras disposiciones virreinales sobre Michoacán en el siglo XVI*. SEP. Centro de Investigaciones y Estudios Superiores en Antropología Social. Casa Chata, México.
- Swan, S.L. (1981) México in the Little Ice Age. *Journal of Interdisciplinary History*. XI, 633-48.
- Wallen, C.C. (1955) Some characteristics of precipitation in México. *Geofisica Annaler*: 37:51-85.