

Before and After the Conquest: Changes in the Use, Management, and Conceptualization of Animals in Megadiverse Mexico

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1. Megadiverse Mexico

In terms of biodiversity, Mexico is the fifth most diverse country in the world, containing around 10% of all living organisms on earth, including a very high frequency of endemic species (Ceballos, et al. 1998; Ramamoorthy, et al. 1993). Despite the fact that Mexico is only the 14th largest country on earth, this megadiversity is present because two major biogeographical zones transition in Mexico: the Nearctic realm to the north and the Neotropical zones to the south (Figure 1) (Ceballos, et al. 2005). Combined with the accentuated topography and complex geography, Mexico contains six main ecological regions that constitute almost all terrestrial ecosystems (CONABIO 2009:10, Toledo 2001:473). Mammalian fauna ranks third in species richness at a global scale, comprised of 535 native species, of which 161 (30%) are endemic (Ceballos, et al. 1998, CONABIO 2009). Over 1000 bird species are known to inhabit national territory (Escalante Pliego, et al. 1993), ranks second in reptilian diversity (804 species, of which 46% are endemic) and fifth in amphibian species richness (361 species, of which 48% are endemic). As of 2009, a total of 2,692 species of fish and 47,853 species of insects have been recorded in Mexico (Ramamoorthy, et al. 1993, CONABIO 2009).

There is a close correlation between the biological and cultural diversity present in modern Mexico, with between seven to ten million people that speak around 291 languages pertaining to 68 linguistic groups and 11 families, placing Mexico as the fifth country with the most linguistic, and thus cultural, diversity in the world (Boege 2008, CONABIO 2009:36). Over 90% of the indigenous population lives in forested areas, either in tropical or temperate forests, and less than ten percent reside in arid/semiarid climates (Toledo 2001). More importantly, the distribution of high linguistic diversity closely overlaps that of biologically enriched zones (CONABIO 2009:21). It is no coincidence that half of the almost 30,000 *ejidos* and indigenous communities are



Figure 1. Map of Mexico with biogeographical zones, molluscan faunal provenience, and the archaeological sites mentioned in the text.

located in the ten most biologically wealthy states of Mexico (Toledo 2001). One great example is the apparent explosion of biocultural diversity present in the state of Oaxaca, which contains the highest level of species richness, particularly of endemic species, in an area where 104 different languages are spoken (Toledo 2001).

Unfortunately Mexico, along with many countries around the world, is in the midst of a global biological and cultural crisis. The list of endangered species in Mexico, particularly of endemic organisms, is alarming, as are the estimates of linguists that claim half of the living languages will perish during the twenty first century (Toledo 2001). The present paper discusses the trajectory of the uses, management and conceptualization of the animals in Mexico in prehispanic and colonial periods to understand this complex dynamic between nature and culture. Mexico has an impressive number of resilient ecosystems that have co-evolved with human activities over thousands of years (Gómez-Pompa and Kaus 1999:8). This study examines changes in the human conceptualization of nature in Mexico to understand what caused this downward trajectory. By utilizing archaeological, iconographic and ethno-historical records to document long term changes in the ways humans interacted with the natural environment, we hope to highlight the importance of what Boege (2008) terms “*in situ*” conservation of this megadiverse Mexico.

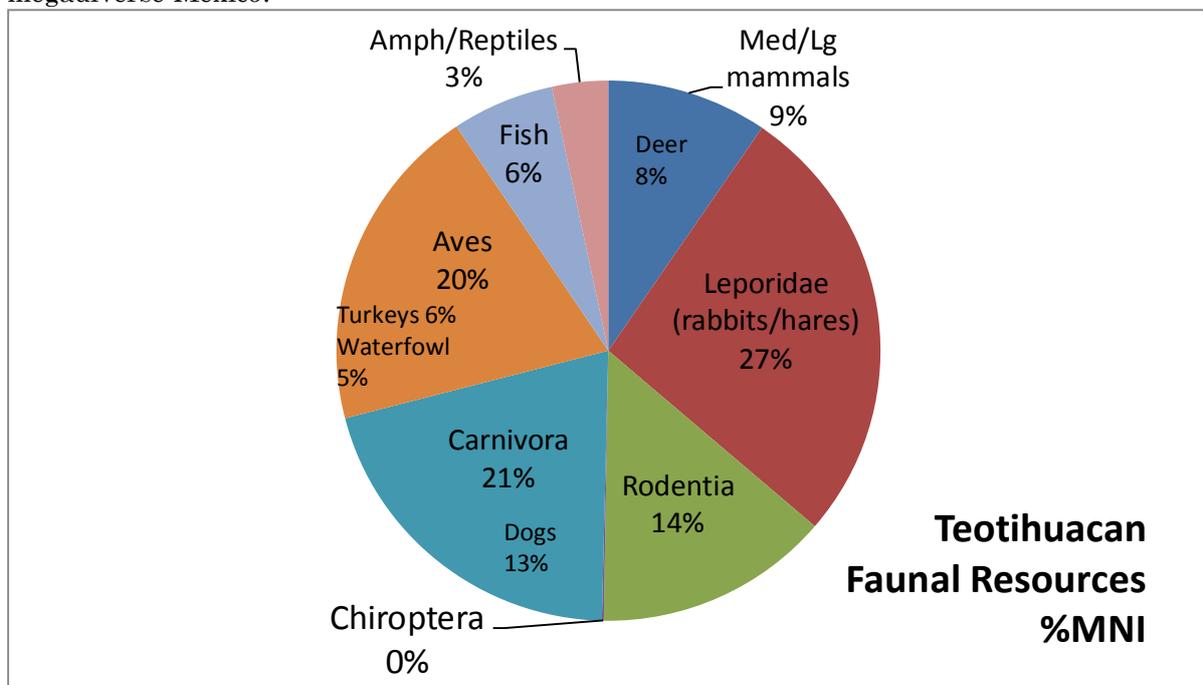


Figure 2. Distribution of fauna found at Teotihuacan represented by percent of the Minimum Number of Individuals (MNI) represented in the zooarchaeological record (see Table 1).

2. Prehispanic Use, Management, and Domestication of Animals

Traditionally it is believed that only a few animals in Mesoamerica were domesticated such as the turkey and the dog (Hamblin 1984; Valadez Azúa 1995; 2003). The importance of such conventional domestic meat is repeatedly questioned at some major urban sites, such as the metropolitan center of Teotihuacan where domestic meat accounted for only 10% of the zooarchaeological materials (Starbuck 1975). A re-analysis of the faunal materials published to date from the site still verifies that only around 19% of the zooarchaeological remains identified were composed of domestic game (Figure 2).

This suggests that hunting may have been an important subsistence strategy at Teotihuacan. Here we argue that Mesoamerican populations did not necessarily rely heavily on domestic game because they took advantage of the faunal diversity present on the landscape and were systematically managing a truly diverse array of species that included household-level breeding of small game. It is known from post-Teotihuacan Aztec documents that a dynamic market system had developed enabling the exploitation of the megadiverse landscape, trading products between a heterogeneous yet localized economic system (McClung and Sugiyama 2012). Efforts to manage and tame animals were not concentrated on alimental functions, but rather were utilized as a means to control nature, to dominate large symbolically enriched fauna for religious purposes.

The animal kingdom was part of a cosmological system in which fauna were considered active agents in the social, cultural, economic, and political aspects of Mesoamerica (Sugiyama, et al. *in press* b). It is precisely this type of ideological framework which encouraged the development of a balanced and managed mosaic of faunal resources in pre-Columbian Mesoamerica, a system that became fragmented during the colonial period, and continues to be threatened in the modern global era. Here, we will use a case study from the site of Teotihuacan to argue that there were several factors that sustained the large populace of the metropolis; the presence of diverse wild and managed resources that were differentially extracted at a local scale, the supplementary resources that were brought in from the market economy, and the utilization of highly symbolic fauna of cosmological importance for ritual contexts.

Teotihuacan is located in the Mexican Basin around 45km northeast of modern Mexico City in the Central Mexican Highlands at an altitude around 2,300 meters. The site was occupied from around AD1 to 600 during the Pre-Classic and Classic periods. At this site, we see the construction of a highly planned urban development around a large ceremonial precinct where three major monuments were constructed; the Moon Pyramid, the Sun Pyramid, and the Feathered Serpent Pyramid (FSP). A truly metropolitan city was built over an area around 20km² in the Teotihuacan Valley occupied by an estimated 100,000 plus inhabitants with multiple ethnic groups densely distributed in the apartment compounds surrounding the ceremonial center (Cowgill 2008; Millon 1981; Millon, et al. 1973). We find magnificent mural paintings that depict many anthropomorphic and natural animals as main icons (Berrin 1988; Fuente 2006; Miller 1973).

A combination of zooarchaeological and iconographic evidence documents the use of fauna in Teotihuacan. In particular, we focus on the importance of animals utilized in ritualized activities focusing on animals sacrificed at the Moon Pyramid. Then, we discuss changes in the use, management and conceptualization of animals after the conquest that were seminal to the current biocultural crisis.

3. Prehispanic Use of Animals: Case of Teotihuacan

One of the reasons for the success of many Mesoamerican city-states is due to the presence of an extremely extensive interaction network that allowed for long-distance exchange of resources across Mesoamerica. We can get a glimpse of the extreme variability that was present through the descriptive ethnohistoric records documenting the market scene upon the arrival of the first conquistadors. For example, in the “fresh catch section” of the Aztec markets lacustrine, terrestrial, tropical and even marine resources were sold daily, including black and white fish, shrimp, snails, salamanders, tadpoles, weasels, moles, wild boars, venison, rabbit meat, hare, duck, crane, goose, mallard, eagle meat, meat of wild beasts, of opossum, snakes, iguana eggs, worms of maguey, and grasshoppers (Sahagún 1963). In addition, they sold pelts of jaguars, mountain lions, otters, deer and badgers (Sahagún 1963:80). Similarly, Maya murals depict marketplaces replete with animals and faunal products such as the

coatis, macaws, turkeys, deer, armadillos, rabbits, iguanas, wax and honey bees, the skins of ocelots, jaguars and deer and a variety of bird feathers (Simonian 1995:23).

These diverse market goods came from various geographical regions through intra- and inter-regional systems. Zooarchaeological and iconographic datasets from Teotihuacan documents the use, distribution and function of faunal resources at this urban center. Table 1 quantifies vertebrate species distribution, while Table 2 lists invertebrate mollusks present in the found zooarchaeological record from this site.

A. *Vertebrate remains*

Figure 2 illustrates that the Teotihuacan subsistence strategy mainly focused on select local vertebrate fauna, such as the rabbits/hares (28%), dogs (13%), deer (8%) and birds such as turkeys (6%) and waterfowl (5%) (Figure 2). The very high percentages of rabbits and hares are of particular interest, as there is possible evidence that the Teotihuacanos were raising rabbits at the Oztoyohualco apartment compound (Valadez Azúa 1993). The overall consumption patterns at Teotihuacan support this hypothesis that there was household level production of rabbits/hares that supplemented domesticated animals and wild game. Waterfowl have also been documented to be kept in domestic spaces during the colonial period (Pohl and Feldman 1982; Valadez Azúa 2003), and it is likely that this was also practiced at Teotihuacan taking advantage of their proximity to lacustrine resources. At the same time, the Teotihuacanos were still subsiding on a varied diet that included a diversity of local and foreign fauna represented at the site. In the apartment compound of Teopanaczo alone, whose debris was fine screened, there were around 80 genus/species identified that included a truly diverse array of fauna not recorded previously at this site (Rodríguez Galicia 2006, 2010). Particularly impressive is the diversity of avian and ictiofauna species, which included 30 genus/species of birds and 18 fish genus/species (Table 1).

Up to 32 genus/species of non-local vertebrate fauna were identified at Teotihuacan. The foreign animals included the jaguar (minimum number of individuals-MNI=9), jaguarondi (MNI=1), lynx (MNI=1), bear (MNI=1) and spider monkey (MNI=2). Exotic birds include the darters (MNI=1), the white ibis (MNI=1), the streak-backed oriole (MNI=10) and the ring-billed gull (MNI=1). The Mesoamerican river turtle (MNI=1), the wood turtle (MNI=1) and the crocodile (MNI=1) were the only three non-local reptiles identified thus far. At the Teopanaczo apartment compound a series marine creatures were identified including the pencil urchin (MNI=1), two types of crabs (MNI=3), a shark tooth (MNI=1) and 16 types of marine fish (MNI=81). As the majority of these imported organisms were deposited at the Teopanaczo apartment compound, this residence either had especially close ties to coastal groups or the detailed recovery techniques permitted the zooarchaeologist to document the true diversity of species that were consumed and utilized at the site for the first time. Future work utilizing fine excavation strategies will help understand in more detail the truly diversified subsistence strategy that may have included the consumption of micro fauna, especially fish and small bird remains, often not identified in the zooarchaeological record.

The only mammalian specie found complete, illustrating that the whole individual was transported into the city, was the jaguar. Jaguars are naturally distributed in the tropical forests of southeastern Mexico up the coastal plains to the mouth of the Río Grande on the Gulf side and along the Sonoran foothills of the Sierra Madre Occidental on the Pacific side (Leopold 1972:464-470). The jaguar remains were excavated from burial offerings inside the Moon Pyramid, which included one complete jaguar and nine skulls. One jaguar canine was also found in an apartment complex (Valadez Azúa 1992).

B. Invertebrate Remains

Even more surprising is the immense quantity of marine mollusks that were imported for non-alimental purposes (Table 2). Particularly striking is the high abundance of mollusks from ritual contexts, emphasizing its symbolic value, which explains the abundant depictions of mollusks in the iconographic record. Marine mollusks came from both ecological zones present in Mexico: 1) the Panamanian Marine Faunal Province located along the west coast of Mexico (Panamanian species), and 2) the Caribbean Marine Faunal Province located at the Gulf of Mexico (Caribbean species) (Figure 1) (Kolb 1987:19-20). The Teotihuacanos had access to extremely varied invertebrate fauna including at least 29 Panamanian and 32 Caribbean species (Table 2). It is unfortunate that not all reports quantified the present taxa. However, from the few reports that give mollusk counts, we can observe a strong preference for several species: *Spondylus calcifer*, *Strombus* sp., *Oliva porphyria*, and *Chama echinata*. On the other hand, they were probably only collecting a modest number of other species equally available to them (Starbuck 1975). These marine products were sometimes brought in huge quantities. For example, *Spondylus calcifer* were imported in large quantities totaling 4084 Number of Identified Specimens (NISP) at the site of Santa Maria Maquixo el Bajo (TC-8), a site interpreted to have been a storehouse that imported and stored this bivalve for use in Teotihuacan (Kolb 1987).

Shells were used in a variety of contexts, in both worked and unworked forms, but there is overwhelming concentration of shells in ritual contexts, particularly as part of burials and offerings. At the apartment compound of Tlajinga 33, in Burial 57, individuals were found wearing a cloke or robe likely made of *Olivella mutica*, wrapping the individuals (Kolb 1987:50). Numerous human jaw imitation necklaces made of shell beads were found at the FSP and the Moon Pyramid (Sugiyama 2004, Paz Bautisa 2010). Complete conch shells are found deposited in burial caches in the Moon Pyramid, including the species of *Strombus* sp., *Pleuroploca gigantea* and *Turbinella angulata* (Figure 3) (Polaco 2004). There were also pendants made out of *Oliva* sp. shells and other small circular beads as well as shell ears flares from these offering caches.

The close association between the movement of shell products and state control is demonstrated by the elaborate worked shell offerings from the FSP. In Burials 5 and 6, there were 18 ornaments of molariform shape that probably formed part of the garment worn by the individuals. These were elaborated with *Tubinella angulata* from the Caribbean Province and some had one or two objects produced from *Spondylus princeps* from the Panamanian Province. Other species utilized in these offerings include *Chama echinata*, *Patella mexicana* and *Spondylus calcifer* (Paz Bautista 2006, 2010).

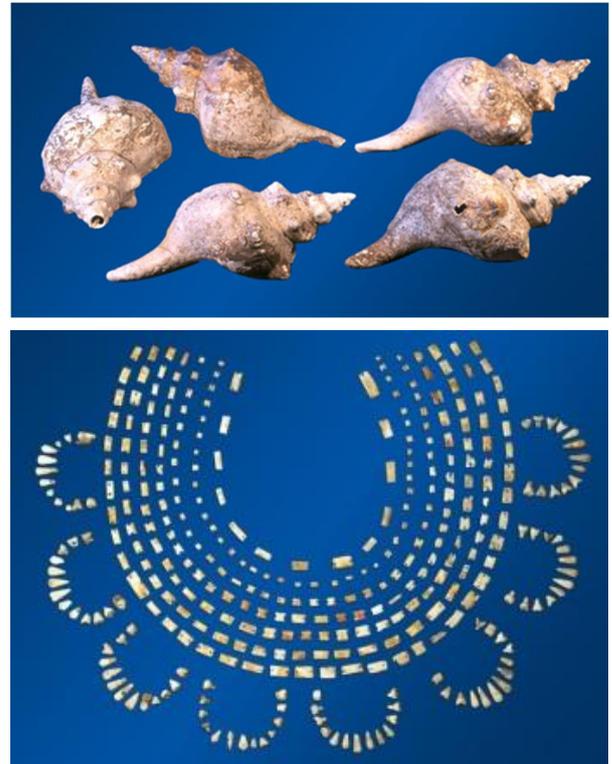


Figure 3. Zooarchaeological evidence of mollusks from the Moon Pyramid, Teotihuacan. a) *Strombus* sp., *Pleuroploca gigantea* and *Turbinella angulata*, from the Burial 3. b) ornaments of molariform shape from Burial 2.

C. Iconographic Evidence

In many cases, the zooarchaeological evidence coincides with the presence of foreign fauna in the iconographic repertoire at Teotihuacan (e.g. jaguars and monkeys), present in various forms ranging from elaborate mural paintings and sculptures to ceramic vessels and figurines. Others represent fauna not identified thus far such as the quetzal, black hawk-eagle, and other species identified as pertaining to the family of Psittacidae (macaws and parrots) (Navarijo 2006).

Representations of mollusks are equally found on a variety of material types and contexts, including mold made appliqués, incised designs on tripod vessels, plano-relief bowls, and mural paintings. Shells were represented in an array of shapes and were elaborated using different techniques (Von Winning 1949). Shell trumpets are depicted on mural paintings at the Palace of the Quetzal-Butterflies where a feline is playing a shell trumpet and at the Temple of the Plumed Conches (Both 2004). These were probably made from either the Panama horse conch (*P. gigantea*) or the Florida horse conch (*P. princeps*) which are both found archaeologically at this site (Both 2004).

Furthermore, the species of mollusks depicted in the Teotihuacan art closely parallel those excavated from the same area. For example, offerings from the FSP illustrate a correlation between shells found in the offerings (*Spondylus*, *Pecten*, *Pleuroploca* and *Oliva*) and those carved in relief on the frontal façade of the pyramid (Starbuck 1975). At the same time, only a limited selection of shells found archaeologically are depicted in Teotihuacan art, *Spondylus calcifer* being dominant in both contexts. This suggests that some of the mollusks were more valued for their symbolic significance than others while some species found in the archaeological record may have held a utilitarian function. The archaeological remains suggest that shells from both coasts were present, but there seems to be more intense importation of shell from the Panamanian coast of select species, primarily of *S. calcifer* (Kolb 1987).

The zooarchaeological and iconographic evidence demonstrates clear preferences for several exotic vertebrates and invertebrates, particularly symbolic fauna that are repeatedly depicted in the mural paintings. Many of these foreign fauna were brought into the city, as we find them in the zooarchaeological record, sometimes in large quantities. However, it is evident that the foreign resources were mainly used as status markers and were restricted mainly to ritual contexts; not for common subsistence purposes. Rather, the Teotihuacanos concentrated on localized systems of wild (deer), domestic (dogs and turkeys), and managed resources (rabbits and possibly water fowl) for alimental purposes.

4. Ritualized Animals in Prehispanic Mexico

A. Zooarchaeological Evidence

Unlike many Old World models concerning the origins of animal management and domestication, in the New World we cannot avoid the apparent emphasis on the religious incentive behind some major shifts in human-animal interactions. Here, we summarize some of the evidence from offering contexts explored at the Moon Pyramid to demonstrate the presence of long term keeping of wild carnivores and will utilize the iconographic data from the site to interpret the meaning behind the shift in this type of relationship where some animals physically resided within the city.

Recent studies have suggested that Teotihuacan was not only a highly planned city, but that the city layout itself was a cosmogram, the materialization of their cosmology into their built-environment itself (Sugiyama 2005). Ruling groups thus proclaimed their rulership through carrying out rituals, including human sacrifices, at these major monuments (Sugiyama 2010). The Moon Pyramid, the second largest monument, was recently explored intensively by the Moon Pyramid Project directed by

Saburo Sugiyama and Rubén Cabrera Castro. These excavations disclosed seven overlapping architectural stages and dedicatory burials with five extremely rich and unique offerings that indicated expanding political, religious, and economic power of the ancient state (Sugiyama and Cabrera Castro 2007). Four of the five burials contained an immense array of burial offerings that included the deposition of faunal remains. Undoubtedly these monumental construction projects and their associated offering rituals were events of highest energy expenditure organized by the state that substantially integrated animals as symbols.

Burials 2, 3, 5 and 6 contained a large quantity of faunal remains that totaled over 100 individuals, which were either sacrificed or offered as prepared objects, an amount unprecedented during the Classic period in any other site in Mesoamerica. Several individuals from these offerings have presented evidence for long term management of some of the most symbolic fauna present in Mesoamerica including felines (pumas and jaguars), canines (wolves), raptors (eagles) and serpents (rattlesnakes). Detailed zooarchaeological analysis conducted by our team (Sugiyama, *et al.* in press a) has documented a series of pathologies and surface modifications on these victims of sacrifice. For example, several eagles show pathologies on the medial side of the tarsometatarsus due to being tethered to a rope for prolonged periods of time.

One puma in particular shows the extremely obvious effects of captivity, as it received various injuries, including the loss of the femoral head that would have been fatal in the wild, leaving the animal unable to hunt as it would not have been able to walk properly. Nonetheless, evidence of remodeling of the bone and the extent of deformation this cost on the corresponding acetabulum shows this animal survived this wound. This puma also illustrates extensive wearing and abrasion on its teeth, probably due to gnawing on cages or other restrictive devices. Just before its sacrifice, the feline was fed two rabbits. One of the rabbits shows evidence of burning, and thus is direct evidence of artificial feeding. Wolves and pumas were found deposited in wooden cages and buried alive in Burial 2, suggesting these were kept in such structures. We hypothesize that these highly symbolic fauna were caught as cubs and raised within the city limits, as is hinted in some colonial documents that record wild animal keeping at what is known as Moctezuma's house of animals (Blanco, et al. 2009; Nicholson 1955). The zooarchaeological evidence at Teotihuacan suggests that symbolically important carnivores were maintained in captivity specifically for ritual purposes. More surprisingly, we see continuity in this practice since the Teotihuacan occupation up to the conquest period (more than 1,300 years). Eagle offerings found at the Templo Mayor have very similar evidence for long term keeping, management and preparation methods in the zooarchaeological remains (Quezada Ramírez, et al. 2010).

We argue that animal management in Mesoamerica should be understood, "as an attempt to domesticate and control internal and social problems...it served as a metaphor and mechanism for the control of society" (Hodder 1990:12). As each one of these carnivores used in the ritual deposits were the top predators on the landscape, they were highly regarded symbols associated with warriors, royalty, and elites that acknowledged the underlying ethnozoological and social classifications (Gossen 1975, Pinzón Castaño 2002, Saunders 1991). We argue that through managing these wild beasts, the Teotihuacanos were able to dominate not only the natural landscape, but permitted them to control the social-political landscape of the arising metropolis (Sugiyama, *et al.* in press b).

B. Iconographic Evidence

This type of hierarchy among the animals is further represented in the Teotihuacan mural paintings. The very same predators that are found in the offerings are represented in the mural paintings in great frequencies. We distinguish two types of representations at Teotihuacan; 1) naturalistic representations and 2) culturally modified depictions. The first category of illustrations



Figure 4. Mural painting of Mythological Animals indicating both naturalistic and culturalized animals (Frente 1995: 100-101, Lámina 5).

represent the animal without cultural alterations and is often found either in secondary locations, at the base or surrounding larger, central figures. There is much more diversity of animals depicted naturalistically, as they include various types of birds, other mammalian species including dogs, and many aquatic animals such as fish and mollusks. In addition, the very same predators we find associated with offering contexts are found naturalistically, such as the puma mural located near the avenue of the dead.

The second type of depiction is what we call culturally modified animals. By culturally modified, we mean depictions of animals that are artificially constructed, either because they are anthropomorphized, contain cultural attributes such as headdresses, clothing, and/or artifacts associated with them (e.g. knives, trumpets, etc.), or are manifestations of hybridized animals. For example, the mural painting known as “Mythological Animals” includes the depiction of naturalistic and culturally modified fauna (Figure 4). In this scene, the central figure is a feathered serpent (a hybrid between a rattlesnake and a quetzal bird) that meanders through the watery scene with secondary, more naturalistically drawn animals attacking the central figure. Most of the animals depicted within the culturally modified category are carnivores, and more interestingly, the very same species found in the offering contexts.

A canid figure, probably a wolf is depicted conducting the ritual act as it carries a sacrificial knife (Figure 5a). One mural painting illustrates a feathered feline that seems to be marching off into war, as it is dressed in military regalia (Figure 5b). Some avian forms, although difficult to identify, are also anthropomorphized as warriors (Figure 5c). These culturally modified images contrast with naturalistic forms in not only the location, which are placed in central positions, but also in the abundance and standardization of the species represented. The very same species that partook in the ritual offerings at the Moon Pyramid that were kept within the city were concreted into the Teotihuacan iconographic repertoire as culturalized carnivores associated to sate militarism, sacrifice, and rituals.

C. Ethnohistorical and Ethnographic Evidence

Repeatedly we see evidence for elites attempting to manage nature within their hands even after the Teotihuacan occupation at a large scale. Colonial documents describe the presence of aviaries and types of zoos, “Moctezuma’s House of Animals” being the most famous example (Blanco, et al. 2009; Cortés 1971; Diaz del Castillo 2003; Nicholson 1955). Spaniards were awed by the quantity and

diversity of animals kept in captivity and utilized for primary and secondary products such as skin, horns, feathers, and meat as well as for ritual sacrifice. Keeping a collection of caged animals was not unique to the Aztec capital. Between the late 1420s and the early 1430s Nahua kings created forested parks, botanical gardens, zoos, aviaries, and fishing ponds to indulge themselves with wild plants and animals in various locations (e.g. Chapultepec, Iztapalapa, Huaxtepec, Texcoco) (Chavero 1892; Heyden 2002; Simonian 1995; Velasco Lozano 2002:180). Imported and native species, particularly of high symbolic value, were praised and handled with care. Elites and royalty had control over these game both indirectly and directly, through keeping them in captivity or creating zoos and gardens.

Ethnographic studies on modern indigenous communities from the Americas also help us to understand native conceptualization of animals. Ojibwa Indians from North America, for example, utilized the concept of ‘persons’ to describe all animate and inanimate beings on the landscape (Hallowell 2002). As ‘persons’ all animate and inanimate beings, such as animals, plants, rocks, water, and even earth itself, have the same ontological status through the capacity for metamorphosis that occurs through establishing interpersonal relationships. Such conceptualization of the world grants personhood, and thus agency, to everything on the landscape. Under this worldview, humans, just like all other objects of nature, must develop meaningful relationships with their environment. The natural landscape is transformed into a social landscape where interpersonal relationships must be formed (Saunders 1991:109). In this light, in many indigenous communities throughout the Americas, it is believed that humans transcend through a multitude of interpersonal relationships with the landscape, and nature itself, creating a culture-specific system of classification and etymology (Ulloa 2002).

This conceptualization of the landscape created a completely different dynamic between humans and animals. There were very sensible regulations of how to interact with their surroundings, where agency was attributed to them. Many of the animals had a direct connection with human beings and with the gods. Huichol Indians from Mexico, for example, describe the wolf as “elder brother”, whereby they recount the very long and complex interactions humans have had with this carnivore as an ancestor, deity, and the principle hunter of deer (Fikes 1985; Zingg 2004). It was wolves that taught humans how to hunt deer, and thus permission must be given to humans during a ritual hunt by these powerful beings. Indeed only the most powerful shamans can transform into such authoritative persons.

Within this cosmological framework, the specific interactions

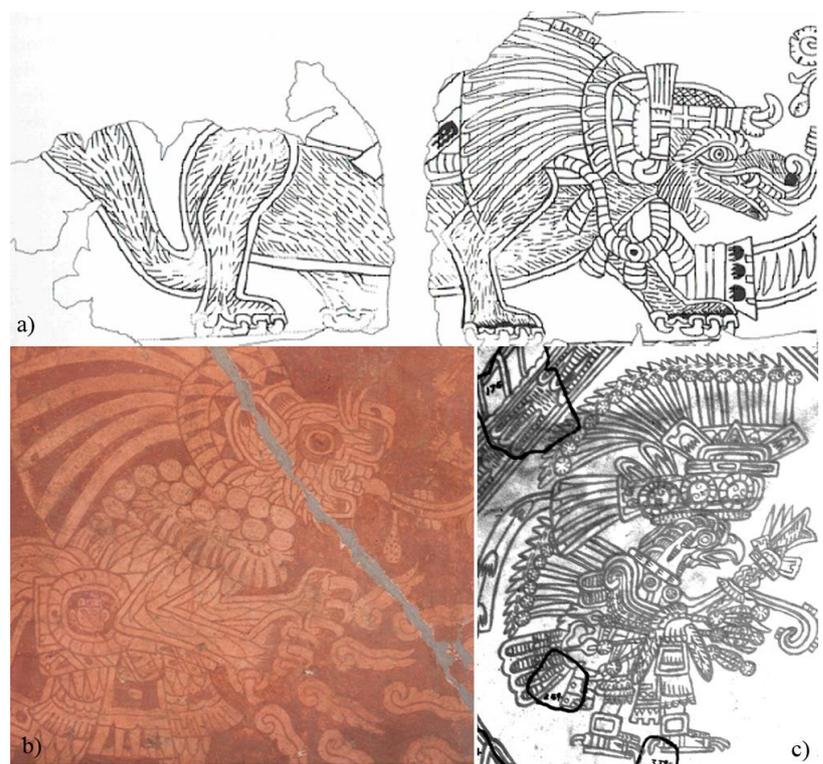


Figure 5. Mural paintings showing culturalized animals, a) Coyote with a sacrificial knife (Berrin 1988: 123), b) feathered feline (Berrin 1988: 187), c) avian warriors Atetelco apartment compound (Miller 1973:162).

the Teotihuacanos had with wild carnivores on the landscape would have been manifestations of the type of metamorphosis that existed between select individuals (the elites that controlled these carnivores) and the predators themselves. These culturalized carnivores would most likely have been manifestations of such relationships. Each individual, animate being and inanimate object was recognized as 'persons' that must establish meaningful relationships to maintain the world as they know it. Ritualized activities, such as those documented at the Moon Pyramid, are ultimately where relationships between these 'persons' are negotiated and formed. These rituals were where power relations, human-animal interactions, economic solutions, social politics, were negotiated and reified (Flad 2001). Thus, while the Mesoamerican cultures differentially interacted with and exploited a diversity of faunal resources, their ontological connection between nature and themselves was defined through interrelated symbiotic interactions between animate and inanimate persons.

During the prehispanic times, populations of varying density interacted and managed nature at varying degrees, sometimes even very intensively. However, this concept of the interrelatedness with all beings on the landscape has caused a very distinct type of interaction with nature itself. This may be the major cause of what Boege (2008) terms, "*de facto* conservation", long term resilient systems maintained through enduring traditions of management and the types of relationships between nature and society. Now we will explore how these types of long term resilient systems broke down with colonialism, that brought about not only invasive species constituted by a suite of domesticated plants and animals, but also completely changed the ways in which humans interacted with nature.

5. Shifts after the Conquest

The Colonial period brought about one of the major biological interchanges as a result of human activity (Corona Martínez 1997:321; Crosby 2004). Particularly among faunal resources, the introduction of European livestock had long-term and devastating effects on the Mexican landscape. Two types of domestic animals were introduced into the Americas, coral animals which include pigs, chickens, European ducks and European dogs, and pasture animals such as cows, sheep, goats and horses. Each type of animal had differential affects on the indigenous, mestizo and Spanish community.

Pre-conquest animal management more closely paralleled the coral animal model, which comprised of the co-occupation of animals within the domestic space such as the case with peccaries, turkeys and ducks (Donking 1985; Pohl and Feldman 1982). The Spaniards cared little to manage the distribution of small scale goods and thus coral animals were smoothly integrated in the indigenous diet and proved to be highly economically advantageous (Crosby 2003). For example, pigs convert 1/5 of what they eat into food for human consumption while chickens provide not only meat but also a dependable resource of eggs. Churches played a major role introducing these animals to indigenous communities as they were collected as common tribute items for the *encomienda* system that took place during the mid 16th century (Gibson 1964). These animals were adapted rapidly, as demonstrated by the dominant role domestic fowl and turkey occupied at the site of El Japón in southeastern Mexico City shortly after the conquest where 68% of the avifauna was composed of these two animals (Corona Martínez 1997).

The most devastating effects on the landscape were caused by large livestock, which were first introduced in 1521 when Cortés sent for cattle to be brought in for breeding. The small number of cattle present at first prohibited the slaughter of these animals, but numbers multiplied at an alarming rate. Within a decade after their introduction, scores of cattle ranches were established (Brand 1961; Sluyter 1996). By 1579 northern ranches were documented to have 150,000 cattle with their numbers nearly doubling every 15 months (Brand 1961). Their main success was due to the pristine grasslands and the relatively few predators present in the New World (Crosby 2004). Their numbers exploded, documented

by the rapid decrease in prices of beef, going from 17 maravedis an arrelde (1.84kg) in 1532 to seven in 1541 to only four in 1542 (Chevalier 1963:92). More cattle were killed for hides and tallow than for meat, particularly to export them to Europe, often leaving feral cattle meat to rot (Acosta 1962; Bishko 1952:57-58; Crosby 2003:86). During this initial period of explosion of cattle production, rich and poor Spaniards and mestizos alike consumed beef and had candles from beef tallow.

It was a completely different story for indigenous populations, which did not adapt to a herding economy. The huge herds of cattle allowed to range freely among agricultural fields resulted in immense damage to indigenous agricultural products and the spread of animal born diseases, driving Indians from their villages and completely depopulating the region (Chevalier 1963:93; Gibson 1964:280). Long term legacies were imprinted into the colonial landscapes as large tracts of forests were cut down and/or burned. Colonization transformed entire landscapes into pasturelands, a process that exacerbated the problem of soil erosion across immense regions (Simonian 1995). Damage was so extreme in Oaxaca that the viceroy Antonio de Mendoza was obliged to abolish cattle estancias in the valleys as he wrote, "May your loardship realize that if cattle are allowed, the Indians will be destroyed" (Chevalier 1963:94).

This initial boom of cattle population calmed at the end of 16th century as the nutrient-rich grass had been depleted, overgrazing had caused extensive erosion, and less palatable degraded bush took over the deforested landscape (Donald 2000:110). Similar sequences of initial introduction and expansion followed by depletion of resources and reduced quantities of alien livestock was documented for horse, sheep and goat herds (Crosby 2003; 2004). A prime example is the effects of sheep grazing in the Valle de Mezquital in the State of Mexico. Melville (1990) documents how this region transformed from a previously densely occupied area with a complex agricultural mosaic of planted and fallow fields, lakes, dunes, forest, and native grasslands into a mesquite dominated desert with vegetation unsuitable for agricultural production.

The introduction of livestock in Mesoamerica caused extensive deforestation at a regional scale, particularly along valley slopes, introduced many new diseases, polluted drinking water, consequently transforming entire landscapes and with a great cost among the indigenous population (Crosby 2003; Gibson 1964:280; Melville 1998). As a consequence, native animals such as bighorn sheep have declined and have been driven back into the mountains (Crosby 2003:211). Some speculate that European plants and animals may have caused the extinction of more species over the last 400 years than the usual process of evolution might kill off in a million (Crosby 2003:219).

6. Changing Conceptions of the Animals after the Conquest

The introduction of livestock brought about substantial changes in the type of human-animal interactions as well as the ways in which animals were perceived within human societies. In fact, Catholic theology served as the very engine of colonization (McSloy, 1996). As the book of Genesis clearly states, they believed that Christians, as the sons of Adam and Eve, were chosen to, "Increase and multiply and fill the earth, and make it yours ; take command of the fishes in the sea, and all that flies through the air, and all the living things that move on the earth." (Genesis 1:28). This conceptualization of nature in Christian thought was essentially materialized up to the 18th century's Enlightenment movement, where a clear hierarchy was defined where plants and animals were created to serve man, and man was to serve god (Binde, 2001). To Christians, the expansive wilderness encountered by the conquistadors were *terra nullius* (vacant lands) for their disposition (McSloy 1996:41).

Eurocentric conceptions of animals and their potential uses dominated many indigenous practices as the Spaniards disregarded previous regulations on the use of certain resources, forced abandonment

of ceremonial uses of many native animals as pagan rituals, and implemented various subsistence strategies focused on livestock production. Many animals that were previously sanctioned as key figures in the Mesoamerican cosmology were no longer valued, and/or converted into a commodity.

One clear case is how the Mexican Grey Wolf (*Canis lupus baileyi*), which we mentioned above as highly praised carnivore used in ritual deposits at the site of Teotihuacan, were considered a threat to livestock because of their large size and hunting capabilities. To protect their livestock, every method was used to kill these predators which directly led to the extremely rapid decline in wolf populations (Leopold 1972). As practiced in Europe, King Carlos I and Queen Juana in 1542 decreed licenses to all cities and villages to kill wolves, even those that had young, and even gave a bounty for each wolf head (Simonian 1995:32). Their range formally extended north to southeastern Arizona, southwest New Mexico, west Texas and south from Sonora and Tamaulipas into Michoacán, the Valley of Mexico and Puebla (Leopold 1972; McBride 1980; Young and Goldman 1944). However, since the Spanish arrival, the Mexican Grey Wolf population declined dramatically and is currently on the endangered species list. Only a few areas sustained a wolf population in the recent past; in the Sierra Madre Occidental, the arid mountains of western Coahuila and eastern Chihuahua, and San Luis Potosí (Leopold 1972:401). There are no wolves in Gamio's (1922, vol I:42-49) list of animals observed in the Valley of Mexico, suggesting that by the early 1900s they were not abundant or no longer found in the area where previously they were used for ritual purposes. Unfortunately, today these wolves are considered to be locally extinct except under conditions of captivity in Mexico (Ceballos, et al. 2005).

This abrupt disappearance of wolves in the Mexican Basin after the Spanish conquest is one of many examples of how previously important fauna, once utilized only for rituals, were converted into a hated animal solely due to its dietary preference for domestic livestock after the Spanish conquest. A similar pattern is observed by the fate of the now endangered jaguar population, a declination accentuated by modern poachers that treat jaguars as another commercial product (Simonian 1995). Loss of the symbolic importance resulted in the dominance of a solely economically oriented subsistence strategy that greatly imbalanced the ecosystem; the balance that was previously understood by the indigenous populations through the cosmology of interrelatedness of all beings on the landscape. Top predators were no longer needed and domestic game became the focus of the homogenous Spanish dietary regime.

7. Conserving Megadiverse Mexico

The megadiversity present in the Mexican ecology triggered the development of multiple interactions between humans and nature where diverse localized exploitation strategies together with the development of extensive interaction networks led toward the development of the Mesoamerican civilizations. Presently, modern indigenous strategies are beginning to be highly regarded as a type of "adaptive management" strategy (Toledo, et al. 2003) through the use of a "managed mosaic" of resources (Fedick 1996; Gómez-Pompa and Kaus 1999). In this paper we highlighted that a heterogeneous and localized practice, supported by a highly integrated interaction network was functioning efficiently prior to the conquest using a case study from the site of Teotihuacan.

These societies opted against specialization and homogenization of resources based on economic efficiency, but rather valued the ideological significance, or symbolic attributes to interpret the nature around them. In this framework, specific animals, particularly the large carnivores on the landscape, functioned as a metaphor of the increasingly stratified social hierarchy or the sacred, powerful political order. The importance of animals in the development of state level social organizations have traditionally pointed to their function as an alimental source and/or for their secondary products such as milk, hides, and as a labor source for transportation and plowing. However, here we stress the

importance of specific animals that were integrated within their worldview. For the Mesoamericans, jaguars, pumas, wolves, eagles and rattlesnakes were among the most powerful animals that functioned as symbols of maximum authority of nature itself. Thus, for Mesoamerican elites, these animals became the very means of obtaining authority by symbolically and physically associating themselves with these carnivores, and in return, “culturalizing” these top predators. This transformation in the relationships with these wild beasts is recorded in the depictions of these sacred animals in the Teotihuacan imagery.

Biological diversity was recognized or respected among past native populations, as complicated, interrelated, and symbiotic relationships existing among the diversified species, including humans themselves. Humans and animals transformed interchangeably, and each individual was tied to nature in a fundamental way through their cosmological system. The Pre-Columbian value system believed that not only plants and animals, but also inanimate objects such as the sun, the moon, the stars, the clouds, water, mountains, mineral, earth, and even air itself were animate beings that were all interrelated to each other (Hallowell 2002). This ideological system required humans as well as all other animate and inanimate beings to keep these interrelated relationships through ritualized activities. It was at these ceremonies, such as the dedicatory rituals from the Moon Pyramid that put order into their universe. This close relationship between culture and nature may have been the very reasons why the cultural and biological diversity thrived prior to colonization as a result of *de facto* conservation.

The colonization of the New World brought about major technological, socio-political, economic, religious and other ideological changes, including the way in which humans interacted with the natural world. There were radical changes in their world view that no longer viewed the interrelated symbiotic relationship between human culture and nature itself as fundamental to coexist. Unfortunately, this led to and is the cause of the present crisis of global biodiversity. The Colonial period altered ecosystems and reduced the abundance of native species or made them extinct. The wholesale introduction of species caused homogenization of ecosystems at a grand scale, a process that goes against the indigenous heterogeneous and localized economy that appreciated and balanced the biodiversity present on the landscape.

Fortunately, Prehispanic Mexico is not merely a concept of the past, but rather lives on within many of the indigenous groups surviving in the current megadiverse Mexico. Recent conservation projects have begun to focus on present indigenous groups as important sources to understand not only the present biological crisis, but also the perseverance of the biological and cultural diversity in Mexico. The results are staggering, as many independent studies record the correlation of the cultural and biological diversity as well as the efficiency of the native managed mosaic of resources that are not only sustainable but also create new diverse niches (Toledo 2003, Gómez-Pompa and Kaus 1999). Boege (2008) thus calls for a need to not only rely on the *de facto* conservation of biological diversity that has survived only due to the perseverance of past and modern indigenous and peasant communities, but for a more active *in situ* conservation tactic. A conservation strategy that permits an integrated vision that focuses not only on biological conservation as an isolated phenomenon, but also one that locates the modern biocultural diversity within the modern cultural, political, social and economic terms. We argue that this close look on changes in the cosmological systems before and after the conquest as an essential step to truly understand the current and past human-nature interaction networks that has created and thrived in this megadiverse Mexico: a step that allows us to understand the necessity of integrating indigenous and modern perceptions of nature within an active *in situ* conservation strategy.

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